

Reference Comparison and Decision Making - Effects of Reference Point Salience on Decision Making Under Risk

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Antti Saviluoto

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REFERENCE COMPARISON AND DECISION MAKING
Effects of Reference Point Salience on Decision Making Under Risk

Decision making theories were originally built around the assumption that individual's decisions are mainly dependent on the monetary outcomes of the decider. This paper explores whether social comparison and controlling the salience of social comparison can change evaluation of choices and preference for risk. The hypothesis is that they can. Early expected utility models modeled risk aversion by assigning different shapes to an individual's utility function. The relatively simple structure of the expected utility model provided a readily understandable tool for predicting decision making under risk. It also contained some problems related to the underlying assumptions which the model was based on. Later developments in economic decision making theory aimed to solve the observed problems and include more factors in to the models. Prospect theory and social preferences models are among these developments in decision making theory. Decision making, as described by these models, can also depend on results attained by other people. Psychological research on decision making has a longer line of research and can contribute more to reference person selection, effects of emotions and social pressure. This paper will present two economic decision making theories, relevant for the subject of social comparison and risk taking, and provide additional review of relevant psychological research. In addition to the literature review, a hypothetical experiment, plausible results and possible implications are discussed in the end.

FINDINGS

Prospect theory and social preferences model include a reference person in the evaluation of an outcome and provide a modeling possibility for estimating how these reference persons could affect decision making. Both models predict that increasing the salience of a reference person's outcomes and comparison will change risk taking in individuals. In prospect theory, salience is predicted to moderate the perceived distance to a reference point. Increasing salience of social comparison is expected to increase the perceived difference to reference point. In social preferences model, the outcome of a reference person is included in the utility function and the parameters are expected to react to changing salience conditions. Changing parameters would change marginal utility of the utility function altering predicted risk preferences.

Psychological research helps further understand how reference persons are selected, what effects emotions and social pressure can have. Reference people are selected mainly due to the fact that people have a need to evaluate their actions and in some fields finding a suitable measure is difficult. In subjective situations, other people provide a convenient way to measure ones abilities and success. Findings in research on social pressure support the hypothesis and include support on the moderating effect of salience on risk taking. Finally, previous research on emotions does not provide any conclusive evidence for or against the hypothesis. The prominent theories on emotions are presented and possible effects of each are accounted for when discussing possible results and implications.

Keywords: Decision making, risk aversion, social preferences, prospect theory, social pressure, gambling, reference group, reference person

Päätöksentekoteoriat pohjautuivat alun perin oletukselle, että yksilöt tekevät arvioivat päätösten paremmuutta ainoastaan eri vaihtoehtojen rahallisten seuraamusten avulla. Tämän katsauksen lähtökohtana on tutkia sosiaalisen vertailun, ja tämän vertailun näkyvyyden, vaikutusta päätöksentekoon ja epävarmuuden sietämiseen rahallisten seuraamusten lisäksi. Hypoteesin mukaan, näillä seikoilla on tärkeä rooli päätöksiä tehtäessä. Odotetun hyödyn teoria mallintaa riskinottoa olettamalla, että olemassa on erimuotoisia hyötyfunktioita. Teorian rakenne onkin yksinkertainen, auttaen ymmärtämään miten eri päätöksiä voidaan arvioida epävarmuutta sisältävissä tilanteissa. Taustaoletukset osoittautuivat kuitenkin pian teorian julkistamisen jälkeen ongelmallisiksi, mikä johti ongelmia korjaavien, vaihtoehtoisten teorioiden kehittämiseen. Myöhemmät päätöksentekomallit ja -teoriat pyrkivät ratkaisemaan odotetun hyödyn teoriassa havaittuja epäkohtia ja myös sisällyttämään arviointiin lisää, rahallisesta lopputilanteesta riippumattomia kriteereitä. Prospektiteoria ja sosiaalisten preferenssien mallit on kehitetty vastaamaan odotetun teorian ongelmiin ja sisällyttämään lisäkriteereitä arviointiin. Yksi olennaisimmista lisäkriteereistä on toisten henkilöiden huomioiminen päätösten paremmuuden arvioinnissa. Psykologisella tutkimuksella on pidemmät perinteet sosiaalisen vertailun, päätöksentekoon vaikuttavien tunteiden ja sosiaalisen paineen vaikutusten tutkimuksessa. Tässä paperissa esitellään tarkemmin prospektiteoria, sosiaalisten preferenssien mallit ja sosiaalisen vertailun kannalta tärkeät psykologisen tutkimuksen osa-alueet. Kirjallisuuskatsauksen lisäksi, lopussa on kuvattu sosiaalisen vertailun vaikutusta epävarmuutta sisältävään päätöksentekoon tutkiva hypoteettinen koeasetelma. Viimeinen osio sisältää keskustelua mahdollisista tuloksista ja niiden merkityksestä.

LÖYDÖKSET

Sekä prospektiteoriassa, että sosiaalisen preferenssien mallissa on mahdollista ottaa huomioon referenssihenkilön vaikutus päätöksentekoon ja arvioida tämän vaikutuksen seurauksia. Molemmat mallit ennustavat referenssihenkilön lopputulosten näkyvyyden lisäämisen muuttavan yksilöiden epävarmuuden sietämisen tasoa. Prospektiteoriassa sosiaalinen vertailun näkyvyyden lisäämisen odotetaan kasvattavan koettua etäisyyttä henkilön referenssipisteeseen. Sosiaalisten preferenssien mallissa, referenssihenkilön lopputulos kuuluu hyötyfunktioon ja näkyvyyden vaihtumisen odotetaan vaikuttavan hyötyfunktion parametreihin. Odotettavasti, hyötyfunktion parametrit muuttuvat näkyvyyden muuttuessa, vaikuttaen yksilön riskipreferensseihin.

Psykologian tutkimus auttaa syvällisemmin ymmärtämään kuinka referenssihenkilöt valitaan ja millaisia vaikutuksia sosiaalisesta vertailusta syntyvillä tunteilla, sekä sosiaalisesta paineesta, voi olla päätöksentekoon. Referenssihenkilön päätarkoitus on helpottaa ihmisten omien ominaisuuksien arviointia asioissa, joissa objektiivisen vertailun suorittaminen on vaikeaa. Sopiva referenssihenkilö toimii hyvin mittapuuna ja omien ominaisuuksien subjektiivisen arvioinnin välineenä. Sosiaalisen paineen tutkimustulokset tukevat tutkimuksen hypoteesia ja tarjoavat todisteita sosiaalisen vertailun näkyvyyden merkityksestä. Tunteiden vaikutuksesta epävarmuuden sietämiseen ei ole yhtenäisiä lopputuloksia. Tunteiden vaikutuksiin liittyvät pääteoriat esitetään teoriakatsauksessa ja näiden teorioiden ennustukset otetaan huomioon mahdollisista lopputuloksista keskusteltaessa.

Avainsanat: Päätöksenteko, epävarmuuden sietäminen, riskinotto, sosiaaliset preferenssit, prospektiteoria, sosiaalinen paine, uhkapelaaminen, referenssiryhmä, referenssihenkilö

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1. Introduction

How does the salience or tangibility of social comparison affect an individual's decisions in a decision making game containing risk? According to the traditional economic theory on decision making, an individual is most concerned with maximizing her monetary payoff in any given situation. This is mainly due to the fact that original utility functions contained only monetary payoffs as criteria. In actual situations, it is doubtful that decision making is so simple. Mainly because real life situations contain much more information, in addition to the financial facts, than laboratory experiments or standard theoretical models do. As economic theory has developed, more intricate theories have also been developed to explain decision making anomalies which seem to incorporate more factors into decision making process than simply personal financial or consumption considerations. The focus of this paper will be on how social comparison could affect behavior. Particularly, how perception of a reference person's success and salience of this the social comparison affect risk taking. The hypothesis of this paper is that observed, comparable results from a reference group have an effect on risk taking of individuals – even if these results are formed completely independent of each other. Furthermore, controlling the salience (or tangibility) of the social comparison will have an effect on how large the effect of social comparison is on risk taking. Increased salience is hypothesized to amplify the effect of social comparison on risk taking. This paper will review the traditional expected utility theory, the more recent social preferences model and prospect theory, design a series of experiments to test the validity of the hypothesis and predict results based on the covered theories. Finally, implications of predicted results on the economic theories covered here are discussed. In addition to examining economic theories related to the questions at hand, psychological theory on how a reference group is selected, and how social pressure and emotions can have an impact on decision making under uncertainty are taken included in the considerations.

A rational decision maker in a completely isolated setting, with no information on others, will sensibly not consider anything else than probabilities and payoffs of different outcomes. In other words, important considerations would only include the objectively observable information related to the problem. There would be no reason to consider anything else since there exists no interaction related to the decision and possible consequences. Usual settings where people actually make decisions are radically more complex. For people making decisions outside of an isolated setting, such as a laboratory, a more complex set of information is available and,

intuitively, would be considered when making an informed decision instead of being ignored. Information such as consequences of decisions, the emotional state of an individual when making a decision, and many other similar considerations would likely be taken into account.

What other considerations could then alter preferences over several risky decisions in a more complex setting? First of all, people can have social preferences and they can care about the distribution of wealth. This means that to an individual, it would not only be important what her outcome is, but she would also care what the outcomes of others are. Social preferences models assume that people maximize their utility and that their utility functions are not purely self-interested when they evaluate decisions. In decision making situation containing risky choices, the social preferences models belong to the domain of expected utility theory. People still maximize their expected utility; just the utility function includes considerations including other people as well. This concern for other's outcomes could alter decision making in several ways depending on which formulation of the social preferences model is used. For example, higher outcomes for others could either yield increasing or decreasing utility for a decision maker. Different formulations and parameter versions of social preferences models, and their predictions, will be reviewed in depth in a chapter dedicated to the subject in theoretical review section.

Compared to social preferences models, which are based on expected utility theory, prospect theory provides an alternative approach into evaluating risky prospects. Prospect theory relies on subjective perception of probabilities, and the relation of the outcome and a reference level in evaluating prospects. A reference level could be, for example, the starting amount of wealth in a gambling game or the one's historical success in similar tasks. Valuations of an outcome in a hypothetical gambling game would depend on the difference between an actual outcome and one's reference level. The evaluation of gambles is thus dependent on the amount of change they cause, instead of final wealth level. Interestingly enough, reference levels (also called reference points) in prospect theory are not limited to monetary considerations. People can evaluate their outcomes in the mentioned gambling situation also to other people playing the same game, their personal goals for outcomes and the subjective expectation of the end result. Similar to social preferences models, reference point formation in prospect theory can help incorporate more intricate evaluation considerations into decision making, in addition to purely monetary terms. Just like in the social preference models, outcomes for other people could affect the evaluation of an outcome by affecting reference point formation. Prospect theory will be reviewed more in

depth in the prospect theory portion of the theoretical review section. This section will also clarify prospect theory's history and differences to expected utility theory.

Outside of the traditional factors included in the economic decision making, two possible psychological considerations, which may influence decision making, are presented: social pressure and emotions. In addition to prospect theory and social preferences models, evidence is presented of the fact that social pressure has an effect on decision making. Experiments show social pressure causing subjects to exert higher effort levels and accept increased levels of risk. Most prominent experiments such as Milgram (1963) and Asch (1951) have experimental structures that exert social pressure explicitly on participants. Social pressure can also be more subtle and simply the presence of peers can influence how people behave. An especially relevant notion for this paper is that the effect of social pressure on behavior is moderated by the visibility of one's peers.

Predictions on the effects of social pressure are quite straightforward - opinions on how emotions affect risk taking is more mixed. Two competing theories on the effect of emotions on risk exist: mood-maintenance hypothesis and affect infusion model. According to mood-maintenance hypothesis (MMH) people in a positive mood wish to maintain their positive feeling by avoiding additional risk. Conversely, people in a negative mood do not wish to maintain their negative feeling and are willing to take on additional risk in order to alleviate the negativity. Competitor for the MMH is called the affect infusion model (AIM). AIM states that people in positive moods tend to accentuate the positive aspects of any situation, thus seeing the positive sides of a gamble more strongly which leads to increased willingness to take on additional risk. Negative moods in AIM lead to decreased willingness to increase risk taking for the same reasons. People in negative moods see the negative aspects of any gamble more strongly and are not willing to increase their level of risk. Additionally, negative feelings and emotions are suspected to affect behavior more strongly than positive moods.

In addition to these main lines of theoretical review, history of economic decision making is reviewed in the form of expected utility theory and the concept of risk preferences will be explained. Since reference point formation and selection of a reference person is less explained in prospect theory, some psychological studies on the subjects will be presented as well. Finally, the hypothetical experiment along with expected results will be discussed.

1.1. Importance

The goal of behavioral economic models is to better understand human behavior in various decision making situations. At the moment, decision making considerations are largely limited to evaluating different combinations of financial outcomes. In order to have stronger predictive capability, the effect of additional, non-financial factors should be explored. Better understanding how people conduct in decision making situations containing risk would have important implications; for example, in designing risk-control or incentive systems for employees in companies. Research could further develop theories such as social preferences model and prospect theory to better account for the effect of social comparison. This development would mean that models become more complex as they account for more factors. This tradeoff would be balanced by improved predictive accuracy.

One practical example of how wage and effort are not always positively correlated is presented by Stark and Hyll (2011). Stark and Hyll describe how observable wage differences in a company lead to higher efforts from the lower earning workers. In addition to Stark and Hyll, there are several other papers exploring the effects of social comparison on decision making and behavior. However, the predictions of different models and results from various studies can vary widely. Reciprocity models are a good example. Reciprocity models, which will be further discussed under the review social preferences theory, would predict a worker will negatively reciprocate a low wage to her company. Reciprocity models' prediction contradicts Stark and Hyll's results. Regardless of the apparent discrepancies, it is undeniable that social comparison and performance of reference persons can have an effect on human decision making. Considering the lack of a unified approach, already simply collecting the different approaches on social comparison and risk preferences into one paper is valuable.

Out of this varied field of models, this paper will pick the most relevant ones and present them in the theoretical review section. Focus will be on exploring how factors such as social comparison and emotions affect decision making, particularly in a decision situations containing risk. The approach is a departure from the mainstream approach into studying risk preferences. Economic studies commonly assume a person's inherent risk preferences are defined by certain attributes (age, sex, education, etc.). A less studied field is how situational factors, such as the social comparison mentioned before, might affect risk preferences in addition to personal attributes.

When researching for this paper, it was difficult to find any meaningful articles discussing or studying how situational factors might affect risk preferences.

However, situational factors might not be any less important. Consider for example the recent cases of rogue traders in banks such as UBS and Société Générale who caused losses of billions. It is hardly credible, that their risk taking behavior can be attributed simply to personal attributes such as age and gender. In the future it could be possible that risky situations are identified, instead of focusing on identifying risky employees. The predictive capability of prospect theory and social preferences model could be greatly improved if the potential impact of various levels of social comparison could be accounted for in the utility and valuation functions. For example in the social preferences model, assuming that the same parameters apply for all situations sounds simplified. Similarly in the prospect theory, assuming that perceived distance to reference point is mainly influenced by the status quo could potentially ignore important decision making influences. The final chapters discussing implications of potential results present suggestions on how different results could be modeled in both economic models.

Social comparison and social pressure can already be linked to increased effort levels (even when financial incentives for increased performance are absent) in individuals. It would make sense that the same factors which increase motivation to raise one's effort would also increase incentives to take on additional risk. Particularly, accepting additional levels of risk is the only method to improve one's standing. Proving this fact empirically would provide additional evidence on how people can modify their behavior in response to explicit social comparison. In competitive settings, the results could aid in understanding possible effects of incentive systems more comprehensively. All in all, the effects of social comparison on risk taking have important implications - even though the subject has not been researched in depth in the field of economics.

1.2. Research question

How do risk preferences change in response to increasing salience of social comparison? According to most basic forms of expected utility theory, risk preferences would not change at all due to social comparison considerations. This stark form assumes that only personal outcomes meaningfully affect decision making of individuals. However, empirical experiments have provided ample evidence that people do consider a multitude of information when making decisions.

Consequently, decision making models such as social preferences model and prospect theory include payoffs for other people and consideration of other factors in addition to individual's private wealth in their respective models. These models are important developments in efforts to build decision making models which more accurately model actual human behavior.

What kind of a situation should the theoretical models reviewed in this paper predict? As mentioned before, social comparison is already proven to increase effort exerted by individuals. The relationship between effort and social comparison will be further discussed in the section reviewing social pressure research. It could be possible that different levels of salience for the social reference person and her results moderate effects of social comparison on risk aversion. It would make sense to hypothesize, that if social comparison has an effect on risk preferences, varying the tangibility of comparison and reference point from least explicit to most explicit would affect the intensity of this effect. The hypothesized effect is that participants experiencing disadvantageous social comparison will experience increased preference towards risk taking. Additionally, those participants who experience advantageous social comparison will have a decreased preference for risk. These results would mimic the effect social comparison can have on exerted work effort - but in the domain of risk preferences. Lastly, emotional effects lead to a possibility that the effect of advantageous comparison is more subtle.

A large part of this paper is dedicated to reviewing the important developments in economic decision making theory and the psychological effects which may alter decision making. Psychological research on behavior will complement economic theory and help in predicting the effects of emotions and social pressure on behavior. Finally, theoretical predictions and a hypothetical experiment are present in the end.

1.3. Expected results

Reviewed theories predict that people observing advantageous social comparison will exhibit lower preference for risk. Additionally, advantageous comparison is expected to affect people less than observing disadvantageous comparison. People observing disadvantageous comparison, on the other hand, are expected to be more willing to accept higher levels of risk. Both of these effects are expected to be moderated by the salience of social comparison. Increasing salience should lead to larger effect of social comparison on risk taking and vice versa. Higher willingness to

take risk is explained by higher marginal utility in social comparison theory and through differences on perceived position in relation to the reference point in prospect theory. It should be noted that the support from social preferences model is dependent on the parameter selection, which will be discussed more in depth in the social preferences section.

How could the changing tangibility or salience, and resulting changes in risk preferences, be modeled in social preferences theory and prospect theory? Parameters of social preferences model could be affected by changing salience and further change the marginal utility experienced by people. For prospect theory, changing the tangibility of social comparison could affect how long a distance to the reference point is perceived to be. Both possibilities will be discussed more in depth in chapter 5.

These expected results are also supported by evidence from social pressure research in psychology. Psychological research has shown that the mere presence of a better performing peer can lead to increased effort and risk taking by individuals. Evidence from research on emotions is much more diverse, however. There is no universal agreement on the effect emotions can have on risk taking; two competing hypothesis predict contrary effects for positive and negative moods. Also, impact of emotions is dependent on which feelings are evoked in each person and how strongly these feelings are experienced. Different moods and their strength are almost impossible to predict and thus reaching a conclusion on the end effect cannot be completely accurate. Regardless of the lack of a unified approach, empirical research by Seo, Goldfarb and Barrett (2010) provide some hints on how emotions might affect risk taking. In this study, pleasant moods lead to increased risk taking in the domain of gains and increased risk aversion in the domain of losses. Furthermore, negative or unpleasant moods also lead to increased risk aversion in the domain of losses but had no implications in the domain of gains. This study suggests that research on emotions does not support the predictions of economic models. Or at least mood states moderate the effects predicted by social preferences models and prospect theory.

In order to further understand effects of emotions in the particular setting of this paper, effects of emotions are measured by a questionnaire to be completed along with the decision task containing risk. Even though research on emotions provides predictions potentially contradicting economic models, emotions are not expected to have such a dominating effect, that they would reverse the predictions of presented previously. Expected results, and implications of different combinations of possible outcomes, with various mood states, are examined in depth in chapter 5.

2. Theoretical background

This chapter will begin with a discussion on the importance of reference group comparison and rules which govern the selection of a reference group or a reference person. Economic theory will follow, beginning with the concept of risk preferences and traditional view on valuing decision making under risk: the expected utility theory. In conjunction with the expected utility model, social preferences function offers a specific type of a utility function which accounts for more than simply individual payoffs. The focus then moves to an alternative to the expected utility theory called the prospect theory. After reviewing these economic models, psychological research on the effects of emotions and social pressure on decision making are explored. Sections outlined above will act as a foundation on which the research question and theoretical predictions of experimental outcomes are based on. Next, notations common to several sections of this paper are introduced.

2.1. Preferences Notations and Definitions

Preference notations are made as follows throughout the paper. Preference notations signify the preference order of an individual over several potential choices. For example, a person could prefer cereals over porridge at breakfast. Weak preference of one option over the other: \succeq , for example preference of A over B ($A \succeq B$) and vice versa ($A \preceq B$). A strict preference is denoted using \succ , for example, strict preference of A over B ($A \succ B$) and vice versa ($A \prec B$). Indifference or no preference between options: \sim , for example an individual is indifferent between A and B ($A \sim B$).

A gamble (can also be called a prospect) will be denoted as below. Where an example gamble X consists of two payoffs (P_1, P_2) and the respective probabilities for those payoffs (α, β).

$$X(P_1, \alpha; P_2, \beta)$$

Probabilities for each outcome will always be symbolized by lowercase Greek alphabet but will also be mentioned separately. All of the probabilities will lie in the interval $[0,1]$.

Expected value of a gamble is a weighted average of outcomes. The weights used are the respective probabilities of each outcome. Expected value should not be confused with expected utility. As the section on expected utility theory clarifies, people's departures from objective

mathematical valuations originally inspired Bernoulli to study how personal utility functions influence the valuation of a gamble.

2.2. Reference group selection and importance of comparison

Reference person, or group, defines an individual, or a group of individuals, who are used as a point of reference when evaluating own outcomes and success. Comparison outcome has basically the same meaning, it defines the outcome level relative to which own outcomes are evaluated. Comparable success on the other hand could encompass anything from placement at a sports event to political opinions. Due to the nature of this paper, focus later on will be mainly on monetary measurement of success. This section includes a review on what constitutes as a reference person in psychology. This will be relevant in following sections dealing with social preferences theory and, particularly, prospect theory.

In the realm of social psychology, Festinger (1954) originally outlined a theory of social comparison process. According to Festinger's theory, people have a constant need to evaluate their current state and their own abilities. More specifically related to the current state, people evaluate how relevant their opinion of their own current state is. These evaluations of opinion and ability would ideally be based on some objective criteria. If an objective measure is not readily available, opinions and abilities are evaluated by observing, and comparing to, the opinions and abilities of others. These observations of other people act as feedback for the observer, and provide a replacement of an objective measurement scale thus helping the observers in their comparison process. Naturally, comparison to just anyone will not be relevant. Most readily a good reference person could be identified by observing performance of others and selecting reference persons with similar performance levels. Conversely, as the observable performance levels diverge, relevance of the comparison decreases. One could think of high-school students playing football. They probably dream of reaching the abilities of a famous football star, but realistically evaluate their own development to other students who more accurately resemble their own skill level. This way of evaluation also gives more measurable feedback as it is easier to recognize development. This is because development relative to one's school friends can be observed more easily than development relative to a superstar of football.

Unfortunately, evaluation of abilities to individuals with similar performance levels proved to be more problematic than Festinger expected as Martin et al. (2002) note in their review of prior research. Firstly, people in experiments were not interested in individuals who performed similarly to themselves but rather, in individuals who did extremely well. This would hint that the presence of a high performer leads to people ignoring more reasonable reference persons. Other problem is that even though performance was comparable at a task, this doesn't tell anything of how good or bad people should feel about their performance. A few observations of performance do not reveal enough of the underlying attributes of people. Proposition of the reference point is later clarified in psychology by theories which state that people choose to compare themselves to others who have similar characteristics and attributes, rather than just evaluating own abilities to individuals with similar results (Martin et al. 2002). This method of evaluating results gives people a more accurate picture of whether she is filling her potential and basing the comparison to a meaningful reference point.

Finally, observed differences between reference person and oneself motivate people to take action in order to reduce those differences. Additionally, there is assumed to be a drive in people to constantly develop their own abilities. So a reduction in an observed difference in abilities would not commonly be corrected by reducing one's own ability level. On the other hand, if a reference group's abilities are observed to be superior, the observer would devote to developing her abilities more and take necessary action to reduce difference. It is worth noting that Festinger does not define which would be more prominent, the desire to develop own abilities or bring the reference group more closer to own abilities. The latter could happen in several ways, such as a person changing her reference person or attempting to alter the actual ability levels of others.

Motivation to take action is not the only possible result of reference group comparison but the comparison process can have wider implications. Suls et al. (2002) states that relative position to a reference point influence an individual's aspiration level, self-concept and subjective well-being. As the section on the effect of emotions on behavior will clarify, defining the types of emotions and moods evoked by the comparison process would be important in predicting behavior. Unfortunately, psychological research has no simple answer on whether downward comparison (comparing to someone worse off) elicits positive feelings or whether positive comparison elicits negative feelings – both could be interpreted in several ways. Downward comparison could mean that one is well off or remind an individual that things can get worse. The same applies for positive

comparison. Instead of focusing on the emotions evoked by different reference comparisons, this section will further focus on what mechanisms notify a person of failure or success. In the end of this section it will be clear that reference persons can affect individual perception of success.

Reference point comparison has a role in self-evaluation and an effect on human behavior but what defines the significance and magnitude of social comparison's effect. One could think of social comparison as an additional source of feedback on behavior, especially when one perceives a failure in relation to a reference person. The rest of this section clarifies how psychological research understands the detection of errors in behavior. As mentioned before, this section will conclude on how reference point performance in relation to oneself can affect the perception of the size of an error.

Humans are capable of detecting errors in their behavior and correcting their behavior in order to improve performance. In psychological research, it is assumed that the cost of errors has led to development of evolutionary mechanisms which detect, correct and compensate errors, and that there are neural processes which guide this error detection. Observations of such possible processes were already present in research by Rabbitt (1966). In Rabbitt's research, response times in a choice-response experiment were longer for choices following a wrong response than for other choice scenarios. Participants detected their error that had occurred in the previous choice and took more time when responding to the following choice. Levelt (1989) mentions a similar pause for consideration in human speech when an error is detected: when speakers recognize errors in their speech, they take a pause to construct a correction to the detected error. The errors can be detected either through self-monitoring or through feedback received. The system that could be imagined to control action and information processing is described by Logan (1985). Logan's research review outlines a system which controls and coordinates the choice of strategies made by individuals, processes information and makes changes to strategies if the goals and the environment change. In addition to these functions, the executive system processes information – regarding errors, for example - upon which chosen strategies are based. In other words, the success in a chosen strategy is constantly reviewed according to set criteria and revised if necessary.

Early research into error detection was driven by observations of behavior. Later on, a more in-depth view on brain activity became the goal. In order to research responses to errors, Gehring et

al. (1990) measured brain responses to errors in reaction time experiments. Errors made by participants were accompanied by a detection of electrical brain activity called error-related negativity (ERN) on the scalp of the participants. Correct answers in reaction time experiments did not lead to detection of the ERN. Gehring et al. (1993) relate the ERN response to a system which monitors performance and compensates for errors performed by individuals. In other words, they provide evidence that a performance-monitoring and error-compensating system exists and that ERN is related to that system by signaling committed errors. The functioning of this system was further investigated by Bernstein et al. (1995) who found that the ERN involves a comparison between the response that actually occurred and a correct response. Moreover, size of the error signal detected in participants was dependent on how similar the two responses being compared were; a greater similarity resulted in a smaller error signal. Clearly, a larger error results in a larger error signal and a smaller error results in a smaller error signal. As will be described later on, success of others in a similar task can also affect the size of the error signal and not only one's own success. This is evidence of the fact that social comparison provides an important and natural way of evaluating success and detecting areas of improvement.

Is the ERN related to whether the error can be corrected immediately? According to Scheffers et al. (1996) it is not. ERN signals manifested similarly both in situations where the error could be corrected immediately and where it could not be undone. Furthermore, size of the error signal did not differentiate between the two choices. Finding no difference between the two, the result implicates that the ERN is more closely connected to a system of error detection than immediate error correction. In their research, Miltner et al. (1997) state that the ERN is not dependent on a specific type of error but the signal is detected in errors of choice, estimation and action. This leads to the conclusion that ERN is related to generic error detection mechanism that is not dependent on identifying particular errors in any specific type of activity.

Mars et al. (2004) state that the feedback ERN detects errors and that even incorrect feedback can affect the behavior of participants in time estimation experiments. In their experiment, participants corrected their behavior according to received feedback and the size of the correction was related to the size of error reported in the feedback. Clearly, performance feedback given by others affects behavior of people. What about the mere presence of people and the observation of their actions and outcomes?

People could also use the success of their social reference persons as feedback, even if these reference persons are not factually giving any explicit feedback. But does observing the success of other people affect the error signal elicited like other feedback? Boksem et al. (2010) observe the size of error-signals in a two-player time estimation game. In this game both players could see both results but rewards were only dependent on independent performance of participants. In other words, it was not possible for participant A's reward to be affected by participant B's actions in any way. First of all, Boksem et al. confirm that incorrect answers in a time-estimation task cause a larger error-signal than a correct answer. Error-signal caused by an incorrect answer is further amplified if another player simultaneously succeeds in the same task. It seems that failure seems much worse when a reference person is perceived as successful. This also means that people allow other individuals to influence evaluations of their success without recognizing the effect themselves.

This section has outlined the current conclusion of psychological research that people need to evaluate themselves and that other people are used in this process of evaluation. The reference person should be comparable to the individual performing the comparison. Observed differences in comparison to the reference person will lead to higher motivation and can subjective well-being, among other things. Unfortunately, the effect of various social comparisons on emotions, and subsequently the effect of emotions on behavior, is unclear. Luckily, research on the error detection systems evidences provides information on how people perceive success and how reference persons can amplify the significance of perceived errors. Finally, the perceived errors and feedback from others clearly does have an effect on observed behavior. The following sections will introduce economic concepts of risk preferences and continue with prospect theory and social preferences model.

2.3. Risk preferences

The effects of personal attributes and how they affect risk aversion in individuals has been widely researched in economics. This research is useful, for example, for companies which need to construct risk profiles according to the limited information available. One useful application could be the screening of certain personality attributes in recruitment situations or the pricing of an insurance policy. In economic theory, and more specifically in expected utility theory, risk

preference levels are divided into three main types: preference towards certainty, risk neutrality and preference towards risk. Risk preferring individuals receive more utility from a gamble than they would from a monetary amount equal to the gamble's expected value. Certainty preferring individuals, on the other hand, receive less utility from a gamble than they would from receiving the expected monetary value of the gamble. Risk neutral individuals would be indifferent between the two. Graphs of the risk types and their respective, traditional utility function types will be presented in the next section.

Previous research states that an individual's risk type is defined by the combination of personal attributes they possess. For example, Guiso and Paiella (2008) propose that increasing wealth decreases risk aversion. In another paper, Dohmen et al. (2011) investigate how age, background, gender and even height can affect individual's willingness to take risks. These and a multitude of other studies agree on the fact that individual attributes do affect risk taking. However, these studies have not attempted to explain how different situations might affect underlying risk preferences. Thus there is an implicit assumption that preferred level of risk aversion remains constant over different situations or at least, that the personal risk preference is dominant in determining even the situational risk preference levels. A more realistic assumption would be that different individuals have varying baselines of risk aversion, the level of which is determined by personal attributes. This baseline level is then modified by situational factors such as how one perceives herself in social comparison situations.

Some basic individual attributes will be measured in the beginning of a decision making game of the experiment that follows later. This will allow for simple comparison between different groups and help ensure that participants in these groups are broadly similar in their attributes. The theories presented here will gather evidence on how social comparison can affect risk taking and thus help gather evidence on effects of situational factors on risk taking.

2.4. Expected utility

Expected utility theory provides a good foundation on decision making under risk and helps understand how decision theory has developed throughout the history of economic theory. Expected utility theory states that people consider the utility of each possible gamble and choose a gamble that maximizes their expected utility. Expected utility differs from expected value and

could be both higher, lower or equal to the mathematical expectation of the value. This chapter will review the most important developments in expected utility theory and explain how the theory is used.

Bernoulli (1738) was the first to consider that people's valuation of gambles was different from the expected monetary values that could be assigned to a gamble mathematically. In practice, this means that a gamble providing either 10 or 0 euros with equal opportunity could be valued at below or above the expected value of 5 euros, depending on who is asked. This personal valuation could, for example, depend on the wealth status of the individual. Bernoulli gives an example where a poor man would be more inclined to sell a gamble below its expected value than a rich man would. Thus, the value of a gamble is not dependent on the expected payoff but on the person making the estimate and the utility it yields to this person. It seems sensible to examine the probability weighed utility of each payoff for a gamble, or expected utility, when attempting to understand decision making under risk. Probability weighing of utilities for various outcomes is the basic idea of evaluating uncertain outcomes used in expected utility theory.

Even though the basic idea was already presented in 1738, expected utility theory (EUT) only began to gain prominence after Neumann and Morgenstern (1947) articulated three simple axioms of preference defining a rational decision maker. Later on, Samuelson (1952) and Malinvaud (1952) articulated the fourth axiom of independence which was only implied by Neumann and Morgenstern. If the four axioms are satisfied, an individual's preferences can be presented by a utility function. The four axioms are completeness, transitivity, independence and continuity. Alternatives to the original axioms have been developed after 1947 but the original four will be described here. The original axioms are most widely used and they will also be most relevant when reviewing prospect theory and criticism towards the expected utility theory.

The first axiom is called completeness. Completeness means that an individual has preferences. That is, she prefers one option over the other or is indifferent. When completeness applies, an individual can decide between alternatives presented to her by using the underlying preferences.

The axiom of transitivity means that individuals are consistent with their preferences. For example, if an individual has three gambles to choose from: A , B and C . This individual has preferences and if A is preferred over B and B is preferred over C , then A is (strictly) preferred over C .

$$\text{If } A \succ B \text{ and } B \succ C, \text{ then } A \succ C$$

Independence axiom defines that if a person has preferences over two gambles, she maintains her order of preference when both of the options are manipulated similarly. Consider again three gambles A, B, C and additionally $\alpha \in (0,1]$.

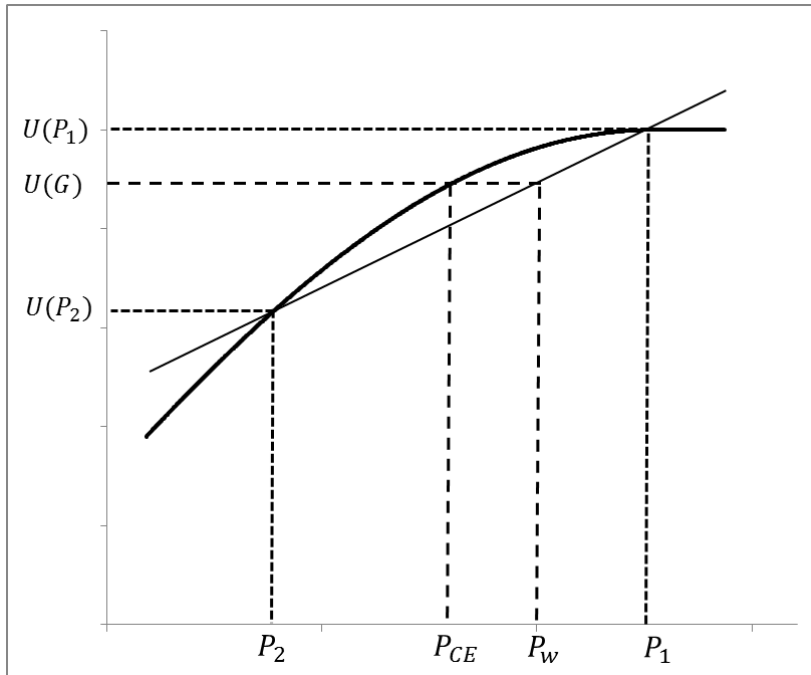
$$\text{If } A \succ B, \text{ then } \alpha A + (1 - \alpha)C \succ \alpha B + (1 - \alpha)C$$

Finally, continuity axiom states preferences are continuous. This means that several gambles of different preferences can be combined to attain gambles, preferences of which are not necessarily identical to any of the single gambles. Consider again three gambles A, B and C .

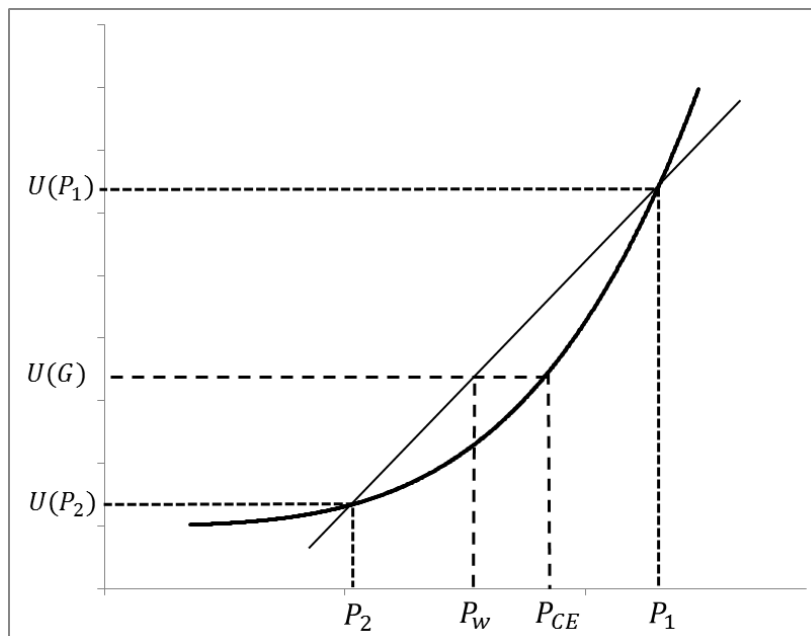
$$\text{If } A \succ B \succ C, \text{ then a probability } \alpha \text{ exists such that } \alpha A + (1 - \alpha)C \sim B$$

For all of the axioms presented here, it is naturally assumed that utilities for different alternatives or gambles correspond to the preferences. For example, if gamble A is preferred over gamble B the utility of gamble A is also greater than gamble B .

Friedman and Savage (1948) defend the principles of EUT in their article after it had been thus far discarded by economists - with the exception of Neumann and Morgenstern. Neglect of the EUT was caused by a belief that the theory could not explain decision making under risk mainly due to the assumption of diminishing marginal utility (Friedman and Savage 1948). Diminishing marginal utility means that having more wealth, people assign smaller amounts of utility to an additional dollar than those with less wealth. Assumption of diminishing marginal utility would assume that all individuals have risk adverse preferences and this made it difficult to explain gambling through expected utility maximization. Neglect of EUT until Neumann and Morgenstern presented their axioms has also been explained with Bernoulli's use of cardinal utility scale instead of ordinal utility (Starmer 2000). What shape does an individual's utility function have if diminishing marginal utility does not apply in all cases? Friedman and Savage (1948) disregard the assumption of diminishing marginal utility for all. Instead, they state that individuals may have different types of utility functions which determine their valuation of uncertain prospects. Similar to maximizing utility under certainty, in EUT individuals attempt to maximize the expected utility they assign to various uncertain outcomes. Shape of the utility function reflects different risk preferences people can have. These are the three types of preferences mentioned in the previous section: preference towards risk, risk neutrality and preference of certainty. Below are depictions of the utility functions associated with preferences for certainty and risk. A risk neutral utility function is linear which leads to the certainty equivalent always equaling the gamble's expected value.



Graph 1: Utility function of a certainty preferring individual. This graph depicts a utility function which is concave, leading to a situation where the expected utility from a gamble $U(G)$, containing two possible payoffs (P_1 and P_2), is always smaller than the utility of the expected value of the gamble. In other words, the value a person would be willing to pay for the gamble (P_{CE}) is always smaller than the mathematically expected outcome from this gamble (P_w).



Graph 2: Utility function of a risk preferring individual. The second utility function belongs to a risk preferring individual and is convex. Convexity causes every gamble to have a higher expected utility $U(G)$, than would be the utility of the expected value (P_w) of the two possible outcomes (P_1

and P_2). This leads to risk preferring individuals being willing to pay more for a gamble than would be the objective expected value ($P_{CE} > P_w$).

Imagine a person has two possible payoffs in a gamble called G , P_1 and P_2 and that $P_1 > P_2$ applies. P_1 and P_2 have probabilities α and β , respectively, of occurring and $\alpha P_1 + \beta P_2 = P_w$. Individual risk preferences are determined by how the following functions relate to each other: $U(P_w)$ and $U(G) = \alpha U(P_1) + \beta U(P_2)$. That is, how the utility of expected payoff and the gamble's expected utility relate to each other.

If $U(P_w) > U(G)$ applies, the individual has a preference towards certainty. This means that a person would receive less utility from taking the gamble than the expected payoff would imply in simply monetary terms. If $U(P_w) < U(G)$ applies, the individual has a preference towards risk. This is a reverse of the first case, now a person actually receives more utility from taking the gamble than the utility of expected payoff would suggest. And in the final case where $U(P_w) = U(G)$, there is no specific preference towards risk or certainty. As it is assumed that all three different shapes for the utility function can be observed in people, the assumption of diminishing marginal utility for all individuals can be discarded. Shapes of the utility functions help understand Bernoulli's original observation and explain why people can assign gambles values that are different from their expected values.

Concept of certainty equivalent can further help clarify different risk preferences. A certainty equivalent is a payoff P_{CE} which satisfies $U(P_{CE}) = U(G)$ for all types of risk preference. Following cases apply for the different classes of preferences and their relation to certainty equivalent.

$$P_{CE} < P_w \quad \text{For certainty preference}$$

$$P_{CE} > P_w \quad \text{For risk preference}$$

$$P_{CE} = P_w \quad \text{For risk neutrality}$$

This leads to a case where risk preferring individuals are only willing to exchange their gamble to a sum of money greater than the expected monetary outcome of a gamble is. Conversely, certainty preferring people are willing to accept less money if they can avoid taking a gamble which contains risk. Whatever shape an individual's utility function has in the end, course of the EUT is very straightforward. If people have rational preferences, the order of which is known over a finite set of gambles, it is possible to describe how they will decide when presented with a choice of

gambles from this set. Friedman and Savage (1948) also proposed that an individual's utility function would be concave for low amounts of wealth, change to convex between certain wealth levels and again continue as concave as the level of wealth surpasses a certain threshold. However, this proposition has been less popular in economics.

Empirical experiments conducted to test EUT discovered several inconsistencies with its predictions. The first of which was the Allais paradox (Allais 1953) which showed that in some cases the preference of an individual over two gambles could be reversed by modifying both gambles identically. The results violate the independence axiom which was explained previously. The purpose of this paper will not be to review all of the subsequent developments in the EUT which attempt to solve the Allais paradox and problems related to the independence axiom. This decision is supported by the fact that there is no conclusive evidence to support any single line of generalized expected utility theory. See Harless and Camerer (1994) for a more in-depth discussion. Most common problems with EUT, which lead to the development of prospect theory, will be presented in the prospect theory section.

How would different levels risk aversion be measured in EUT? Arrow-Pratt measure of risk aversion, developed simultaneously by Pratt (1964) and Arrow (1965) provides an answer. Below is a formulation of the measure as presented by Pratt (1964, pp. 122), where $r(x)$ is the risk aversion measure, $u'(x)$ is the first derivative of a utility function and $u''(x)$ is the second derivative.

$$r(x) = \frac{-u''(x)}{u'(x)}$$

A positive measure would indicate risk aversion and a negative figure represents risk seeking. A higher curvature of a concave (convex) utility function in would indicate higher levels of risk aversion (seeking). In his paper, Pratt mentions that risk aversion is affected by two variables: the wealth of the individual and the level of risk. For example, for a concave utility function, the risk aversion is a decreasing function of wealth and an increasing function of risk. This is intuitive, as the level of wealth increases individual's tolerance for a defined gamble, which remains unchanged, also increases. Again, the idea behind risk aversion (seeking) is the concave (convex) shape of the utility function. It is difficult to formulate a utility function in empirical settings so the experiments presented in the empirical section will use a more convenient measure of risk

aversion. In the experiment participants are given a certain amount of money and they have to decide how much of it to place as a stake in a gamble where the money either is doubled or lost with equal opportunity. The higher the staked amount, higher the implied risk taking of an individual.

Arrow (1971) further shows that individuals are risk neutral in gambles using arbitrarily small stakes. This as well makes intuitive sense, since outcomes are small enough to virtually not change the individual's wealth, risk does not enter decision making as an important consideration. Stakes in the proposed hypothetical experiment later on will not be arbitrarily small as defined by Arrow and should thus yield meaningful results.

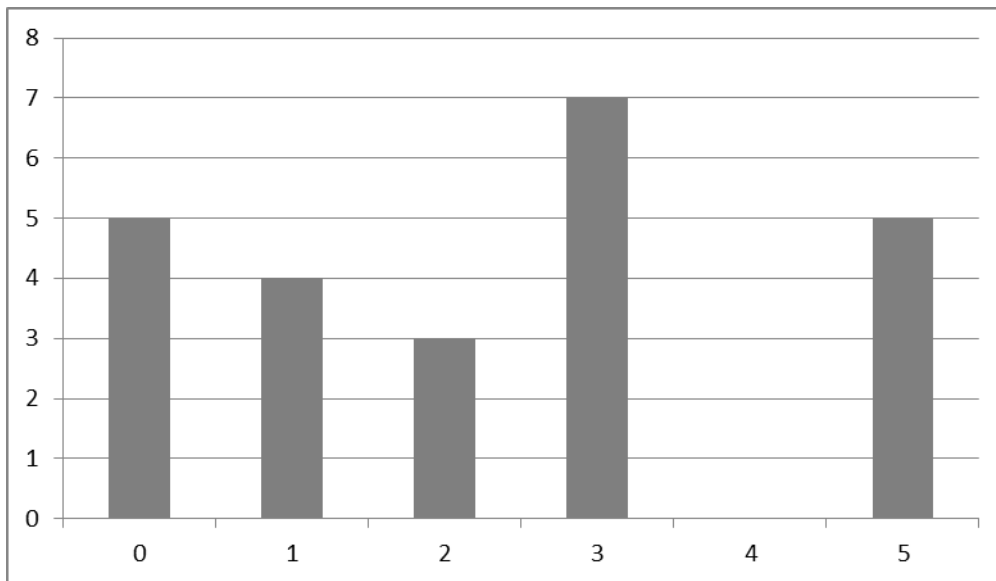
Apart from small stake gambles, some economists such as Mathew Rabin state that a problem still exists with expected utility. For certainty preferring behavior, concave utility function implies a diminishing marginal utility as wealth increases and this can lead to problems as mentioned earlier (Rabin 2000). The problem arises as it is possible to find equal probability gambles with a modest possible loss and infinitely increasing possible gain, which an individual would not accept. This problem arises in modest or large stake gambles and is thus not that important for the goal of this paper, as the potential empirical research is focused on small stake gambles.

Despite criticism, expected utility theory is very useful in understanding the idea of decision making under risk and can be used to understand how changes in utility affect decision making. The social preferences model presented in the next chapter is an expected utility maximization model where the utility function accounts for other variables in addition to wealth. Prospect theory, on the other hand was created as an alternative model to EUT and will be discussed as well.

2.5. Social preferences -model

Let's assume that a person makes decisions according to one criterion: attempting to maximize her monetary payoff. This person is then given the task of dividing 10 dollars between her and another person, called the "accepter." The accepter always has to accept the division proposed. What proposed division would now make sense, considering our decider's motives? A good prediction would be the decider keeps the full 10 dollars to her and the accepter would just have to live with the situation. This would be the case if one is to assume that the decider's utility

function is only dependent on the monetary amount received and strictly increases as the payoff increases. Experiments with actual people making the same decision show that this prediction is overly simplified. Below is an example graph of actual results, with real payoffs, of offer sizes from Forsythe et al. (1994, p. 366). Horizontal axis as the amount of money offered to the acceptor and the vertical axis indicates how many observations of this offer there were. Total amount of observations in this particular experiment was 24.



Graph 3: Amount of dollars offered to the acceptor in a 10-dollar dictator game (Forsythe et al. 1994)

It is worth noting that the results presented above are taken from a game with real money stakes. Also, the decider's proposed division is always enforced. There is no apparent reason for the decider to offer the acceptor anything above 0. As people are clearly offering more than would be predicted, there must be some other motives at play and affecting their decisions. Most people would not consider a division where the proposer takes the full 10 dollars fair. Thus it is important to find a model, which includes more factors to the utility function than simply monetary incentives, if these anomalies are to be explained. In this chapter, considerations for other people, how they can affect decision making and how the concept of fairness fits into social preferences are explored. First, the backgrounds of three social preferences models will be reviewed and then a composite model combining all three will be presented. The three branches of social preferences models discussed here are reciprocity, difference aversion and social-welfare maximization models.

As early as 1925, Alfred Marshall noted the use of term "fairness" by both employers and employees (Marshall 1925). Even if he noted that the term is difficult to grasp from an economists point of view, he also states that it must have some real meaning at a workplace. So how could an individual's view on fairness change the way she behaves?

Mayo (1949) had a more clear vision on the matter, as he states that a social group is very influential in determining the functioning of company. In Mayo's opinion, social groups influence behavior by varying how motivated the workers are, how often they are absent from the workplace and how productive they are. Mayo's perception on the effect of social groups was based on his own observations. Could it be that that people would also care about how they view fairness towards their social group in addition to considering themselves? Effects of social groups on workplace behavior were recorded and presented in figures a little later by George Homans (Homans 1954). Homans noted productivity levels exceeding company requirements in very simple tasks, regardless of the fact that none of the employees either wanted a promotion or believed in there being a possibility for one. Aside from career advancement, there must be other forces driving such behavior.

The concept of fairness is an intuitive way of describing social preferences that may affect behavior. Social considerations could have at least three types of influence on preferences - as presented in Charness and Rabin (2002). Firstly, there's reciprocity. It is perceived as fair that people, who one is kind to, are also kind towards that individual. Secondly, individuals can have a preference towards difference aversion. For example, people would perceive decreasing wealth differences between individuals as fair. The methods by which differences are reduced are not so important and even decreasing overall wealth of the group could be acceptable if differences were reduced. Thirdly, people could have a preference towards maximizing the social welfare of a group. That is, differences in outcomes for different members are not important as in the preference for difference aversion. It is more important to maximize the social group's outcome as a whole.

These social preferences affect employee behavior in Homans' paper according to Akerlof (1982). Workers in Homan's paper form a social group and this group had formed a norm on how much would be a suitable level of productivity - which was in excess of the company's requirement. The level of productivity in excess of the company requirement can be understood as a gift by the employees to the company. In return for the group's collective productivity effort, they expect the

company to reciprocate their gift. This could for example be a higher average wage for the group as a whole or leniency towards the weakest workers of the group, which would point to difference aversion. The company's response then again affects the worker's norm formation. As the group forms its own norm of a suitable level of productivity it can be seen as maximizing the social welfare of the group. Workers anticipate the company to reciprocate their effort and thus increase welfare of the group. (Akerlof 1982)

Homans' paper provides a good example on how social preferences can influence behavior in an environment where money has traditionally been the main motivational driver in economic analysis. Now, reciprocity, difference aversion and social welfare maximization are explored separately. These relate to how fair interaction between people is judged and how fair it is to advance the two mentioned social goals (income equality and social welfare maximization).

2.5.1. Reciprocity

It is intuitively sensible that people would like to punish those treating them badly and reward those who have behaved towards them in a positive way. Wage setting as a gift giving game between a group of workers and their employer, presented earlier, depends on this intuition. Workers in this game expect a reward for their gift of higher productivity to the company. If the employer was to not return the favor to the workers, they could feel unfairly treated and punish the company by lowering their productivity. Akerlof (1982) mentions, that employer's behaviour in Homans' paper had already led to problems with reciprocity before. It could be that the employer at some point did not reciprocate the employee effort, which led to conflicts in the company.

In this example the different parties were giving and expecting gifts from each other. But what if there was no such expectation. In Akerlof (1982), one could say that the employer improves the worker's conditions in order to avoid their punishment. Would the employer still reciprocate if there was absolutely no risk of reprisal?

In the 1980's economists started developing formal models to describe social preferences and their influence on behavior. Sudgen's (1984) model was among the first in which individuals donate an effort to provide public goods for all. In this model, people donate effort to provide public goods for all. A person receives utility from the public good, but she is also obliged to donate some level of effort towards the production of the public good. The utility function is

defined as below, where u_i is a utility function for person i , q_i is the effort level she donates to the production of the public good and z is the amount of public good available. Her utility is an increasing function of z and decreasing of q_i .

$$u_i = u_i(q_i, z)$$

In Sudgen's model, the amount of the donation is defined by the social group an individual belongs to. The amount a person donates is determined by two things: (1) the level of desirable contribution this person thinks everyone should give in a group and (2) the amount donated by other people in the group. As in Sudgen (1984), consider that q_o is the level of optimal donation by her social group in i 's view. Also, q_j is defined as a contribution of any other member of that same social group. Now individual i 's contribution q_i is in her view sufficient if either of the following criteria is fulfilled.

$$q_i \geq q_o \qquad q_i \geq q_j$$

As it is possible to see here, Sudgen's model only set's minimums to donations people feel obliged to give. The model is still somewhat simpler than what one would consider reciprocity to contain. For example, punishing those who are unfair towards a person is not considered. The case presented by Sudgen applies to a case where a group is together producing something and enjoying the product together. Negative consequences for unfair behavior are still missing from this model. It does however present a model where an individual is not purely motivated by simple self-interest.

Reciprocity as a concept is more complex than simply accounting for how much individuals are willing to contribute towards a common goal. According to bargaining experiments, people assign some value to punishing those who give unfair offers. This is evidenced by the fact that experiments have found people turning down positive payoffs in bargaining games if this also punishes an unfair party.

Thaler (1988) describes several such instances of experiments utilizing the ultimatum game. In an ultimatum game, one of two players decides how to divide a set amount of money and the other decides whether to accept this division. When accepted, the division is executed as suggested but if turned down, neither player gets anything. As mentioned by Thaler, the traditional solution only considers the financial payoffs for each player and would suggest an outcome where the smallest

positive amount of money is offered to the other player and she accepts it. Observed outcomes are quite different with players turning down even sizeable offers in order to punish others for perceived unfair division. That is, people are willing to sacrifice their own financial payoffs in order to punish parties they feel are behaving unfairly.

A model which accounted for more interaction than Sudgen's formulation, in a game of two players, was later developed by Rabin. Rabin (1993) presents three rules, according to which reciprocity drives individual preferences. Firstly, people wish to reward those who are kind to them and are willing to sacrifice their own material well-being to do so. Secondly, people prefer to punish those who behave unfairly towards them and are again willing to sacrifice their material well-being to do so. Thirdly, two first motivations affect behavior more when the cost of sacrifice is smaller. Fairness in Rabin's model is basically defined as how equally payoffs are divided in a game and in this respect relates to how fairness is understood in Fehr and Schmidt's (1999) difference aversion model described later on.

Rabin examines a normal form game theoretic situation and incorporates beliefs into his model in addition to simply considering the game's explicit payoffs. More specifically: beliefs of the intentions of other players' are included. Player *A* decides how to treat player *B*, and bases this decision on her belief of how player *B* will in turn treat player *A*. Player *B* goes through the same consideration process. Below is a utility function presented for player *A* in a two player game consisting of players *A* and *B*. In this function π_A is player *A*'s material payoff, \bar{f}_B is the level of kindness player *A* expects from player *B* and f_A is the level of kindness exhibited towards player *B* by player *A*. It is worth noting that Rabin considered normal form games where players chose simultaneously and so the belief of the other's behavior is important instead of actual observed behavior. A rational assumption would be that an individual's belief of the fairness of others is affected by their past behavior as well.

$$U_A = \pi_A + \bar{f}_B [1 + f_A]$$

The kindness functions can have values ranging from -1 to $\frac{1}{2}$. Equitable payoff is defined as a value of 0 for either of the two fairness functions. Additionally, positive values exhibit higher kindness and negative values unkind behavior. Kindness function is an increasing function of how much payoff is given to the other player and vice versa. How fairly player *A* actually behaves towards player *B* depends on the expectation of player *B*'s fairness towards player *A*. If $\bar{f}_B < 0$,

then player A has an incentive to lower f_A in order to increase utility. In the examples presented by Rabin lowering f_A also lowers π_A . Because the decision to punish also affects player A 's material payoff, punishing player B should provide an offsetting increase in utility to be reasonable. The smaller the loss in material payoff is the more reciprocal behavior will be exhibited by the players.

If in the above function $\bar{f}_B > 0$, then player A prefers to increase f_A . Player A would prefer to be fairer to player B , if she expects player B to be fair to her. This is of course contingent on the fact that increases in f_A are not offset by changes in π_A . It's possible for π_A to decrease but the total utility should still be higher as a result of the increase in f_A . This exemplifies sacrificing monetary payoffs in order to increase the level of fairness towards another player. It is worth noting that Rabin only considered single-stage games of complete information in his model due to the fact that fairness easily incorporated into normal form game theoretic situations. Regardless of this shortfall, the presented model explains general principles of reciprocity clearly.

Returning to Homans' recording of employee behavior, Rabin's formulation of reciprocal behavior would explain the worker's and employer's behavior. This model would also predict that the employer rewards the efforts of the employees and that this rewarding is not necessarily motivated by the fear of reprisal. The prime motivation would instead come from the reciprocating fairness of the employees. From the employees' side, Akerlof and Yellen (1990) conclude that employee efforts depend on the relationship of fair and actual wage. Employees hold a conception of a fair wage level, which they compare to their observed actual wage and finally reciprocate their wage level to the company by deciding an effort level dependent on the observed relationship. In other words, employees observe how fairly they are treated and decide how well the employer should be treated in response.

Dufwenberg and Kichsteiger (2004) expand Rabin's theory to sequential games. However, the main purpose of this review is to expand on the notion of fairness in the social preferences model and thus an expanded review of reciprocity will not be relevant. An important notion for reciprocity is the intention behind an action – people care whether the other person acting in a fair manner. The following review of difference aversion, on the other hand, discusses fairness from the viewpoint of discrepancies in wealth division between people.

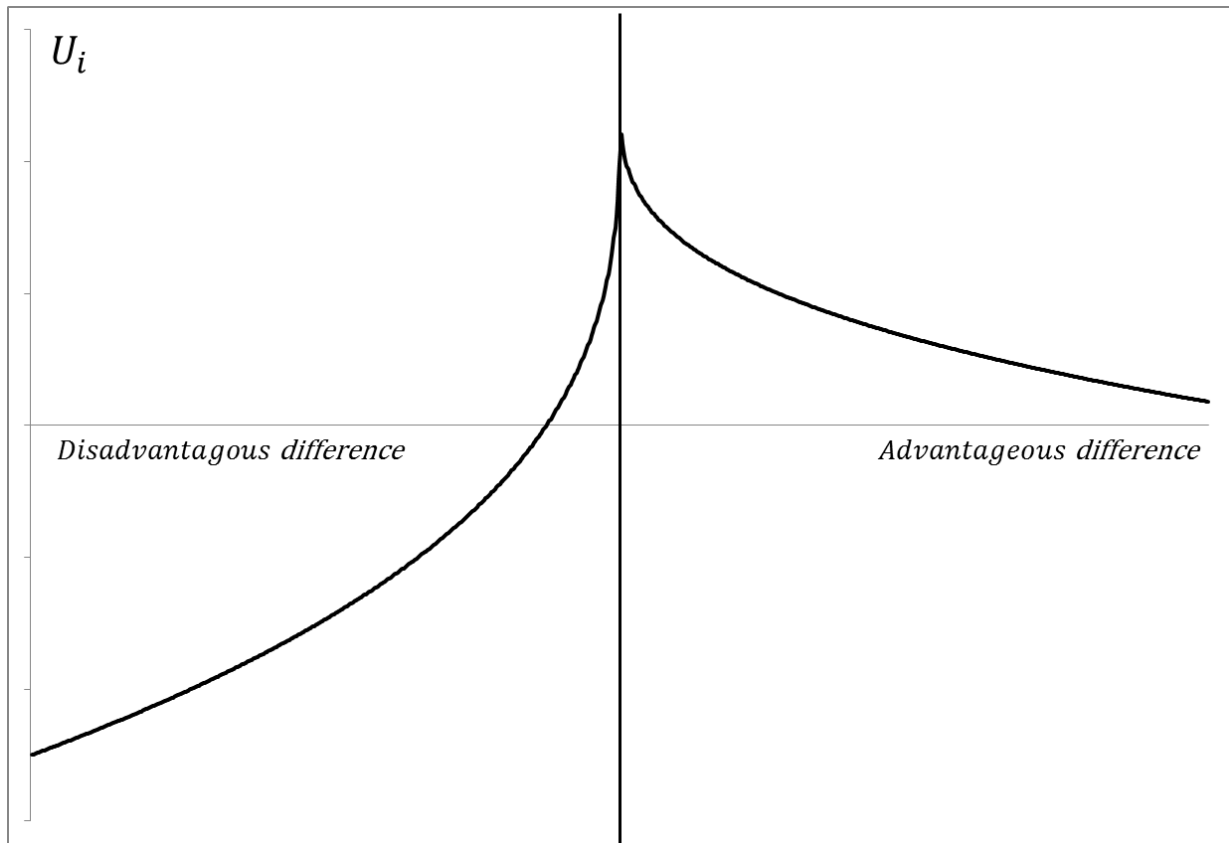
2.5.2. Difference aversion

Difference aversion refers to a personal preference towards inequality reduction. Inequality aversion manifests in individuals taking action to reduce differentials. Inequality reduction could result from sacrificing a person's own payoff or by taking a conscious action to lower other's payoffs in order to advance a more equitable situation. As discussed previously in the section on reference person selection, psychological research has recognized comparison to social reference prior to it being considered in the field of economics. Theories such as the social comparison theory and equity theory captured the basic idea of difference aversion in the 1950's and 1960's.

In social comparison theory, people have a need to evaluate themselves to other people (Festinger 1954). In Festinger's paper, a comparison is always more meaningful as the similarity between people increases. Importantly, as the differences within a social group increase, both the group and individual members will be motivated to reduce the differences. In a case of two people, the person taking note of the discrepancy between her and the reference person would be motivated to reduce the difference. Whereas social comparison theory deals with ability and opinions between people, equity theory deals more narrowly with work effort and payoffs resulting from effort.

Equity theory in social psychology describes reactions similar to the social comparison theory. Equity theory was created to explain how people evaluate fairness of income difference. According to Adams (1963), people evaluate their own ratio of rewards and effort to the ratios of reward and effort of others. If others have a notably higher ratio of rewards to effort, the individual observing this difference will begin to feel displeasure and is motivated to correct the situation. For example, if person A's colleagues were to receive a larger compensation for the same work that person A is doing, A would feel unfairly treated.

In the realm of economics, one of the first experiments estimating the effect of difference in payoffs on utility between two players was Loewenstein et al. (1989). The estimated social utility function resulting from this study has a tent shape: players exhibit the highest utility when there is no difference between payoffs. If a player is behind another player, utility for this player rises steeply as the discrepancy between players decreases. On the other hand, estimated utility of a player is not strictly increasing as the difference to another player increases advantageously. Rather, it is convex and downward sloping. These results would support the hypothesis that reducing differences between people is an important consideration in decision making.



Graph 4: Development of utility for individual i as the payoff difference first decreases and then increases to the advantage of i (Loewenstein et al. 1989)

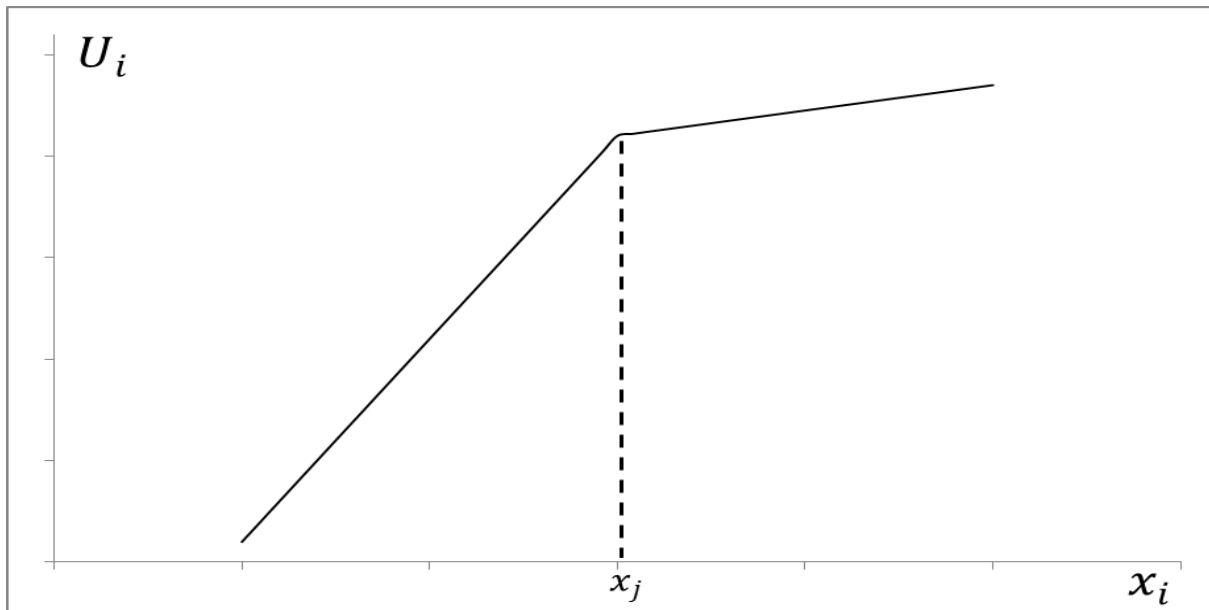
Clark and Oswald (1996) further research that a person's satisfaction depends on income relative to others by going through data from the 1991 British Household Panel Survey. Clark and Oswald find no correlation between absolute earnings and self-reported job satisfaction. Instead, higher income relative to similar peers' income is related to a higher self-reported job satisfaction. This study does not comment on the form of a possible utility function over the difference between individuals. It simply provides evidence that interpersonal comparison can have an effect on the satisfaction experienced by people and thus, could more likely influence decision making as well. It also seems to contradict the research by Loewenstein et al. by implying that utility increases as the advantageous difference increases.

Continuing difference aversion research, Fehr and Schmidt (1999) begin with the assumption that people dislike outcomes which promote inequality and build a simple model to describe the effect on decision making. A simple version of the Fehr and Schmidt (1999, p. 822) model contains two people. In the below depiction, x_i denotes the monetary payoff of individual i , x_j denotes the payoff of individual j , α_i and β_i describe the effects of inequality on utility.

$$U_i(x) = x_i - \alpha_i \max[x_j - x_i, 0] - \beta_i \max[x_i - x_j, 0]$$

Additionally, $\beta_i \leq \alpha_i$ and $0 \leq \beta_i < 1$. This is intuitively sensible as an increase in inequality is at least as detrimental for utility when person i is behind person j in payoffs compared to person i being ahead. In other words, the effect of advantageous inequality on utility is smaller than disadvantageous utility. As mentioned by Fehr and Schmidt, this relationship between α_i and β_i is supported by results from Loewenstein et al. (1989) as the slope of the utility function is steeper when the person at a disadvantage makes the comparison. This is also evident from the left side of Graph 4. Loewenstein et al. (1989) also predict that the utility for an individual would decrease as her payoffs increase, provided that difference to the reference person also increases. This would translate to $\beta_i > 1$, when i is ahead in payoff, and it does not seem sensible that individual utility would decrease as payoff increases, even if social differences grow.

Values $\beta_i > 1$ are therefore not considered in the model, as this would suggest that a person gains disutility for each dollar they get and that grows the payoff difference $x_i - x_j$, when ahead of another person. Even if $\beta_i = 1$, person i would always prefer decreasing $x_i - x_j$ instead of taking money herself and this too, seems unrealistic. In prospect theory presented later, one could consider that the reference point for x_i is x_j . The social utility function resembles a linear version of the prospect theory's valuation function when utility of person i is graphed over $x_i - x_j$ with x_i increasing. Below is a depiction of the social utility function described above, where x_j remains constant and x_i is increasing. The bend in the curve is where $x_i = x_j$ and towards the right from there $x_i > x_j$.



Graph 5: The social utility function from Fehr and Schmidt (1999) as x_i increases and x_j remains constant

This model implies that people would be willing to sacrifice their own payoff if the opponent's payoff is reduced by a certain amount. More specifically, a person with a payoff x_i , where ($x_i < x_j$), would be willing to sacrifice this payoff if it leads to the reference person losing at least $x_i (1 + \alpha_i) / \alpha_i$. As it was assumed that $0 \leq \beta_i$, decreasing the other person's payoff when ahead does not increase one's utility and thus sacrificing payoffs to decrease the payoffs of other players makes no sense. Rather, people wish to aid those who are behind in order to reduce the difference between payoffs. The propensity to sacrifice one's payoffs in order to aid people who are behind in payoffs depends on how the sacrifice affects difference in payoffs ($x_i - x_j$) and on the size of β_i .

This model can also explain reciprocal behavior explained through Rabin's (1993) model. In the ultimatum game, an offer is accepted if the utility is above zero. Offers, where over half of the divisible sum is offered, are always accepted as these are always positive. But when the offered sum is less than half, it depends on α of the accepting player. Let's consider an example where players j and i are playing the ultimatum game. Player j offers a division where payoff is smaller for player i ($x_i < x_j$). This offer is only accepted if α_i is such that the division does not produce negative utility from the difference in payoffs. In this case it should fill the condition for α_i as presented below.

$$\alpha_i < \frac{x_i}{x_j - x_i}$$

Even though the model presented here can explain behavior in the ultimatum game, it cannot account for behavior in other cases. One such case is a public good game without punishment previously examined with Sudegen's reciprocity model. In this public good game, most people seem to behave in an unfair way, contradicting predictions of the difference aversion model presented here. This may be due to there being several players participating in the experimental games. Fehr and Schmidt theorize that when a game consists of several players and some fractions of the players have purely selfish motives; it is possible that people disregard inequality concerns and only attempt to maximize their own payoff (Fehr and Schmidt 1999, p. 834).

Bolton and Ockenfels (2000) present another difference aversion model, the *Equity, Reciprocity and Competition* model (ERC), where the individual's utility is replaced by a motivation function v_i for person i . This motivation function is dependent on the size of the payoff individual i receives (y_i) and her share of the total payoff (σ_i).

$$v_i = (y_i, \sigma_i)$$

Value function is increasing in y_i and decreases as σ_i distances itself from the socially equitable share, which would be dividing the total payoff equally among n people. ERC bases the decision making explanations on the individual's share of the total payoff available for division, and as such is not as relevant for this paper.

The difference aversion models assume people perceive the fairness of distribution as a key ingredient of their decision making process. In addition to difference aversion and reciprocal behavior, there exists evidence that people could be motivated by maximizing the payoff of all participants even if payoff differences are increased as a result.

2.5.3. Social-welfare preferences

Social-welfare preferences mean individuals attempt to maximize social-welfare by making decisions which result in the greatest combined utility (Yaari & Bar-Hillel 1984). When maximizing the overall utility is a prime concern, individuals are not attempting to maximize their own monetary payoff or averting distribution differences. In addition to maximizing combined utility of

individuals, people care about helping those who are worse off more than of helping those who are relatively well off. Difference aversion is not considered an overriding priority.

Andreoni and Miller (2002) identify the prevalence of different preferences from an experiment where participants decide on how much surplus they share with another anonymous player. In this experiment, about half of the participants (47.2 percent) were identified as selfish, one-third (30.4 percent) as acting according to difference aversion and one-fifth (22.4 percent) as attempting to maximize overall utility. Charness and Rabin (1999), and Charness and Grosskopf (2001) provide additional evidence on the fact that people are concerned increasing overall payoffs, even if these decisions lead to increasing inequality.

Charness and Grosskopf (2001) report, that when a person's own payoff is fixed, she is not too concerned with distributional fairness of payoffs. In fact, when given the decision on how much to allocate for another person, it does not seem to matter if this allocated sum exceeds their own payoff. These observations would be in line with maximizing the utility of all participants instead of attempting to avoid differences in payoffs. In study 1 of Charness and Grosskopf (2001) one participant always has a fixed payoff of 600 pesetas and they had to decide whether to allocate the other player with 600 or 900 pesetas in one decision and 600 or 400 in another. In the first allocation decision, most people (65.6 percent) chose to allocate the other player a high amount of 900 pesetas. In the second decision, the difference was even clearer as 88.5 percent chose to allocate the other participant 600 instead of 400.

Another interesting finding was that participants were willing to sacrifice a small amount of their own payoff if it leads to large gains for another person. This could be seen as the opposite of difference aversion models where people were willing to sacrifice some of their own payoff in order to reduce the other player's payoff. In Charness and Grosskopf (2001) study 2, 66.7 percent chose to allocate another participant 1200 and themselves 600 pesetas, instead of allocating both 625 pesetas. Social-welfare maximizing behavior is mainly observed in empirical experiments and no model describing simply these preferences has been presented. The composite model including all three social preferences considerations models social-welfare maximization along with reciprocity and difference aversion.

2.5.4. Composite Model

Incorporating reciprocity, difference aversion and social-welfare preferences, Charness and Rabin (2002) construct a model which integrates the three fields of social preferences presented before. The utility function weighs payoffs for two players and considers how the payoffs relate to each other. Below is a formulation of the social preferences model presented in Charness and Rabin (2002). In this utility function for player A , π_A and π_B indicate payoffs for players A and B respectively.

$$U_A(\pi_A, \pi_B) = (\rho * r + \sigma * s + \theta * q) * \pi_B + (1 - \rho * r - \sigma * s - \theta * q) * \pi_A$$

$$s = 1 \text{ and } r = 0 \text{ if } \pi_B > \pi_A$$

$$s = 0 \text{ and } r = 1 \text{ if } \pi_B < \pi_A$$

$$s = 0 \text{ and } r = 0 \text{ if } \pi_B = \pi_A$$

$$q = -1 \text{ if } B \text{ has been unkind to player } A \text{ and } q = 0 \text{ otherwise}$$

In addition to the multipliers, there also exist three parameters. Here θ models reciprocity and is “crudely” defined by Charness and Rabin as $\theta > 0$ when $q = -1$. Reciprocity is not directly in focus of this paper and thus, this definition does not need to be more elaborate. The relationships of ρ and σ define more finely how observations of the other player’s payoffs effect utility.

A general case where player A feels positive or at least neutral towards B , parameters can be defined as $1 \geq \rho > \sigma > 0$. With such parameters, player A receives additional utility when either player’s payoff increases. No disutility is created by increasing either payoff, although, player A would prefer increasing π_A over π_B . This parameter setting is related to the preference towards maximizing social-welfare as mentioned in the previous section. Assume $\pi_B > \pi_A$, now increasing π_B by sacrificing π_A seems acceptable to A if $\sigma > \frac{1}{2}$. If the payoff x sacrificed by A increases π_B by ax , the parameter should fulfill $\sigma > \frac{1}{a+1}$ in order for the sacrifice be meaningful.

By modifying the parameters further, it is possible to model difference aversion instead of maximization of social-welfare. If A receives disutility as the payoff difference compared to B grows, the following parameter specification would be valid: $0 < \rho < 1$ and $\sigma < -\rho < 0$. With these parameters, Charness and Rabin model of social preferences gives similar results to the Fehr and Schmidt (1999) model on difference aversion presented previously.

With the different parameter specifications this model can describe the various behavior patterns described as social preferences. The model will be used later to predict how different preferences could affect decision making when possible results from the experiment are assessed. As mentioned before, the social preferences model acts as a utility function for the expected utility model. An alternative for the expected utility is the prospect theory presented in the next section.

2.6. Prospect theory

Prospect theory has its roots in empirical inconsistencies observed with the expected utility theory in situations containing risk. In certain empirical studies on individual decision making, such as in the Allais paradox (Allais 1953), expected utility theory incorrectly predicts choices of participants. First, three problems identified in expected utility theory will be presented here. These include the certainty effect, reflection effect and the isolation effect. After reviewing the problems, the prospect theory model will be examined as a new model attempting to address these issues.

2.6.1. Problems with the axiom of independence

Consider the following rationality assumption presented in the expected utility section, also known as axiom of independence. The axiom states that if A is preferred over B and both alternatives are manipulated identically, preference order should remain unchanged. Below is a mathematical presentation of this axiom where C is a third alternative.

$$U(A) > U(B) ; 0 < \alpha \leq 1$$

$$\alpha U(A) + (1 - \alpha)U(C) > \alpha U(B) + (1 - \alpha)U(C)$$

Experimental problems presented to individuals have found evidence contradicting this axiom of which Kahneman and Tversky (1979) present several examples. First contradiction reviewed is called the certainty effect. Participants in an experiment chose between two options in two problems presented to them. The first problem consisted of gambles A and B . The second decision making problem consisted of gambles C and D .

PROBLEM 1: $A(2500, .33 ; 2400, .66 ; 0, .01)$ $B(2400, 1)$

PROBLEM 2: $C(2500, .33 ; 0, .67)$ $D(2400, .34 ; 0, .66)$

When presented with this choice, 82 percent of the participants chose *B* over *A*. When presented with the second choice problem, however, 83 percent of the participants chose *C* over *D*. This would seem to contradict the axiom of independence, since *A* and *B* were manipulated identically to come up with choices *C* and *D*. This equates to the following change, assuming $U(0) = 0$.

$$U(2400) > .33U(2500) + .66U(2400)$$

$$U(2400) - .66U(2400) < .33U(2500) + .66U(2400) - .66U(2400)$$

$$.34U(2400) < .33U(2500)$$

Assuming that an individual uses the same utility function to evaluate probabilities, decreasing the probability of receiving 2400 in both alternatives *A* and *B* should not change the order they are preferred in. This contradiction is caused by the certainty effect; participants prefer more certain outcomes to uncertain ones. This preference leads to inconsistent predictions by the expected utility theory as it predicts preferences would remain constant despite the operation performed on both choices.

Reflection effect is the second problem, qualities of which were originally theorized of by Markowitz (1952). The reflection effect leads people to reverse their preferences for gambles when all of the outcomes are multiplied by -1, all other things equal. It would imply that, for example, a risk avoider presented with positive outcomes would become a risk lover when presented with negative outcomes. For example, examine the following example.

PROBLEM 1: $A(4000, .80; 0, .20)$ $B(3000, 1)$

PROBLEM 2: $C(-4000, .80; 0, .20)$ $D(-3000, 1)$

In Kahneman and Tversky (1979), presenting the first problem to participants led to 80 percent of them to choose *B* over *A*. However, when presented with problem 2, 92 percent of participants chose *C* over *D*. Clearly, the preferences towards risk were reversed by simply switching the sign of possible payoffs. In other words, majority of the participants evaluated the first problem using a concave utility function and the latter using a convex utility function. If the independence axiom would hold, this would not occur.

The third problem presented by Kahneman and Tversky is called the isolation effect. Isolation effect means that individuals concentrate on facts that separate different decisions and neglect to

account for the facts that are common to them when evaluating choices under risk. Below is another example from Kahneman and Tversky (1979). For the first problem, participants are endowed with 1000 before having to answer the question and in the second problem they are endowed with 2000 beforehand.

PROBLEM 1: $A(1000, .50; 0, .50)$ $B(500, 1)$

PROBLEM 2: $C(-1000, .50; 0, .50)$ $D(-500, 1)$

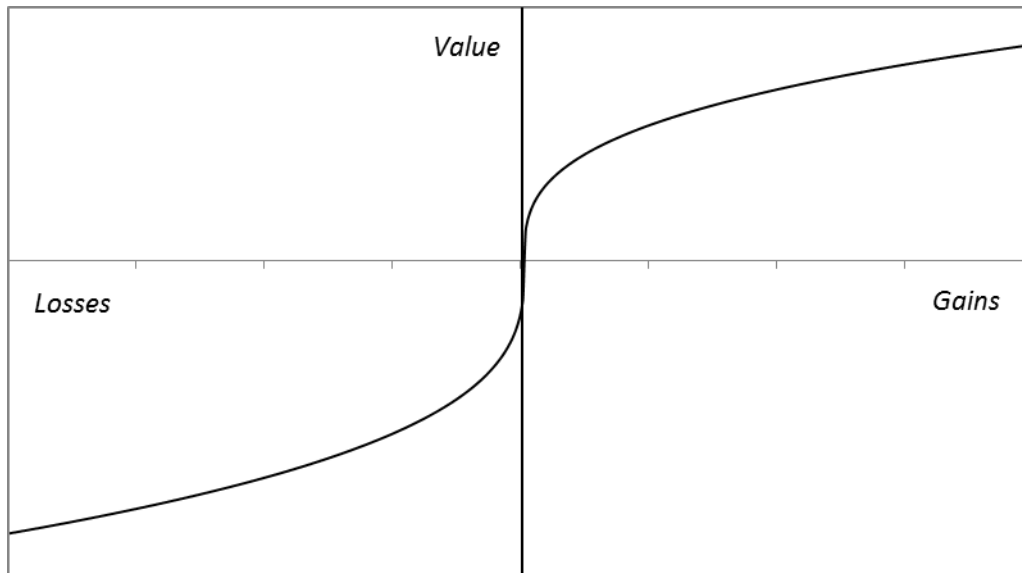
Now the starting situation has been manipulated so that participants should be indifferent between A and C , and B and D according to EUT. However, B was chosen over A by 84 percent of the participants and C was chosen over D by 69 percent. Instead of considering the different end results of the whole game, participants instead conform to the reflection effect when evaluating choices.

2.6.2. Prospect theory model

As the presented problems decreased the apparent descriptive power of the expected utility theory, a new theory was developed to solve these issues and model decision making under risk. Kahneman and Tversky (1979) presented an alternative model to the EUT called prospect theory. In this model, people evaluate outcomes based on a point of reference and an outcome's distance to that reference point. The prospect theory model consists of two parts: value function and weighting function. Value function in this model is not based on the absolute amount of final wealth the outcome would provide. Choice valuation is instead dependent on difference between a possible outcome and a person's reference point. As the difference between an outcome and the reference point grows, the valuation of that outcome either increases or decreases. Valuation is related to utility so that a person's utility increases (decreases) as the valuation increases (decreases).

The value function also has two important properties: increasing distance to reference point has a diminishing effect on the valuation and loss aversion is modeled with the valuation curve being steeper in the vicinity of the reference point. Diminishing effect feature of the value function means that additional increases of the same size to the distance from a reference point will produce smaller changes in the value function as the distance grows. In other words, value

function presents diminishing marginal value, the further one travels away from the reference point. Due to this feature, the valuation graph is convex for losses and concave for gains. A graph presenting a valuation function with these features is depicted below and is based on Kahneman and Tversky (1979).

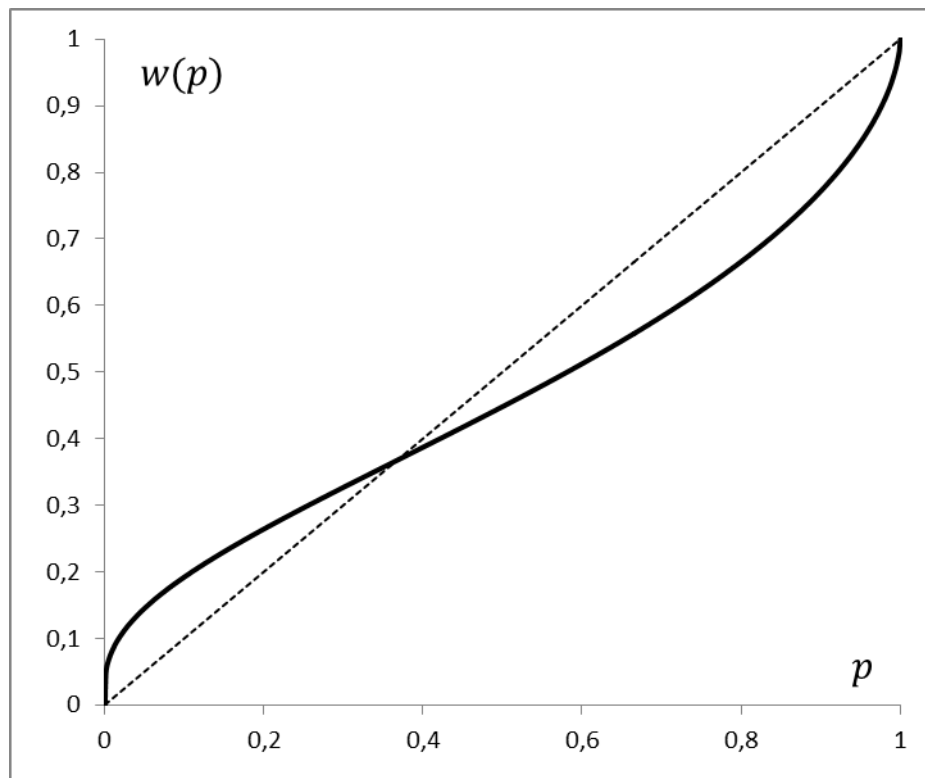


Graph 6: Value function around a reference point as in Kahneman and Tversky (1979)

The reference point in this graph is at zero in the middle with gains extending to the right and losses to the left. To the left, the curve is steeper as losses are valued to be more severe than gains of the same size. From the slope around the reference point, it is clear that the impact of changes around the reference point have a larger impact on the value function than changes that are distant from the point. Depending on the chosen reference point, or points, a certain financial standing can be interpreted either as a gain or a loss.

In addition to the value function, individual perception of the probability (p) has an effect on the choice. This perception of probability is called the weighting function $w(p)$, as prospect theory states that people do not objectively evaluate probabilities. Rather, they overweigh small probabilities and assign smaller weights to high probabilities (Kahneman and Tversky 1979, pp. 283). This leads to small probabilities affecting decisions as if they were higher than objective evaluation would lead one to think. Conversely, high probabilities are weighed as if they were smaller than an objective evaluation would suggest. Exactly which probabilities are then overweighed and which ones are underweighed? Empirical experiments estimate the function to be s-shaped, with probabilities under approximately 0.3-0.4 being underweighed and the rest

overweighed to some extent (Prelec 1998). Below is a depiction of the weighting function as depicted by Prelec.



Graph 7: Thick line presents the probability weighting function for prospect theory over the dashed gradient with a slope of 1 (Prelec 1998)

As mentioned before, the chosen reference point has a large effect on how an outcome is perceived. There are several options which could be used as a reference point and people can even have several competing reference points at once (Baucells et al. 2011). Status quo, expectations of future outcomes, personal goals or social comparison could act as reference points. Traditionally, prospect theory states that status quo should serve as the main reference point. For example, in gambling situations it makes sense to evaluate success by comparing the difference of resulted wealth situations to the initial wealth standing. However, later research has presented evidence that people evaluate multiple reference points according to the available information. Ordóñez, Connolly and Coughlin (2000) present evidence that people evaluate outcomes such as salary not only according to the absolute amount of salary received, but also according to how much wage their reference persons are receiving. People simultaneously evaluate the change from status quo and fairness. Furthermore, these several reference points may provide conflicting information on whether a person should feel good or bad about an outcome. This means that

multiple reference points can affect decision making simultaneously instead of a person only considering a single reference at a given moment (Koop and Johnson 2010). Unfortunately, it is yet impossible to say how much various types of reference points influence decision making and what the relative impacts of different reference points would be.

People's expectations could be used in reference formation. When exact probabilities are not available, people form expectations of the likelihood of future outcomes. Köszegi and Rabin (2006) describe how expectations people hold of the future outcomes can be used as a reference. People form a probabilistic belief of a certain outcome when they start focusing on a decision and use this as a reference point to evaluate the actual outcome of their decision. It is important to note that according to Köszegi and Rabin (2006), reference points are formed prior to the realization of actual outcomes. Actual outcomes are then perceived as gains or losses, depending on how they relate to the reference point formed earlier. Even increases in wealth can be perceived as losses by the individuals if the realized outcome is lower than that which they expected. For example, if a person expects to receive a pay raise of 1000 euros with 70 percent probability she would use 700 euros as her reference point. However, if she in reality only receives a 500 euro raise, the 200 euro difference to the reference point would be perceived as a loss even though her wage increased.

Personal goals can also function as points of reference. In psychology, goals can be actual rewards or simply set levels of performance without an actual reward attached to it. Psychological research has also shown that people's performance levels are higher when they have goals, compared to situations where people are told to do their best. Heath et al. (1999) tie together the concept of goals and prospect theory to explain motivation and effort levels in various tasks which contain no rewards. One such example used by Heath et al. is setting a performance goal in a given sport event. Depending on how people of same attributes set their goals, similar levels of performance might seem either inadequate or good depending on how they relate to the personal goals. For example, assume people *A* and *B* usually train by swimming the same distance of 1000 meters. Now *A* and *B* set diverging goals: *A* sets the goal to swimming 2000 meters during their next training whereas *B* sets the normal goal of 1000 meters. They both then swim 1500 meters. As would seem natural, *A* is predicted to feel more negative and should also exert more effort on attempting to reach her goal of 2000 meters. On the other hand, *B* is predicted to feel happy about her performance but is also expected to be less motivated to keep swimming after exceeding her own target. Goal thus acts as a reference point and the slope of the value function

predicts motivation to exert additional effort. What qualifies as a personal goal is not strictly defined and thus leaves the possibility of more personal motivations open.

People could also form references through social comparison processes as implied already by the previous example of evaluating the fairness of a wage. As discussed previously in the review of psychological research on social comparison, people have a tendency to evaluate themselves to a social reference group. For example, one could be estimating her accuracy and refer to another person completing the same task in order to evaluate success. Boksem et al. (2010) show that participants in time estimation tasks react both to relative success and to their actual end results in estimation tasks. In this experiment, both participants were shown their own results and the result of the other participant after each estimation task. Payoffs were dependent on individual performance and were independent of the other participant's success. Nevertheless, participants reacted more strongly to situations where they lost and the other participant succeeded compared to a situation where they both lost. More specifically, they experienced a stronger error signal when they failed and the other player succeeded.

Negotiations are a field where social comparison affects negotiator's evaluation of success (Novemsky and Schweitzer 2004). Novemsky and Schweitzer show that satisfaction of negotiators is dependent on social comparison. More interestingly, in the realm of social comparison the amount, for example monetary amount, by which a social reference person is won, is less important - negotiators simply have a preference towards outperforming others. As the experiments used undergraduate students instead of seasoned negotiators, it can easily be imagined that these students or people in general, would form reference points at least in part through social comparison.

It is largely unknown how people evaluate reference points, especially when there are several plausible options available. Kahneman (1992) acknowledges the need for further research in situations where people identify several reference points. Papers such as Baucells et al. (2011) complement reference point formation research in the realm of reference prices but research on what moderates the effect of social comparison on decision making is largely absent. The empirical experiment presented later on will in part study if social comparison can have a noticeable effect on a person's reference point. Now that the main economic theories have been

reviewed, the following sections will present psychological factors which may affect decision making: social pressure and emotions.

2.7. Effect of social pressure on decision making

The effect of social pressure on decision making has been explored in psychology for a good part of the last century. Asch (1951) presents evidence that other people's explicit opinions can lead people to provide wrong answers in experimental setting, or at least that these opinions affect their perception of the correct answer. Another important paper by Milgram (1963) shows that people administer dangerous levels of electric shocks to supposed subjects in learning experiments when they are simply told to do so. Over 60 percent of the participants administered the highest possible shock when told to do so, regardless of explicit pain expressed by an actor portraying the learning experiment subject. Obviously, in both of these classical experiments social pressure made the participants act contrary to their beliefs and encouraged them to defy logical reasoning. Both of these experiments also rely on external authority exercising explicit power over the subject. With this in mind, further research provides evidence that people's behavior can be modified by a simple presence of peers as well.

In a more recent study, Gardner and Steinberg (2005) write that people exhibit more risk taking when they are in peer groups by focusing more on the possible payoffs of risky behavior than potential costs or losses. In this study, a peer group of 2 other participants was compared to completing experiments alone. The simple presence of peers was enough to increase actual risky behavior in the experimental game. In addition to risk taking, social pressure can also affect performance and motivation in tasks requiring effort from the participants. Falk and Ichino (2006) experimented on how people perform individually versus pairs in a simple task of filling envelopes. Even though participants were paid independent of output, pairs of participants exhibited significantly higher productivity when compared to individuals - this would imply that presence of a peer increases the level of effort put into completing a task. Higher effort implies that participants feel increased motivation to reach higher levels of productivity.

Mas and Moretti (2006) provide more evidence by studying how high performing workers affect other workers' productivity working in the vicinity at a grocery checkout counter. Mas and Moretti find that introducing highly productive workers also increases the effort level of workers who

previously exhibited lower productivity. It is important to note that the positive spillover effects only apply for less productive workers who can visibly observe the worker of higher productivity being ahead of them and that the effects are observed regardless of limited economic incentives. Additionally, physical distance to the reference point influences the effect a reference person can have on behavior. Higher distance makes careful observation of comparison point more difficult and decreases the spillover effects. Vice versa, a decreasing distance would lead to increasing spillover effects.

Overall empirical evidence points to the fact that social pressure does have an effect on decision making of individuals. Also, it is important that the comparable individuals' – to which own productivity is compared – performance can be explicitly observed. As people yield to social pressure, they accept higher levels of risk more freely neglecting possible losses and accentuating the possible positive outcomes. These aspects combine the important implications for this paper: visibility and effect on behavior. The next chapter will present what moods reference person comparison can invoke and how these are hypothesized to affect behavior.

2.8. Effect of emotions on decision making

This final section of the theoretical review focuses on previous research on emotions and decision making. Emotions and moods can have various channels through which they influence decision making, such as affecting subjective evaluations on different decisions and expectations of future outcomes. Two opinions also exist on how different moods affect evaluations. However, it is good to start from the early observations of effects of emotions on people by Isen and Shalcker and move onwards from there.

Isen and Shalcker (1982) induced different moods on participants and found that different mood states had effects on how these students evaluated different stimuli. Negative moods lead to more negative evaluations and positive moods, naturally, lead to more positive evaluations. The study states that mood states divert attention away from the attributes of the stimulus being shown to them or distorts it according to the different mood being experienced by the participant at the moment. Mood of the participant can especially affect evaluation of objects that are ambiguous in nature. That is, they are neither clearly positive nor negative. (Isen and Shalcker 1982)

If moods do affect evaluations, what is the process through which this effect occurs? According to Loewenstein and Lerner (2003), emotions can have an effect decision making in two ways: through expected emotions and immediate emotions. Expected emotions are the emotional states the decision-maker expects to be related to different outcomes of decisions and immediate emotions are the emotions that are experienced when the decision is being made. It is worth noting that not all immediate emotions are necessarily related to the actual decision at hand but could, for example, result from something the decision-maker has experienced previously during the same day.

Regarding expected emotions, people react to relative changes in their situation instead of absolute consequences and they compare the outcomes also to those outcomes which did not materialize (Loewenstein and Lerner 2003). One could think of this process to functioning similar to the valuation function in prospect theory. Regret is a good example of comparing realized results to outcomes that could have been but never were. However, emotions expected to be experienced through materialization of outcomes tend to be exacerbated and people expect to feel better (or worse) in different situations than they actually do when the objective circumstances change (Loewenstein and Frederick 1997). It seems people adapt to changing situations, and recognize this adaptation, but still do not account for adaptation in their future expectations. This basically leads to the fact stated earlier that people overestimate the resulting feelings, and also the duration of those feelings, related to various outcomes.

Expected emotions affect the emotional evaluation of various outcomes related to different choices in decision making but immediate emotions are salient at the time when a decision is being made. Immediate emotions can affect decision making by modifying how people perceive expected emotions and by changing the information processing quality or quantity of an individual (Loewenstein and Lerner 2003). Intensity of these immediate emotions has an effect on how strongly they affect the decision making but even at the lower levels, they should have an effect on at least how information regarding a judgment of a decision is formed. These lower levels of intensity do not overwhelm cognitive processing as may be the case for highly intensive emotions. Highly intensive emotions can have a stronger effect on individual's decision making than would be sensible. For example, people suffering from agoraphobia may find it very difficult to leave their homes, or meet new people, which obviously disrupt their lives despite there being little cognitive reason for staying at home (Barlow 2004). (Loewenstein and Lerner 2003)

Naturally, agoraphobia is an extreme case but the effects on lower levels of emotional intensity provide insight into how emotions affect decision making in everyday situations. The channels through which emotions can change situational evaluations are now familiar but what kind of an effect could different mood and emotional states have on decision making?

Two theories on how different moods affect judgment can be identified: mood-maintenance hypothesis (MMH) and affect infusion model (AIM). MMH would suggest that when people are in a positive mood, they are less likely to take high risks (Isen and Patrick 1983). Conversely, when people are experiencing sadness, they are more willing to take higher risks (Raghunathan and Tuan Pham 1999). The basic idea of MMH thus is that people in positive states of mind wish to maintain this positive feeling and want to avoid risk-taking, whereas people experiencing sadness want to alleviate their negative feelings and accept taking more risks as a method to reach that goal. All negative moods do not have the same effect on risk-taking, however. For example, sadness induces more risky behavior, whereas people experiencing anxiety wish to avoid risks even though both are negative feelings (Raghunathan and Tuan Pham 1999). Distinctive types of feelings thus can have different effects on behavior regardless of whether they are broadly defined as positive or negative. However, as there is no comprehensive review of how the myriad different emotions affect decision making and it makes sense to concentrate broad definitions such as positive and negative moods.

Affect infusion model, on the other hand, predicts contrary behavior to the MMH. According to AIM, people in a positive mood would be more willing to take risks and people experiencing negative moods would be less likely to take risks (Forgas 1995). Yuen and Lee (2002) studied risk taking tendencies in different mood states and found that people in depressed, or negative, moods were less prone to risk than individuals in positive or neutral moods. Furthermore, asymmetry was detected between the differences: positive and neutral moods did not induce significantly different levels of risk aversion, whereas negative moods caused higher risk aversion (Yuen and Lee 2002). The difference is due to a suggestion that positive moods increase the likelihood that a situation is seen in more of a positive light and accentuates the positive aspects of a risky decision (Chou et al. 2007). On the other hand, people in negative moods would concentrate on the threatening aspects of risky decisions and this would increase the likelihood of increasing risk aversion in their behavior.

It has been suggested that the AIM and MMH apply for different levels of motivation in people and that the level of motivation an individual has paves way for different ways moods affect behavior (Forgas 1995). When an individual is strongly motivated to reach a certain end state, the MMH would apply. Whereas lower levels of motivation could be associated with AIM (Chou et al. 2007). Empirical evidence supporting both models exists and it cannot be clearly said which theory would apply in this paper's empirical setting. What can be said with relative certainty is that emotions do have an effect on risk preferences. One interesting example is Shiv et al. (2005), where participants with brain injuries in emotion processing areas performed better in choosing among positive-expectation gambles. Injured participants were emotionally unaffected by gains and losses in a series of gambling tasks, and could thus maximize expected value better.

This paper does not set out to prove either of the two theories to be valid or invalid. The point of this discussion was to familiarize the readers with the fact that emotions can indeed affect decision making and risk aversion in individuals. In this study the mood state of the participants will be measured before and after the experiment by a questionnaire following Mathews et al. (1995) and Yuen and Lee (2002). It is of interest whether the experimental game can alter the mood state of the participants and whether specific changes in the altered mood states correlate with varying risk behavior.

There is knowledge of research studying how varying mood states and the prospect theory function together and this may provide some hints on how moods could affect decision making. Seo, Goldfarb and Barrett (2010) combine prospect theory with mood states and study how combinations of framing effect and different moods affect risk aversion. An experiment combining risk taking in investment decisions and measurement of mood states is performed in order to check the effects of different mood states in domains of gains and losses. They state that the effect of moods on risk taking depends on the framing of the current situation. Particularly, framing an outcome as a gain (loss) leads to pleasant feelings accentuating risk taking (risk aversion). Conversely, unpleasant moods decreased willingness to take risk in the domain of losses. No conclusive evidence is presented of positive mood affecting risk taking in the domain of losses.

Results of Seo, Goldfarb and Barrett do not mean that mood states would predict risk taking better than the prospect theory. Rather, risk taking below the reference point is lower (higher) when negative (positive) moods are felt as compared to experiencing neutral moods. Feelings and

immediate emotions that are “extremely intense” could even overpower the prospect theory’s valuation function as a basis for evaluation and direct risk taking completely depending on the experienced moods. A more relevant notion is that experienced moods might shift the valuation and probability weighing functions. As there is no consensus on the effect of moods and emotions on decision making, it is difficult to make predictions based on the reviewed research. Different mood states of the participants will be measured in the experiment and this will shed more light into whether AIM of MMH is more prominently supported.

3. Hypothesis

As seen in the previous sections, several different aspects can be used to examine what factors could affect risk aversion in individuals. In addition to the commonly researched attribute factors such as age and gender, external and situational factors such as social pressure can influence decision making containing risk. It would seem likely, that the preferred level of risk aversion in a given situation is a function of a risk aversion baseline and external factors which can alter risk aversion away from this baseline. The experiment detailed in the following chapter attempts to show that level of risk aversion will vary between different groups, depending on situational factors and on the observed reference persons. Situational factor in this study is the salience level of another player's endowment and how it compares to the received endowment - which can be either higher or lower - given before the actual decision task.

This paper will focus on a special case where a reference person's endowment salience is controlled in three separate experiments and compared to two control experiments. It is of interest, whether this salience level has clear effects on the risk aversion level exhibited by the participants. Hypothesis is that more tangibly observing results higher than what the participant has attained will result in increased risk taking, when compared to the control groups. Conversely, those receiving the higher endowment are expected to exhibit lower risk taking when compared to the control groups. The theoretical predictions by different theories will now be presented in the same order the theoretical chapter was constructed.

The social preferences model has two predictions, depending on how the parameters are chosen. With the parameters chosen for this paper, social preferences model supports the hypothesis. If parameters are specified as $1 \geq \rho > \sigma > 0$, higher risk taking is not expected. Participants get no disutility from being behind the other participant. On the other hand, losses are not looming as large as usual since a part of the utility is derived from the endowment gained by the other participant. This would imply that the risk aversion for participants with high endowment would be lower. On the other hand, if parameters $0 < \rho < 1$ and $\sigma < -\rho < 0$ are assumed, participants receive disutility from difference in payoffs. The latter parameter set will be used as it seems more likely to hold in the actual experiment. It is doubtful that people would derive almost equal utility from an unknown person's payoff increases. With these parameters, any gain for a participant behind in monetary outcomes, which decreases the difference, is highly valued by that participant as utility is increased both by the decreasing difference in outcomes and increasing payoff.

Participants receiving higher endowment are predicted to be less risk averse - unless there is a risk of falling behind reference participants in endowment.

Assume a lower endowment participant's payoff remains the same, now a decrease of one euro would lead to high endowment participant's utility changing by $(1 - \rho) * \Delta\epsilon$. But any euro below the lower endowment participant's outcome will lead to the high endowment participant's euro amount providing negative utility in addition to having a lower payoff. If there is a risk of falling behind the other player, the higher endowment participant will avoid this risk. As mentioned before, the latter parameter setting seems more likely and will be used in predictions. Particularly in a situation where the participants are not expected to be familiar with each other, an assumption that participant utilities were only positively correlated with any participant's increase in payoff seems exaggerated. It seems doubtful that participants would experience no competitive instinct and would receive increased utility without social consideration of relative positions. Overall, it seems justified to use the latter set of parameters, which support the hypothesis.

Risk preferences could change between experiments in the social preferences model if the parameters σ and ρ would change. Consider the following functions depicting the social preferences theory in two distinct situations. In the first function, participant *A* has a higher outcome and in the latter, participant *B* has a higher payoff. For both functions, assume that reciprocity considerations are not taken into account. With these functions depicting utility changes (ΔU_A) in response to changes in payoffs ($\Delta\pi_A$ and $\Delta\pi_B$), we can examine how parameter changes would affect marginal utility in each case.

$$\Delta U_A(\pi_A, \pi_B) = \rho * (\Delta\pi_B) + (1 - \rho) * (\Delta\pi_A)$$

$$\Delta U_A(\pi_A, \pi_B) = \sigma * (\Delta\pi_B) + (1 - \sigma) * (\Delta\pi_A)$$

As the social preferences model parameters are defined as $\sigma < -\rho < 0$, it is easy to see how changes in both parameters would change risk preferences. An increase in both parameters would result in the utility function's slope value being lower both when ahead and behind in outcome. An increase in ρ would decrease marginal utility when ahead of a reference person in payoff and increasing σ would lead to a decrease when behind. Conversely, a decrease in both parameters leads to the resulting slope value of the utility function being higher. Higher (lower) slope value leads to higher (lower) marginal utility per additional euro and thus increasing (decreasing) risk preference for the same amount of euros. According to the hypothesis, decreasing parameter

values would correspond with disadvantageous comparison and increasing parameters with advantageous comparison.

Unlike with social preferences theory, prospect theory supports the hypothesis and involves no alternative parameters to choose from. According to Kahneman and Tversky's prospect theory risk taking should increase for the low endowment participant and decrease for the high endowment participants. These results are predicted by prospect theory if observing the other player's results influences reference point formation. If salience affects formation of the reference point, it will surely influence participant's perception of their success and thus affect how individuals perceive the difference to their reference point relative to a lower tangibility situation. For the lower endowment participant, this would equal to being on the side of gains in Graph 6, and observing the visible score causing the reference point to shift rightwards. A higher salience level would cause a larger shift. With increased salience, any increase in score has higher value and seems more important. The reverse would be true for higher endowment participants: observing a lower payoff reference person leads to the reference point shifting towards left and lower marginal utility for additional euros. This means the higher endowment participant would be less inclined to accept higher levels of risk. This risk aversion would only increase as the tangibility of the low endowment participant's results increase. This proposition is based on the fact that increasing salience is expected to have a larger effect on people's reference point. As the experiments will only use equal opportunity gambles, there is no need to consider the probability weighing function and how it changes.

Social pressure aspect of decision making should become more explicit by the increasing salience of the other player's score and thus increase the frequency of risky choices. Seeing that they are behind a visible peer in score and higher risk level being the only way to attain higher score (since no effort is modeled in the game), the players would accept higher levels of risk. Research on social pressure's effect on chosen effort levels and risk taking is rather unified and thus it is possible to say that research on social pressure supports the hypothesis.

The effect of emotions is ambiguous and depends heavily on which moods are evoked and salient at the moment for each participant. According to the affect infusion model, positive moods in participants would evoke higher risk and negative moods would lead to a preference of lower levels of risk taking. Mood-maintenance hypothesis, on the other hand, would predict the exact

opposite results. Measuring the participant's mood state with a questionnaire directly after making the decision, but before any outcome is revealed, should yield more insight. It will be of interest what moods are present in participants receiving the different endowments and if these have any effect on the chosen risk levels. Also, one could consider how the expected emotions could influence evaluation of potential situations. As mentioned in the emotions section, expected emotions are often thought to be better or worse than they actually turn out to be. This could translate to low endowment participant's exacerbating the expected feelings in case of winning gamble. Conversely, it could be that high endowment participants would expect to feel worse than they actually would in case they lose a gamble. However, there is no evidence on which aspects of expected outcomes the participants would focus on.

Overall, it seems more likely that the risk taking will increase as a result of increasing the salience level as is supported by social preferences theory, prospect theory and research on social pressure. The following sections will introduce an empirical experiment designed to study the hypothesis presented here. Finally the expected results and possible implications of each will be explored.

4. Empirical Experiments

The set of experiments described here studies whether risk taking in a gambling task will change as a result of increasingly visible social comparison. Salience of the other person's results is controlled in the three last experimental stages by changing the description given to participants. In total, there will be five different experiments which include two control groups and three different levels of salience for the social comparison. Participants in all experiments are divided into two groups: those who are granted a higher endowment before the decision and those who are granted a lower endowment. High endowment will be 10 euros and the low endowment will be 5 euros in each experiment. All participants have only one choice containing risk; there is no possibility for interaction between several players or possibility for strategic consideration of a multi-stage game. In order to control for subjective viewing of probabilities, probabilities of winning and losing will be the same for all gambling decisions in all experiments.

All experiments will include the same amount of participants. The basic structure of the experiment is that participants are split into two groups. One group will receive the higher and one the lower endowment. Both groups will then complete a task where they will choose how much of the endowment they gamble (x). In the winning condition of the gamble, with probability of 0.5, the participant will receive double the gambled amount. In the losing condition, probability of 0.5, the participant will lose the gambled amount. In both cases, participants can keep the portion of endowment which was not gambled.

$$\text{Gamble: } G\left(\frac{1}{2}, 2x; \frac{1}{2}, 0\right)$$

Finally, all participants will complete a questionnaire mapping the participant's mood state similar to Mathews et al. (1995) and Yuen and Lee (2002). This questionnaire is included in the Appendix. Mood questionnaire consists of ten questions where participants self-report how they feel on an eight-point scale. Afterwards, it is possible to examine the answers and conclude whether positive or negative moods were dominant in the participant at decision time. As evident from the appendix, the ten questions consist of five pairs with each pair consisting of opposite statements. The actual mood will be evaluated by reversing one of the pair questions and evaluating the actual state as a combination of both questions in a pair.

The first experiment will concentrate on the differences between two beginning endowments. The point is to see what the risk taking levels for the two beginning endowments would be, without

any social comparison or emotional aspects, as the participants are not told what endowments are given to how many participants.

Second experiment will measure how knowing that other participants have received high or low endowment affects risk taking. However, in the second condition it is not explicitly told who receives what, focus will mainly be on how the disappointment or happiness from the received amount affects risk taking.

Third experiment will add a more explicit social aspect as the participants are assigned to pairs, and out of each pair one will receive the high endowment and one the low endowment. Here it will be clear how one's endowment relates to a specific social reference person – the paired participant. However, description of the endowments will not be comparative and the language does not encourage comparison to the other person.

In the fourth experiment participants are again assigned a pair. This experiment will increase the salience level of social comparison by changing the description wording given to participants – otherwise the execution is similar to experiment number three. The description will emphasize the fact that a player is either a winner or a loser from the paired participants.

Fifth experiment will begin as the two previous ones, but will also include an explicit comparison to the other player's endowment in the participant's description. As in the previous experiment, two endowments are worded to be a result of either winning or losing in the first stage. In addition, the description will include a text directly comparing the endowments of the two participants.

It is expected that each experiment from one to five would increase risk taking for the low endowment group and decrease risk taking for the high endowment group on average. From first to second experiment, this increase should occur simply due to the inclusion of a social comparison aspect. From the third experiment onwards, the effect should be attributable to increasing salience of social comparison. The following sections will describe the five experiments in more detail and finally the possible result combinations and implications will be reviewed.

4.1. Experiment 1

First experiment will begin with collecting all participants to a single room where the experiment proceedings will be explained. Participants will be told that each will be given an endowment and they have to decide how much of this endowment to play in the gambling game. Size and distribution of endowments will not be clarified to participants. They will not know that others might receive more or less. Each participant will then be given an envelope containing endowment information, answer space for the gambling game decision and the final mood mapping questionnaire. Half of the endowments will be EUR 5 and the other half EUR 10. Description of the endowment will be given as below for both groups.

“You have been given 10 euros. Please complete the following gambling decision task as instructed and finally the mood mapping questionnaire.”

“You have been given 5 euros. Please complete the following gambling decision task as instructed and finally the mood mapping questionnaire.”

After completion of the decision and questionnaire, participants may proceed to exit the room. Outside, the answer sheets are collected, gambling task decision is recorded, outcome calculated, and finally the participant is paid the possible outcome and remaining endowment.

Emotions and social pressure are expected to have no effect in this experiment. The expected result of this experiment depends on what is assumed of the participant's utility function and reference point. Since there is no social aspect to this experiment, social preferences model will not be used to predict the results. Rather, simply the individual shapes of the utility function over wealth will lead to different risk taking behavior. Regardless of the different risk profiles, average gamble size is expected to increase as the endowment increases. This is because gamblers are assumed to present a similar portion of both endowment groups, gambling on average the same percentage of the endowment and they will have a greater amount of money to gamble with in the high endowment condition.

Predictions of the prospect theory vary depending on how the endowment relates to an individual's expectation. It is most likely safe to assume that both endowments are higher than the participants expect. This means the endowment will be understood as a gain leading to lower risk taking, particularly as the endowment size increases.

In both cases it will be of interest to observe solely the effect of initial endowment in this experimental setting. Gambling patterns and bet sizes in this experiment will act as a control group and reference for the future experiments.

4.2. Experiment 2

Second experiment will again begin with explaining the experiment proceeding to all participants. In this condition, participants will be told in the beginning that half of the participants will receive a high endowment and that half will receive a low endowment. They will not be told who receives which endowment. The only difference to the above experiment is that participants will know in which endowment group they are in. Descriptions of the different endowments are as in the previous experiment as well as final proceedings regarding payout and leaving the experiment.

Predictions of the second experiment can incorporate the social preferences model in addition to prospect theory. It is assumed that the different endowment conditions will use each other as reference groups. Social preferences prediction, using the parameters defined in hypothesis-section, is that participants in the lower endowment condition will exhibit higher risk taking when compared to the previous experiment. Participants in the higher endowment condition, on the other hand, will exhibit lower risk taking. This occurs due to the different utility function slope values these individuals have. As evident from graph 5, being behind a reference person (or a group) leads to a higher slope value, resulting in higher risk taking preference, compared to when one is ahead.

In order to use prospect theory, assume participants set an equal expectation of both outcomes as their reference point ($\frac{1}{2} * 10 + \frac{1}{2} * 5 = 7.5$). Now anyone in the low endowment condition would experience loss due to an outcome lower than their expectation. Experiencing loss leads to higher risk taking compared to the previous experiment. Conversely, the higher endowment condition will experience gain and exhibit lower risk taking when compared to the previous experiment. In addition to the expected outcome, people will likely consider a reference group when forming their reference point which will further increase the mentioned effects on risk taking.

Higher and lower endowment conditions will likely also lead to experiencing some degrees of pleasant and unpleasant moods. It will be of interest to observe, what changes in moods will occur as a result of participants now observing other possible endowment.

4.3. Experiment 3

The third experiment will begin with participants being assigned another participant as a pair during the experiment instructions phase. Instructor will advise that one participant from each pair will receive an endowment of 10 euros and the other an endowment of 5 euros. Two unmarked envelopes are then given to each pair, which contain the two potential endowments, choice task and mood questionnaire. Participants proceed to complete the choice problem and questionnaire. Envelope containing the choice task will mention the attained endowment size, as in experiment one, and instructions on how to complete the choice task and questionnaire. When complete, participants may proceed to exit the room where answers are collected, the result of their possible gamble is calculated and final outcomes are paid in cash.

Main prediction from here on is that risk taking will increase for the low endowment condition in each experiment and decrease for high condition participants. Additionally, it is reasonable to suspect that increasing tangibility of other participants will lead to greater effect on other participant's reference points or utility function parameters. For those in high endowment condition, including the other participant increasingly into one's reference point formation will lead to an even increased sense of gain. The reverse applies for those in lower endowment condition. This would accentuate the risk preference and certainty preference for low and high conditions, respectively.

4.4. Experiment 4

This experiment will be executed as experiment 3 described above. However, this time the description of the received endowment in the experiment will be changed to reflect the difference between players more. The instructor will also refer to receiving a low endowment as a loss and receiving the high endowment as a win. The written description of the endowment in this experiment will be as follows.

“You were fortunate enough to win 10 euros. Please complete the following gambling decision task as instructed and finally the mood mapping questionnaire.”

“You were unfortunate to lose and received only 5 euros. Please complete the following gambling decision task as instructed and finally the mood mapping questionnaire.”

When the participants are complete with the decision task and questionnaire, they may proceed to return their decisions and be paid the calculated result of the gamble as in all of the previous experiments. Apart from the changes mentioned above, everything else will be executed similarly to past experiments.

As presented in the theoretical review, effects exhibited by social pressure are expected to have an increasing effect on risk taking as the language is changed to bring out the comparative aspect more explicitly. Additionally, framing of the endowment as a result of either a loss or gain will likely further accentuate the effect of reference point perception on risk taking. Finally, the effect of loss condition player’s salience on the reference point of a win condition player - and vice versa - is expected to have continued effect as mentioned in previous experiments. That is, low (high) endowment groups are expected to exhibit increasing (decreasing) risk taking. The effect on social preferences model’s utility function is also likely to continue, with the marginal utility for high endowment condition participants decreasing and increasing for the low endowment condition participants.

4.5. Experiment 5

This experiment will be executed as experiment 4 described above with participants being again paired up and the proceedings explained. Instructors will refer to participants either winning 10 euros or losing and receiving 5 euros in the instructional part. Participants are again given envelopes containing a description of the endowment as follows.

“Congratulations! You were fortunate enough to receive 10 euros instead of the smaller 5 euros allocated to your pair. Please complete the following gambling decision task as instructed and finally the mood mapping questionnaire.”

“We are sorry. You were unfortunate and received the smaller endowment of 5 euros instead of the larger 10 euros allocated to your pair. Please complete the following gambling decision task as instructed and finally the mood mapping questionnaire.”

As before, when participants are done with the decision task and questionnaire they may proceed to leave the experiment space and be paid the final outcome and the remaining endowment.

This experiment is expected to exhibit highest levels of risk taking on the part of low endowment condition participants. On the other hand, risk taking should reach the lowest level in this experiment for the high endowment condition players. This experiment should lead to the subjective difference to reference point being perceived, on average, as the largest out all the experiments mentioned here. Additionally, the marginal utility should be lowest for the high endowment participants and highest for low endowment participants, out of all experiments.

The last section of this paper will discuss some possible results that could be obtained and what the implications of those results would be.

5. Possible results and interpretations

The expected result is that, following the hypothesis, risk taking will gradually increase from the first to the fifth experiment with each experiment leading to higher risk taking levels compared to the previous one. There are several different factors why this is expected to happen, such as stronger inclusion of observations of other player's outcomes in reference point formation, changing social preference model parameters in response to stronger salience and effect of social pressure. However, the effect of different mood states will be more difficult to predict. Possible different outcomes and their implications are discussed and formalized below.

Firstly, unchanged risk aversion throughout the experiments could be coupled with mood measurements which are stable for both endowment groups in each experiment. This would lead to likely conclusions that either the experimental structure has failed to represent a meaningful decision situation for the participants or that social comparison simply does not have an effect on risk taking. Considering the previous empirical evidence, the first conclusion would seem more likely. Structure of the experiment should be examined and revised in order to present a more meaningful decision problem for future participants.

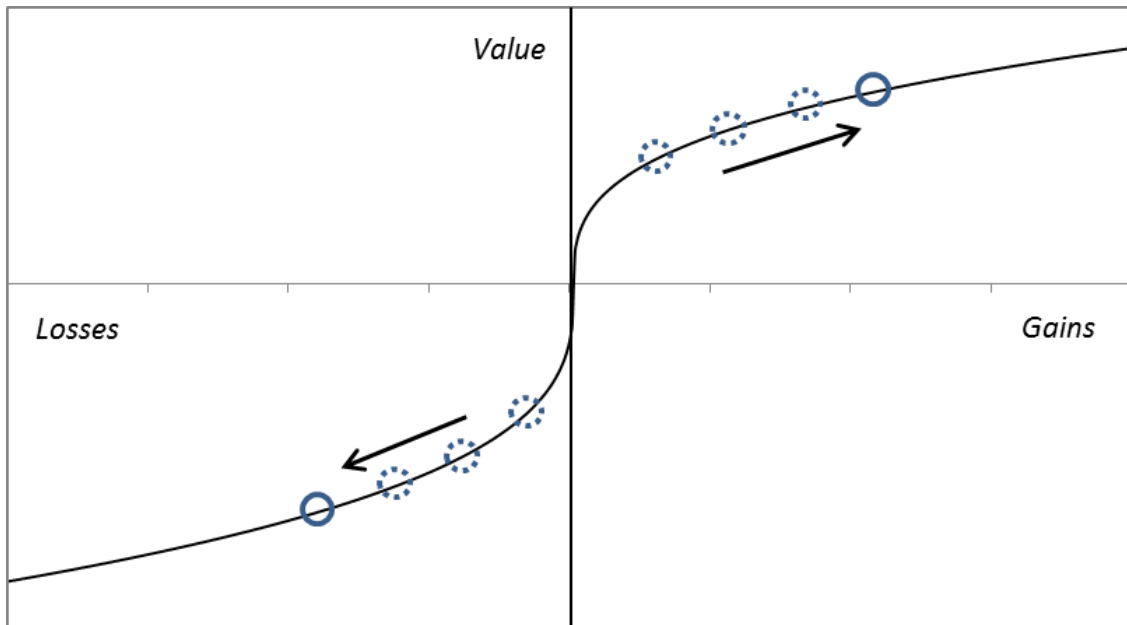
What if risk taking would change in the second experiment in comparison to the first but remain constant after that? If mood measurements also register a change between the first two experiments, it could be possible that social comparison and feelings can have an effect on risk taking. However, salience as a moderator for risk taking would seem to be less meaningful. A change in risk taking between the two first experiments is necessary in showing that simply being aware of the possible endowments and their distribution can have an effect on risk taking behavior - even though completely objective consideration of the gambling decision should not be affected by this change. If this initial change in risk preferences observed, it is clearly more likely that further changes in salience will have a meaningful impact on behavior. From prospect theory's point of view, these results would imply that knowledge of the distribution of endowments would affect reference point formation but increasing salience probably does not moderate this effect. This means that the initial knowledge on whether a person has received a high or a low endowment would influence reference point formation but changing salience would not further increase perceived distance to reference point. For example, for the high endowment condition, knowledge that half of the participants receive less would shift the reference point towards the left and thus increase perceived difference to reference point. This on the other hand

would lead to lower marginal valuation for each additional euro, leading to decreased preference for risk. However, increases in the salience of the reference person's results do not cause further changes in the reference point or how one's own distance to reference point is perceived. In terms of social preferences theory, it is clear that observing higher reference person's results will cause the slope value of the utility function to be steeper compared to a situation where one is ahead (see Graph 5). As was the case for prospect theory, obtaining these results would suggest tangibility has little meaning in moderating preference for risk so further changes in the social preferences model are not expected.

Another hypothesized outcome from the second experiment onwards would be gradually changing risk taking in response to the increasing salience of other participant's endowment outcome and social comparison. More specifically, high endowment condition is expected to exhibit decreased risk taking and low endowment condition is expected to exhibit increased risk taking. This type of risk taking results could be coupled with either an observation of varying or constant mood states. Constant mood states are defined so that high and low condition participants would report mood states greatly similar to prior experiments. With constant mood states, the connection between risk taking and mood states measured by the questionnaire would be unclear. One reason could be the limited length of the questionnaire being unable to detect more subtle changes in participant mood states. Another reason could be the self-reporting nature of the questionnaire and the fact that people might not report their mood changes accurately enough. Varying mood states with no clear relation to the clearly observable risk taking development throughout the different experiments would also lead to an inconclusive result. Again it would seem likely that the mood questionnaire should be revised due to previous empirical evidence that moods and decision making are related.

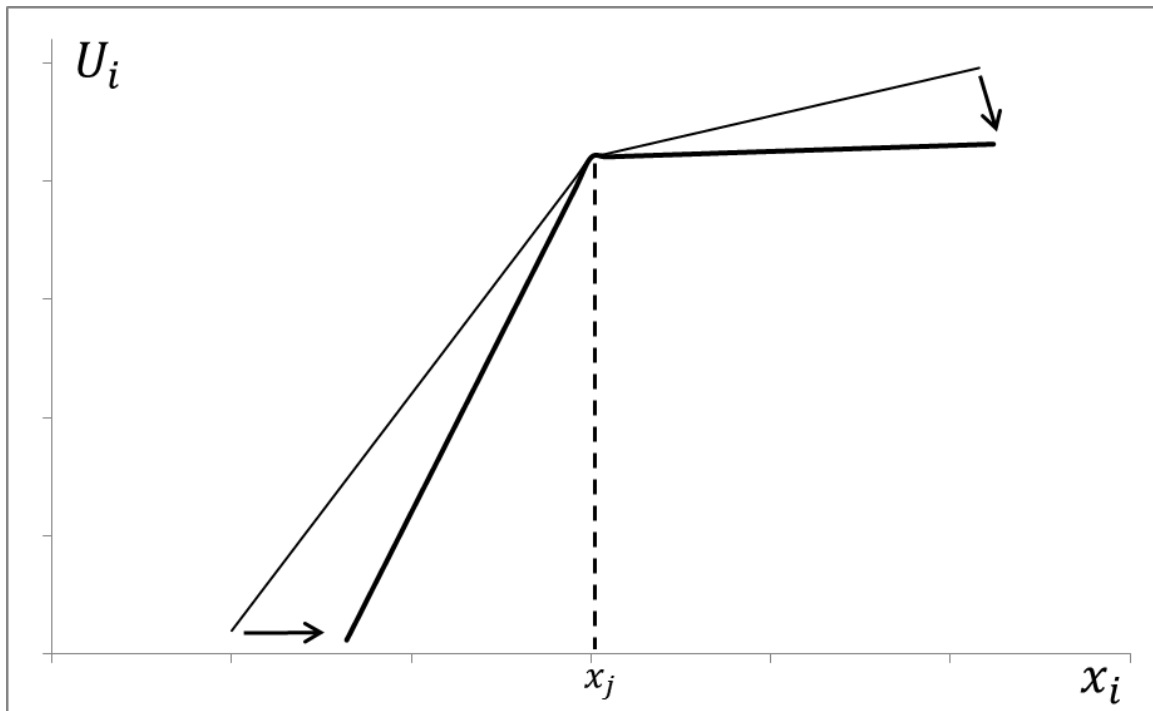
Gradually changing risk preference would mean that salience of social comparison, in addition to the actual comparison, has an effect on reference point formation in prospect theory and size of parameters affecting utility function slope in social preferences theory. One could think that, even though the knowledge of other participant's results is available at the earlier levels, it becomes gradually more meaningful and increasingly used in decision making as the salience increases. In prospect theory, perceived distance to the reference point is suspected to be greater for both endowment conditions in each successive experiment, leading to greater changes in preferred risk level. In graph 8, circles represent one's perceived position in relation to the reference point in the

middle. In the domain of gains, a high endowment participant perceives her position to be moving to the right as salience increases. Conversely, in the domain of losses, a low endowment participant perceives her position to be moving to the left and further away from the reference point as salience increases. Upon obtaining this result, it could be possible to have more accurate information on how a reference point is formed and how social comparison affects this reference point.



Graph 8: Hypothesized changes in the perceived positions of low (losses) and high (gains) endowment participants as the salience level gradually increases in experiments

For social preferences model, the implied change resulting from increased salience is somewhat different. Different, as the perceived position relative to the reference point does not change. Rather, the marginal utility of additional payoff changes in two distinct ways for the two classes of participants. In social preference model presented earlier, these results would imply that the parameter ρ increases for a high endowment condition participant. This would cause their utility function's slope value and marginal utility to decrease, resulting in decreased preference for risk. For a low endowment participant, a decrease in parameter σ would cause the marginal utility to increase along with the preference for risk. The below graph depicts the effect of a decrease in σ and an increase in ρ on the utility function of individual i as the thicker line. Thus the gradual salience level increases result in increased slope value (risk taking) behind the reference person and decreased slope value (risk taking) ahead of the reference person.



Graph 9: Possible changes in the social preferences model as a result of increasing salience of social comparison

In the case of varying mood states, with gradually increasing feeling of unpleasantness (pleasantness) for the low (high) endowment condition participants and increasing (decreasing) risk taking would provide support for the mood-maintenance hypothesis. The changes suggested before on social preferences model and prospect theory could, with these outcomes, be conveyed or amplified by the changing mood states. Increased risk taking could be related to stronger emotional reaction evoked by the more salient differences which eventually leads to mentioned changes the economic models. As mentioned before, this development could be explained by both prospect theory and social preferences theory. In prospect theory, perception of one's own position in relation to the reference point would shift right (left) in each experiment for the high (low) endowment group as the salience increases (as depicted in graph 8). Even if we assume that the mood-maintenance hypothesis is valid, it is difficult to say whether changing mood states lead to the change in perception or simply moderate the effect.

In social preferences theory, as defined before, increased tangibility would affect the parameter size. Parameters would decrease (increase) for the low (high) endowment participants increasing (decreasing) the slope of the utility function. As was the case for prospect theory, further research

would have to be conducted to reveal whether emotions and moods lead to the changes or just modify how strong these effects are.

Finally, it is possible that risk taking remains little - or unchanged for low endowment condition and increases for the high endowment condition - while the mood measurements gradually change. This case would show support for the affect infusion model. This condition is slightly different from the previous possible where the MMH was proposed to be valid. In this condition, it can be said that emotions or mood states modify how strongly social comparison is perceived but they do not convey changes in risk taking. If moods conveyed changes, risk taking preference would not remain static over the several experiments as moods change simultaneously. Consider, for example, that low condition participants report gradually more unpleasant moods in every experiment. According to the affect infusion model, negative moods lead to more pessimistic estimates and subsequently, decreased preference for risk. On the other hand, high endowment condition would show increased preference for risk. Risk taking remains little changed because increasing salience of social comparison and participant's moods cause risk preferences to change to different directions causing the net effect on risk taking to be smaller than with previous results. This condition would also seem to confirm that salience of the social comparison does moderate the emotional reaction experienced by individuals. However, the increasingly negative feelings are negating the effect of increasing risk preference and vice versa.

Overall, there are several possible combinations of outcomes possible. Especially due to the difficulty of predicting the effect of different mood states make accurate predictions of final behavior ambiguous. Due to the inconclusive nature of the predictions, it would be of interest to analyze actual experimental results. These results could then further help understand situational factors which may influence risk preferences and provide evidence on whether social preferences model and prospect theory should include the salience of social comparison in them.

6. Conclusion

The experimental structure here is based on psychological and economic research and suggests that tangibility of social comparison has an effect on individual risk taking. Results supporting this hypothesis would have implications on how reference point comparison, and controlling the salience of this comparison, affects social preferences model and prospect theory. However, at this stage it is too early to mention how changes in mood and emotional states relate to risk taking.

If the experiments uncover changes in risk preferences due to salience of social comparison, it would suggest that the slope value of social preferences utility function, along with the perception of one's position in relation to reference point, would change in response to the changes in salience level. These are the two main explanations on why risk taking could possibly change in participants. In social preferences model, the slope of the utility function is responsive to the salience level, which in turn leads to increased marginal utility and higher risk preference. The slope value changes as parameters of the utility function change as depicted in graph 9. Prospect theory explanation states, that the subjective perception of the difference between one's own position and reference point increases as the salience of social comparison increases (graph 8). Greater difference to reference leads the participants to perceive their position on the value function differently in each experiment, resulting in different evaluations of marginal value for each level of tangibility.

Effect of emotions on decision making containing social comparison is less clear. It is not known if social comparison leads to changes in emotions and mood states, changes in which lead to different preferences in risk taking. Another option is that social comparison in itself causes changes in social preferences utility function and perceived position in prospect theory, in addition to changes in mood states. These mood state changes then in turn moderate the effects of social comparison on risk taking through effects suggested either by the affect infusion model or mood-maintenance hypothesis.

Actual execution of the experiment would yield interpretable results and provide information on which of the possible result scenarios reviewed would be most plausible. Also, results would tell whether it is sensible to include the salience of social comparison into the prospect theory and social preferences model's parameters.

References

- J. S. Adams** (1963) "*Toward an understanding of inequity*", *Journal of Abnormal and Social Psychology*, Vol. 67, pp. 422-436
- G.A. Akerlof and J.L. Yellen** (1990) "*The Fair Wage-Effort Hypothesis and Unemployment*", *The Quarterly Journal of Economics*, Vol. 105, Issue 2, pp. 255-283
- M. Allais** (1953) "*Le comportement de l'homme rationnel devant le risque: critique des postulats et axiomes de l'école Américaine*", *Econometrica*, Vol. 21, No. 4, pp. 503-546
- J. Andreoni and J.H. Miller** (2002) "*Giving According to GARP: An Experimental Study of Rationality and Altruism*", *Econometrica*, Vol. 70, No. 2, pp. 737-753
- K.J. Arrow** (1965) "*Aspects of the Theory of Risk-Bearing*", Helsinki: Yrjö Jahnssoonin Säätiö.
- K.J. Arrow** (1971) "*Essays in the Theory of Risk-Bearing*", Chicago, IL: Markham Publishing Company
- S. E. Asch** (1951) "*Effects of Group Pressure upon the Modification and Distortion of Judgment*", *Groups, leadership, and men*, Pittsburgh: Carnegie Press
- D. H. Barlow** (2004) "*Anxiety and its Disorders: the Nature and Treatment of Anxiety and Panic*", New York: Guilford Press
- M. Baucells, M. Weber and F. Welfens** (2011) "*Reference-Point Formation and Updating*", *Management Science*, Vol. 57, No. 3, pp. 506-519
- D. Bernoulli** (1954) "*Exposition of a New Theory on the Measurement of Risk*", *Econometrica*, 22, pp. 23-36 (English translation of the 1738 Latin original)
- M. A. S. Boksem, E. Kostermans and D. De Cremer** (2010) "*Failing Where Others Have Succeeded: Medial Frontal Negativity Tracks Failure in a Social Context*", *Psychophysiology*, Vol. 48, Issue 7
- G.E. Bolton and A. Ockenfels** (2000) "*ERC: A Theory of Equity, Reciprocity and Competition*", *The American Economic Review*, Vol. 90, No. 1, pp. 166-193
- C.M. Cambell and K. Kamlani** (1997) "*The Reasons for Wage Rigidity: Evidence from a Survey of Firms*", *Quarterly Journal of Economics*, Vol. 112, No. 3, pp. 759-789
- G. Charness and B. Grosskopf** (2001) "*Relative Payoffs and Happiness: An Experimental Study*", *Journal of Economic Behavior and Organization*, Vol. 45, pp. 301-328
- G. Charness and M. Rabin** (1999) "*Social Preferences: Some Simple Tests and a New Model*", Universitat Pompeu Fabra and University of California at Berkeley, mimeo
- G. Charness and M. Rabin** (2002) "*Understanding Social Preferences with Simple Tests*", *Quarterly Journal of Economics*, Vol. 117, Issue 3, pp. 817-869
- K.L. Chou, T.M.C. Lee and A.H.Y. Ho** (2007) "*Does mood state change risk taking tendency in older adults?*", *Psychology and Aging*, Vol. 22, No. 2, pp. 310-318

- A.E. Clark and A.J. Oswald** (1996) "*Satisfaction and Comparison Income*", *Journal of Public Economics*, Vol. 61, pp. 359-381
- S. DellaVigna** (2007) "*Psychology and Economics: Evidence from the Field*", National Bureau of Economic Research, Working Paper No. 13420, September 2007
- T. Dohmen, A. Falk, D. Huffman, U. Sunde, J. Schupp and G.G. Wagner** (2011) "*Individual Risk Attitudes: Measurement, Determinants and Behavioral Consequences*", *Journal of the European Economic Association*, Vol. 9, Issue 3, pp. 522–550
- M. Dufwenberg and G. Kichsteiger** (2004) "*A Theory of Sequential Reciprocity*", *Games and Economic Behavior*, Vol. 47, Issue 2, pp. 268-298
- A. Falk and A. Ichino** (2006) "*Clean Evidence on Peer Effects*", *Journal of Labor Economics*, Vol. 24, No. 1, pp. 39-57
- E. Fehr and K. Schmidt** (1999) "*A Theory of Fairness, Competition and Cooperation*", *Quarterly Journal of Economics*, Vol. 114, No. 3, pp. 817-868
- L. Festinger** (1954) "*A Theory of Social Comparison Processes*", *Human Relations*, Vol. 7, pp. 117-140
- J.P. Forgas** (1995) "*Mood and judgment: The affect infusion model (AIM)*", *Psychological Bulletin*, Vol. 117 (1), pp. 39–66
- R. Forsythe, J. Horowitz, N.E. Savin and M. Sefton** (1994) "*Fairness in Simple Bargaining Experiments*", *Games and Economic Behavior*, Vol. 6, pp. 347-369
- M. Friedman and L.J. Savage** (1948) "*The Utility Analysis of Choices Involving Risks*", *Journal of Political Economy*, Vol. 56, No. 4, pp. 279-304
- M. Gardner and L. Steinberg** (2005) "*Peer Influence on Risk Taking, Risk Preference, and Risky Decision Making in Adolescence and Adulthood: An Experimental Study*", *Developmental Psychology*, Vol. 41, pp. 625-635
- W.J. Gehring, M.G.H. Coles, D.E. Meyer and E. Donchin** (1990) "*The Error-Related Negativity: An Event Related Brain Potential Accompanying Errors*", *Psychophysiology*, 27, S34
- W.J. Gehring, B. Goss, M.G.H. Coles, D.E. Meyer and E. Donchin** (1993) "*A Neural System for Error Detection and Compensation*", *Psychological Science*, Vol. 4, No. 6, pp. 385-390
- L. Guiso and M. Paiella** (2008) "*Risk Aversion, Wealth and Background Risk*", *Journal of the European Economic Association*, Vol. 6, Issue 6, pp. 1109–1150
- D.W. Harless and C.F. Camerer** (1994) "*The Predictive Utility of Generalized Expected Utility Theories*", *Econometrica*, Vol. 62, No. 6, pp. 1251-1289
- J. Hartog, A. Ferrer-i-Carbonell and N. Jonker** (2000) "*On a Simple Measure of Individual Risk Aversion*", Tinbergen Institute Discussion Paper, TI 2000-074/3
- C. Heath, R.P. Larrick and G. Wu** (1999) "*Goals as reference points*", *Cognitive Psychology*, Vol. 38, pp. 79-109

- A.M. Isen and T.E. Shalcker** (1982) *"The Effect of Feeling State on Evaluation of Positive, Neutral, and Negative Stimuli: When You "Accentuate the Positive," Do You "Eliminate the Negative"?"*, *Social Psychology Quarterly*, Vol. 45, No. 1, pp. 58-63
- A.M. Isen and R. Patrick** (1983) *"The Effect of Positive Feelings on Risk Taking: When the Chips are down"*, *Organizational Behavior and Human Performance*, Vol. 31, Issue 2, pp. 194-202
- D. Kahneman, J.L. Knetsch and R. Thaler** (1986) *"Fairness as a Constraint on Profit Seeking: Entitlements in the Market"*, *The American Economic Review*, Vol. 76, No. 4, pp. 728-741
- D. Kahneman and A. Tversky** (1979) *"Prospect Theory: An Analysis of Decision under Risk"* *Econometrica*, Vol. 47, No. 2, pp. 263-292
- D. Kahneman and A. Tversky** (1992) *"Advances in Prospect Theory: Cumulative Representation of Uncertainty"*, *Journal of Risk and Uncertainty*, Vol. 5, No. 4, pp. 297-323
- D. Kahneman** (1992) *"Reference points, anchors, norms, and mixed feelings"*, *Organizational Behavior and Human Decision Processes*, Vol. 51, No. 2, pp. 296-312
- G.J. Koop and J.G. Johnson** (2010) *"The use of multiple reference points in risky decision making"*, *Journal of Behavioral Decision Making*, Vol. 121, pp. 1133-1165
- B. Köszegi and M. Rabin** (2006) *"A Model of Reference-Dependent Preferences"*, *The Quarterly Journal of Economics*, Vol. 121, Issue 4, November 2006, pp. 1133-1165
- W.J.M. Levelt** (1989) *"Speaking: From Intention to Articulation"*, Cambridge, MA: MIT-Press
- G. Loewenstein, M. Bazerman and L. Thompson** (1989) *"Social Utility and Decision Making in Interpersonal Contexts"* *Journal of Personality and Social Psychology*, Vol. 57, pp. 426-441
- G. Loewenstein and S. Frederick** (1997) *"Predicting Reactions to Environmental Change"*, *Environment, ethics, and behavior: The Psychology of Environmental Valuation and Degradation*, San Francisco: New Lexington Press/Jossey-Bass, pp. 52-72
- G. Loewenstein and J. Lerner** (2003) *"The Role of Affect in Decision Making"*, *Handbook of Affective Science*, Oxford: Oxford University Press, pp. 619-642
- G.D. Logan** (1985) *"Executive Control of Thought and Action"*, *Acta Psychologica*, Vol. 6, Issues 2-3, pp. 193-210
- E. Malinvaud** (1952) *"Note on von Neumann-Morgenstern's strong independence axiom"*, *Econometrica*, Vol. 20, pp. 679
- H. Markowitz** (1952) *"The Utility of Wealth"*, *Journal of Political Economy*, Vol. 60, No. 2, pp. 151-158
- R.B. Mars, E.R.A. De Bruijn, W. Hulstijn, W.H.R. Miltner and M.G.H. Coles** (2004) *"What if I told you: "you were wrong"? Brain potentials and behavioral adjustments elicited by feedback in a time-estimation task"*, In: M. Ullsperger, M. Falkenstein, editors *"Errors, conflicts, and the brain: Current opinions on performance monitoring"*, Leipzig: MPI of Cognitive Neuroscience, pp. 129--134

- R. Martin, J. Suls and L. Wheeler** (2002) *“Ability Evaluation by Proxy: Role of Maximal Performance and Related Attributes in Social Comparison”*, Journal of Personality and Social Psychology, Vol. 82, No. 5, pp. 781-791
- A. Mas and E. Moretti** (2006) *“Peers at Work”*, NBER Working Paper No. 12508, Sept. 2006
- G. Mathews, D. Pitcaithly and R.L.E. Mann** (1995) *“Mood, neuroticism, and the encoding of affective words”*, Cognitive Therapy and Research, Vol. 19, No. 5, pp. 563–587
- S. Milgram** (1963) *“Behavioral Study of Obedience”*, The Journal of Abnormal and Social Psychology, Vol. 67, pp. 371-378
- W.H.R. Miltner, C.H. Braun and M.G.H. Coles** (1997) *“Event-Related Brain Potentials Following Incorrect Feedback in a Time-Estimation Task: Evidence for a “Generic” Neural System for Error Detection”*, Journal of Cognitive Neuroscience, Vol. 6, Issue 6, pp. 788-798
- J. von Neumann and O. Morgenstern** (1947) *“The Theory of Games and Economic Behavior”*, Princeton: Princeton University Press
- N. Novemsky and M.E. Schweitzer** (2004) *“What makes negotiators happy? The differential effects of internal and external social comparisons on negotiator satisfaction”*, Organizational Behavior and Human Decision Processes, Vol. 95, pp. 186-197
- L.D. Ordóñez, T. Connolly and R. Coughlin** (2000) *“Multiple reference points in satisfaction and fairness assessment”*, Journal of Behavioral Decision Making, Vol. 13, pp. 329-344
- J.W. Pratt** (1964) *“Risk Aversion in the Small and in the Large”*, Econometrica, Vol. 32, No. 1-2, pp. 122-136
- D. Prelec** (1998) *“The Probability Weighting Function”*, Econometrica, Vol. 66, No. 3, pp. 497-527
- P.M.A. Rabbitt** (1966) *“Errors and Error Correction in Choice-Response Tasks”*, Journal of Experimental Psychology, Vol. 71, Issue 2, pp. 264-272
- M. Rabin** (1993) *“Incorporating Fairness into Game Theory and Economics”*, The American Economic Review, Vol. 83, No. 5, pp. 1281-1302
- M. Rabin** (2000) *“Risk Aversion and Expected-Utility Theory: A Calibration Theorem”*, Econometrica, Vol. 68, No. 5, pp. 1281-1292
- R. Raghunathan and M. Tuan Pham** (1999) *“All Negative Moods Are Not Equal: Motivational Influences of Anxiety and Sadness on Decision Making”*, Organizational Behavior and Human Decision Processes, Vol. 79, No. 1, pp. 56–77
- R.D. Rogers, A.M. Owen, H.C. Middleton, E.J. Williams, J.D. Pickard, B.J. Sahakian and T.W. Robbins** (1999) *“Choosing between small, likely rewards and large, unlikely rewards activates inferior and orbital prefrontal cortex”*, The Journal of Neuroscience 15, October 1999, 19(20): 9029-9038
- P. Samuelson** (1952) *“Probability, utility, and the independence axiom”*, Econometrica, Vol. 20, pp. 670-678

- M.K. Scheffers, M.G.H. Coles, P. Bernstein, W.J. Gehring and E. Donchin** (1996) *“Event-related Brain Potentials and Error-related Processing: An Analysis of Incorrect Response to Go and No-go Stimuli”*, *Psychophysiology*, Vol. 33, Issue 1, pp. 42-53
- M. Seo, B. Goldfarb, L. Feldman Barrett** (2010) *“Affect and the Framing Effect within Individuals over Time: Risk Taking in a Dynamic Investment Simulation”*, *Academy of Management Journal*, Vol. 53, No. 2, pp. 411-431
- B. Shiv, G. Loewenstein, A. Bechara, H. Damasio and A.R. Damasio** (2005) *“Investment Behavior and the Negative Side of Emotion”*, *American Psychological Society*, Vol. 16, No. 6, pp. 435-439
- O. Stark and W. Hyll** (2011) *“On the Economic Architecture of the Workplace: Repercussions of Social Comparisons among Heterogeneous Workers”*, *Journal of Labor Economics*, Vol. 29, Issue 2, pp. 349-375
- C. Starmer** (2000) *“Developments in Non-expected utility theory: The hunt for a descriptive theory of choices under risk”*, *Journal of Economic Literature*, Vol. 38, No. 2, pp. 332-382
- R. Sudgen** (1984) *“Reciprocity: The Supply of Public Goods Through Voluntary Contributions”*, *The Economic Journal*, Vol. 94, No. 376, pp. 772-787
- J. Suls, R. Martin and L. Wheeler** (2002) *“Social Comparison: Why, With Whom, and With What Effect?”*, *Current Directions in Psychological Science*, Vol. 11, pp. 159-163
- R.H. Thaler** (1988) *“Anomalies: The Ultimatum Game”*, *The Journal of Economic Perspectives*, Vol. 2, No. 4, pp. 195-206
- M. Yaari and M. Bar-Hillel** (1984) *“On Dividing Justly”*, *Social Choice and Welfare*, Vol. 1, No. 1, pp. 1-24
- K.S.L. Yuen and T.M.C. Lee** (2002) *“Does Mood State Change Risk Taking Tendency in Older Adults?”*, *Journal of Affective Disorders*, Vol. 75, Issue 1, June 2003, pp. 11-18

Appendix

Mood mapping questionnaire

“Please complete the following information and return this form when you are finished.

Age _____

Sex Male / Female

Years of education _____

How much would you be willing to pay, in order to participate in the following game? You have a 50% probability of winning EUR 100 and a 50% probability of getting nothing.

I would be willing to pay EUR ____ in order to participate in this gamble.”

Participants also charted their mood state by answering the below questions. Order of the questions charting mood was random but in this appendix they are grouped with their counterparts. The counterpart answers will be reversed and used to deduce the mood of the participant more accurately.

“Please state on an eight-point scale how accurate you think the following statements are (1 = definitely not / 8 = definitely).”

“I feel happy.” / “I feel sad.”

“I feel satisfied.” / “I feel sorry.”

“I feel energetic.” / “I feel tired.”

“I feel anxious.” / “I feel calm.”

“I feel tense.” / “I feel restful.”