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A Survey Study of Factors Influencing Risk Taking Behavior

in Real World Decisions under Uncertainty

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Abstract

With the goal of investigating decision making under uncertainty in real world decisions, we conduct a survey requiring 261 subjects to describe recent real life decisions and to answer questions about several dimensions of a decision, including framing, status quo, domain, and type of consequences. The study shows that when real world decisions are framed as choices between a sure outcome and a risky alternative a key prediction of Prospect Theory holds, namely, that a losses framing increases risk taking behavior. The results also provide support for the need to include the domain of a decision as a factor influencing risk taking behavior. Risk attitudes do not vary across the three groups considered and do not depend on whether the type of consequences are monetary or not. While we observe that status quo has some influence in setting the framing, we confirm that framing, and not status quo, is the driver of the risk attitude.

Key words

Real world decisions, risk taking behavior, framing, domain, type of consequence, status quo.

Resumen

Con el objetivo de investigar la toma de decisiones bajo incertidumbre en el mundo real, hemos suministrado un cuestionario a 261 sujetos en el que nos describen una decisión real reciente. Dicha descripción incluye varias dimensiones de la misma, como el encuadre de pérdidas o ganancias *(framing)*, el statu quo, el dominio y el tipo de consecuencia. El estudio demuestra que cuando se trata de una decisión entre algo seguro y algo arriesgado, se cumple la predicción de la teoría de prospectos de que un encuadre como pérdidas aumenta la propensión a tomar riesgos. Los resultados también indican que el dominio de la decisión es un factor que influye en la propensión a tomar riesgos. Las actitudes ante el riesgo no varían según el grupo de estudio o de si el tipo de consecuencia es monetario o no. Finalmente, mientras que el statu quo influye en establecer el punto de referencia, es el punto de referencia, y no el statu quo, el que afecta a la propensión al riesgo.

Palabras clave

Decisiones en el mundo real, toma de riesgos, encuadre, dominio de las decisiones, tipos de consecuencias, statu quo.

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A Survey Study of Factors Influencing Risk Taking Behavior in Real World Decisions under Uncertainty

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C O N T E N T S

1. Introduction

ONE of the most influential descriptive theories of decision making under uncertainty is Kahneman and Tversky's Prospect Theory. While a considerable amount of empirical research has been dedicated to testing the predictions of Prospect Theory (see surveys from Camerer, 1995; Luce, 2000), most of the evidence comes from laboratory experiments where subjects face choices designed by experimenters (Wu, Zhang, and Gonzalez, 2004). Laboratory research has the advantage of performing controlled experiments, while allowing for the use of real monetary incentives. However, one disadvantage of the laboratory experiments is that they analyze decision making almost exclusively in hypothetical decision situations. The extent to which the results of these experiments can be generalized to real world decisions is still under debate (e.g., Kühberger, Schulte-Mecklenbeck, and Perner, 2002). Our study aims to contribute to this debate, by investigating risk taking behavior, as suggested by Prospect Theory, in real world decisions.

The methodology we choose has been to design a survey to elicit certain aspects of real decisions made. We requested three groups of subjects (undergraduates, MBAs and executives) to describe one recent real life decision. We then asked the subject to fit the description in a simple decision analytic framework consisting of 2 alternatives and 1 uncertainty. Finally, subjects answered questions regarding several dimensions of their decisions including framing, status quo, domain, and type of consequences. Based on this survey, we then attempt to test whether some of the main predictions of the Prospect Theory, validated in laboratory experiments, can be extended to real world decisions. The study also provides evidence for other factors that influence the risk taking behavior and that deserve more exploration. Finally, our investigation offers interesting insights about risk taking behavior for different subject pools. We use a logistic regression model to analyze the influence of framing, status quo, domain and type of consequences of a decision on risk attitudes.

Before designing the survey, we collected a list of potential factors that may influence risk taking behavior. Traditional decision theory argues that the magnitude of outcomes and their probabilities, together with stable risk preferences over outcomes, were the major factors that influence risk taking

behavior (Keeney and Raiffa, 1976; Clemen and Reilly, 2001). Behavioral decision theorists have expanded the list of relevant drivers of risk attitudes. Specifically, Kahneman and Tversky (1979) proposed framing as the major factor influencing the risk taking propensity. Closely related to framing is the status quo or the alternative seen as the default alternative (Samuelson and Zeckhauser, 1988; Schweizer, 1994; Johnson and Goldstein, 2003). However, most of the studies on these aspects used experimental settings in which framing and status quo were manipulated or induced. Our goal is to test whether the effects of framing and status quo replicate in environments where those factors are not manipulated experimentally.

The domain of a decision has been proposed as another aspect that influences risk attitudes (Slovic, 1972; Hershey and Schoemaker, 1980, 1994; March and Shapira, 1987; Schoemaker, 1990). However, most of the studies consider only a few, exogenously given, domains (Fagley and Miller, 1990; Rettinger and Hastie, 2001). The domain of a decision is, of course, *a priori* more difficult to characterize than framing, which explains why framing effects are better understood than domain effects. Our approach allows us to analyze a variety of domains and, thus, to provide further evidence for the relevance of the domain of a decision in explaining risk attitudes. Specifically, we study a broad category of professional vs. private domains, together with a finer classification (investment, career, leisure, etc.) of up to 17 domains.

Incentives can be real or hypothetical, and in a separate classification, monetary or non-monetary (e.g. use candies instead of money). Most behavioral research in laboratory is conducted using monetary outcomes (hypothetical or real). An implicit assumption often made is that the conclusions also apply to non-monetary outcomes. Fagley and Miller (1997) have compared the way people make choices in decisions involving monetary as opposed to non-monetary (human life) outcomes and concluded that framing is independent of whether the outcomes are monetary or non-monetary. Similarly, Leclerc, Schmitt and Dubé (1995) investigated whether time is treated as money in decisions under risk. However, not much is known about the relationship between risk attitudes and other types of consequences (comfort, convenience) of a decision. Since in reality many decisions are either non-monetary, or a combination of non-monetary and monetary outcomes, it is important to measure the influence, or lack of influence, of the type of consequence on the risk attitudes. This study provides new insights into this matter.

Our results make several contributions to the literature. First, we develop an original decision making setting to explore risk behavior under un-

certainty. Our study complements the laboratory studies on decision making under uncertainty by using real world decisions, which adds realism and descriptive relevance. Second, we provide an alternative way to verify the main predictions of Prospect Theory. While previous research has mainly examined framing (e.g., Camerer, 2000) and risk attitudes (e.g., Binswarger, 1980) for given domains, we advance the current understanding by analyzing other factors, such as status quo, domain, and type of consequences of a decision in a variety of domains. Third, our varied subject pool gives us the opportunity to observe similarities and differences in decision making among different subjects, not all undergraduates.

We are not the first to study real world decisions. Hogarth (2004) used the Experience Sampling Method, i.e., subjects were alerted by mobile phone messages and were requested to fill a short questionnaire reporting a recent decision at random times of the day. However, his study addressed a different issue than the one proposed by ours, namely, it looked at the effect of feedback on confidence in everyday decision making.

The remainder of the paper is organized as follows. Section 2 describes the survey design, discusses the measurement, and performs a preliminary data analysis. Section 3 explains the statistical results, including (3.1) an analysis of similarities and differences across the groups (3.2) a logistic regression model analyzing the probability of making the risky choice and (3.3) a discussion about the relationship between status quo and reference points, and other factors that influence risk attitudes. Section 4 concludes.

2. Research Methods

2.1. Subjects

We distributed a questionnaire to three groups of participants [1]. The first group consisted of 77 undergraduate students from Duke University. The second group was made up of 131 MBA students at IESE Business School in Barcelona, Spain. The third group consisted of 53 executives who were enrolled in the executive education program at IESE Business School. Table 2.1 summarizes the different demographical characteristics of the undergraduates (in what follows Undergrads), MBA students (MBAs) and executives (Executives).

TABLE 2.1: Characteristics of subjects

	Undergrads		**MBAs**		**Executives**		**Total**	
N	77		131		53		261	
Median age	24.5		28		36		28	
Country	86% USA		30 diff. countries		91% Spain			
Gender	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Female	35	45%	36	27%	2	4%	73	28%
Male	42	55%	95	73%	51	96%	188	72%

2.2. Survey design

The questionnaire required subjects to describe a recent decision. We wanted subject to conform to a simple decision analytic scheme. The decision should involve two alternatives, a sure alternative *S* and a risky alternative *R*.

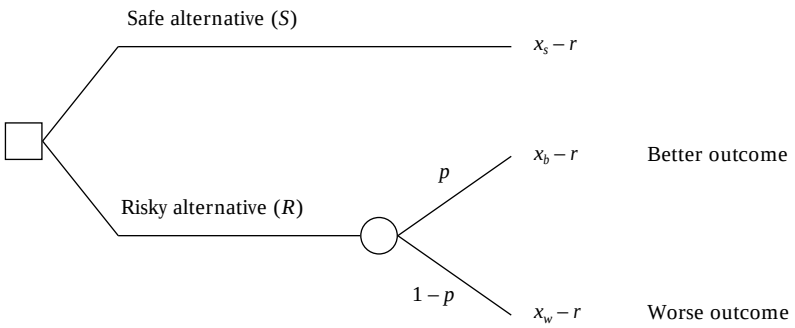
1. The questionnaire can be downloaded from http://webprofesores.iese.edu/mbaucells/

Further, the outcomes of the risky alternative should be summarized in two scenarios, a *better outcome* scenario and a *worse outcome* scenario.

Then subjects were required to answer a number of questions which were meant to measure several dimensions of a decision. Some of those dimensions (e.g., p, $x_b - x_w$) correspond to the elements of a decision depicted in Graphic 2.1, while others were meant to help us to further characterize a decision (e.g., domain, frequency, framing).

Figure 2.1, not shown in the questionnaire presented to the subjects but underlying its design, contains several dimensions of a risky decision. r is the reference point, x_s is the monetary outcome of the safe alternative (S), and $x_s - r$ is the perceived gain or loss associated with such outcome. Likewise, $x_b - r$ and $x_w - r$ with $x_b > x_w$ are the perceived gains or losses of the better and worse outcomes, respectively, of the risky alternative (R). Finally, p is the probability of the better outcome.

FIGURE 2.1: Decision framework underlying the questionnaire



2.2.1. Domain

Through the descriptions and explanations of the decisions and their corresponding outcomes, we classified the decisions into 17 mutually exclusive domains. These domains were later combined in two broad groups named *professional* and *private*. The specific description of the way in which this classification was made is postponed to the next section.

2.2.2. Type of consequence

Early in the questionnaire subjects were asked to classify the outcomes of their decisions according to one or more of the following seven categories: monetary, comfort (or discomfort), convenience, time (arriving on time or late, delays, waiting), social consequences (fame, embarrassment), career and other.

2.2.3. Probability *p*

Direct scaling was used to measure the probability of success of the risky alternative, *p*. More precisely, subjects were presented with a linear scale between 0 and 1 with increments of 10% and were requested to use a cross to indicate the estimated probability that the better outcome would happen and then to write down this estimate in a place especially indicated.

2.2.4. Status quo

The status quo was given by the alternative that was perceived as a default alternative, i.e., the alternative that would be chosen if no action would be taken. To find the status quo, subjects were requested to decide whether in their decisions: 1) the safe alternative was the default alternative or 2) the risky alternative was the default alternative or 3) neither alternative was the default due to the fact that both alternatives required taking some action.

2.2.5. Valuation of the outcomes

In order to have a quantitative measure of the consequences we requested the subjects to provide monetary estimates of the outcomes. Thus, subjects were asked to imagine that they had chosen the risky alternative and the worse outcome had happened. In this case, they had to provide us with their willingness to pay to replace: 1) the worse outcome with the better outcome and 2) the worse outcome with the sure outcome. This information provided us with the differences: $x_b - x_w$ and $x_s - x_w$. As a double check, subjects were asked to provide us with their willingness to pay to move from the sure to the better outcome given that they had previously chosen the safe alternative. Their answers provided us with values for $x_b - x_s$ and $x_s - x_w$, which in principle should agree with the previous estimate of $x_b - x_w$ [2].

2.2.6. The attractiveness of the safe alternative *q*

The fraction $q = (x_s - x_w)/(x_b - x_w)$ indicates the position of the sure outcome relative to the better and worse outcomes. We call *q* the *attractiveness of the safe alternative*. For non-trivial decisions *q* takes values strictly between 0 to 1. A risk neutral decision maker would prefer the risky outcome if and only if $p \geq q$. This observation is easily seen by setting $r = x_w$, in which case the expected values of *S* and *R* are $q\,(x_b - x_w)$ and $p\,(x_b - x_w)$, respectively.

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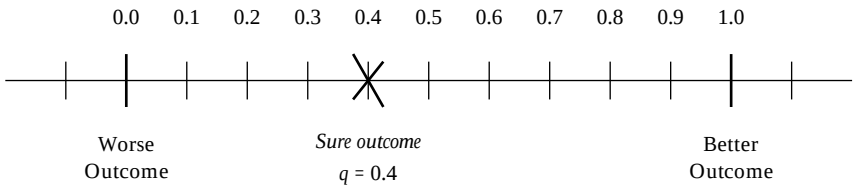
2. Undergrads expressed these values in dollars, whereas MBAs and executives responded in euros. Exchange rates between these two currencies were around one when data were collected, and we use euros as the unit of monetary measure.

We elicited *q* using a direct scale. Specifically, subjects were presented with a scaled line as in Graphic 2.2, and asked to estimate the location of the sure outcome with respect to the worse and better outcomes in terms of their preferences [3].

FIGURE 2.2: Scale to locate the sure outcome with respect to the better and worse outcomes



2.2.7. Framing

Framing is related to the locus of the reference point *r* relative to the outcomes, yielding a perception of either gains or losses for each outcome. Overall, the decision can be perceived as gains, losses, or mixed. We asked subjects whether they perceived the sure outcome as a gain, a loss, or neutral (neither gains nor losses) by ticking one of the three available check boxes. The framing of the decision was described as *gains* for those subjects reporting the sure outcome to be a gain, *losses* if the sure outcome was perceived as a loss, and *mixed* if the sure outcome was perceived as neutral. As a consistency check, we also asked the subject to classify as gain, loss or neutral the two outcomes of *R*. We eliminated from the analysis of framing 17 cases that showed some inconsistency. For example, if the safe alternative was perceived as neutral, then the better outcome could not be perceived as a loss, nor the worse outcome could be perceived as a gain. This left us with 244 valid answers out of 261.

2.2.8. Final choice

Subjects were asked to write down whether they have chosen the safe or the risky alternative. Combining this answer with other dimensions such as framing and probability *p* would provide the necessary information to evaluate subjects' risk attitudes.

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3. It is also possible to estimate *q* using the monetary valuations of the outcomes. In fact, the following three ratios $(x_s - x_w) / (x_b - x_w)$, $(x_s - x_w), / ((x_b - x_s) + (x_s - x_w))$ and $1 - (x_b - x_s) / (x_b - x_w)$, provide estimates of *q*. If we take the median of these three numbers and compare it with the scale estimate of *q*, we find a correlation of 0.56. While the correlation is somewhat low, our results do not change significantly with the measure used. In order to avoid possible additional biases, we decided to use the direct scale estimate of *q*.

2.3. Preliminary data analysis

In order to describe and analyze the results of the survey, the responses to some of the questions were coded. In what follows, we first explain the way we coded the variable domain and then describe how we coded other dimensions.

2.3.1. Coding of the domain

The domain of the decisions reported by the subjects was assessed using the open-ended question (see elicitation of simple decisions) described in the methods section. In other words, subjects were not asked to pigeon hole their decision in a particular domain, but to describe in words their decisions. In order to classify the decisions into domains, the authors identified 17 domains, as shown in Table 3.1. The 17 domains were combined into two broad categories: professional and private. The *professional* decisions were composed of: business, start MBA, human resources, job, protocol, and studying. The rest of domains were labeled as *private* decisions. The two authors independently associated each decision to exactly one domain of the 17 domains available. A handful of decisions were classified differently by the two authors. After discussing those cases, an agreement was reached, which in many cases clarified the definition of the different domains.

2.3.2. Coding of the other dimensions

Since subjects were allowed to select as many types of consequences they thought necessary, their answers were coded with 0s and 1s, where 1 stands for an option being chosen. In this way, we constructed 7 binary variables: D_MONEY, D_COMFORT, D_CONVENIENCE, D_TIME, D_SOCIAL, D_CAREER and D_OTHER. Notice that the binary variable D_MONEY distinguishes between the monetary and non-monetary outcomes.

Two binary variables D_GAIN and D_LOSS were constructed to account for framing, with D_GAIN = 1 for those reporting a gain framing and 0 otherwise, and D_LOSS = 1 for those reporting a loss framing and 0 otherwise.

We also created a binary variable for the status quo, namely D_SAFE_DEFAULT, with D_SAFE_DEFAULT = 1 if the safe alternative was reported as the default alternative and 0 otherwise.

We constructed a binary variable, D_PROFESSIONAL with D_PROFESSIONAL = 1 for professional decisions and 0 otherwise. We also created binaries for each of the 17 categories mentioned earlier.

A set of two binaries, D_UNDERGRAD and D_EXECUTIVE, were generated for the three groups: Undergrads, MBAs and Executives, with

D_UNDERGRAD = 0 for Undergrads and D_UNDERGRAD = 1 otherwise and, D_EXECUTIVE = 1 for Executives and D_EXECUTIVE = 0 otherwise.

Finally, subjects' choices of risky or safe alternative was coded as a binary variable D_RISKY with 1 standing for the risky choice being made and 0 otherwise.

2.4. Methodological issues

The indications of several articles (e.g., Schwarz, 1999; Schwarz and Oyserman, 2001) were followed in designing the present questionnaire. For instance, in order to explore potential differences in question interpretation and other sources of bias and error, we pre-tested the questionnaire using 15 individuals. As a result, we changed the order and rewrote some questions to minimize misinterpretations. Some improvements regarding the visual presentation of the questions were also suggested and, accordingly, implemented.

Another aspect that we considered was the reliability of the domain construct. In order to evaluate the inter-rater reliability for the domain, we measured the extent of the consensus on the use of the 17 domains available as the number of agreements divided by total number of observations. The inter-rater reliability was of 76%.

While the self-reported decisions of our survey are not necessarily representative of all decisions, they nonetheless envisage a broad variety of decisions. The crucial requirement for the validity of our regression analysis is to cover broad ranges for those dimensions that we measure. For instance, it is important to have enough data points in the professional decisions that were framed as losses and for which the risky choice was made. While our subject sample is far from being representative of the general population, it is more representative than those samples consisting solely of undergraduates used in most studies testing Prospect Theory. The MBAs and executives samples cover a considerable range of demographical characteristics, and can be seen as representative for the population of MBAs and executives. However, one has to be aware of possible selection bias. For example, the fact that subjects are young may explain why health related decisions were infrequent.

Several biases may have a distorting effect. For instance, the retrospective elicitation of probabilities and outcome values are subject to hindsight bias. Similarly, the request to think of a decision involving a risky alternative may have induced subjects to think of a decision where they took the risky

alternative, explaining thus the high overall percentage of risky choices (74%). However, the choice of *R* versus *S* is influenced by other factors, some of which we can identify with independence of this selection bias. Finally, because subjects had to retrieve from their memories a recent decision, the availability bias (Tversky and Kahneman, 1973) may have distorted the sample, making easily retrievable or available decisions appear more frequent than what they actually are. However, if we assume that those biases produce a common shift of the answers, it does not invalidate our regression analysis of the factors that influence risk taking.

3. Results

THE analysis and presentation of the results is divided into two parts. In sub-section 3.1, we present an overview of similarities and differences across the three groups with respect to several dimensions. We complement this qualitative analysis with the investigation of the relationships between some dimensions. Sub-section 3.2 examines the influence of framing, status quo, and other variables on the final choice by means of a logistic regression model. Sub-sections 3.3 and 3.4 discuss the relationship between status quo and reference points, and other factors that influence risk attitudes.

3.1. Overall picture and group analysis

3.1.1. Types of consequences and domain

Graphic 3.1 presents the percentages for the types of consequences for the three groups. While most experiments employ decisions with monetary consequences, our survey shows that aspects other than monetary are involved in most decisions. More precisely, only 11 decisions out of 261 were *exclusively* monetary, and 37% of decisions were entirely non-monetary.

GRAPHIC 3.1: Type of consequences faced by the three groups

(percentage)

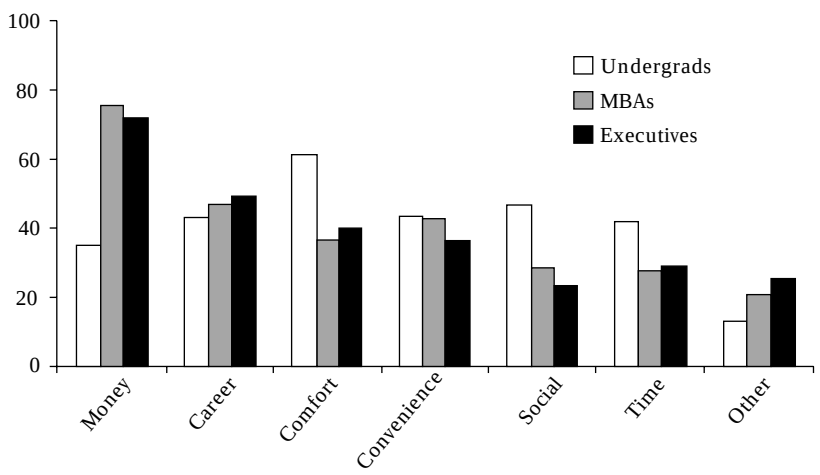

TABLE 3.1: Domain of the decisions for the different groups

(percentage)

		Undergrads	MBAs	Executives	Total	Risky
Professional	HUMAN RESOURCES (assignment of tasks, choose collaborators, organizing subordinates)	—	—	19	**4**	100
	START MBA (keep current job or start MBA)	—	29	—	**15**	94
	BUSINESS (decisions made in the current job)	—	2	28	**7**	73
	JOB (change job or not)	4	8	30	**11**	88
	PROTOCOL (how to deal with superiors[1])	5	2	4	**3**	83
	STUDYING (continue education or not)	12	2	—	**5**	73
Private	SAFETY (undertake laser eye surgery, driving after drinking, wear helmet)	12	2	—	**4**	90
	LOCATION (move to another city/country or not)	6	3	2	**4**	50
	INVESTMENT (investing personal wealth)	—	7	2	**4**	70
	RELATIONSHIP (continue/start or not a relationship)	6	3	2	**4**	37
	BUY_SELL (whether to buy/ sell something and choice of supplier)	6	10	2	**7**	79
	FLAT RENTAL (rent a flat or wait for other opportunities)	—	11	2	**6**	75
	ETHICS (tell the truth, break the law)	8	—	—	**2**	48
	ORGANIZATION (planning of activities, scheduling, do now/do later)	16	13	6	**12**	77
	LEISURE (entertainment activities and sports[2])	6	6	—	**5**	57
	TRAVELLING (traveling/vacation decisions)	3	2	4	**3**	73
	CAMPOUT (campout or do something else[3])	16	—	—	**5**	80

1. Examples of protocol are “to attend dinner after the interview/not attend”, or “abide with supervisor/confront him”.
2. Since our questionnaire asked subjects to recall a risky decision, a few of them reported leisure decisions involving risky sports like sky diving or paddling in the open ocean.
3. Several undergraduates have been participated to some campout activity just before filling out the questionnaire. This is reflected in their answers, with 12 out of 77 subjects reporting Campout related decisions.

Furthermore, MBAs and Executives reported that money was involved in more than 70% of their decisions, whereas Undergrads' decisions with monetary consequences accounted for only 35%. The pattern for MBAs and Executives is strikingly similar in all the categories (p-value of χ^2 global independence test equals 0.993). MBAs and Executives deal primarily with money, followed by career and comfort. In contrast, Undergrads seem to face consequences related to comfort, socializing, and career. Younger people seem mainly concerned with decisions involving their free time. As they start taking new responsibilities, social and comfort are replaced by monetary aspects. Career and convenience seem to have a constant presence in people's decision for many years of their lives.

While most of the available studies consider only a few possible, exogenously given, domains (Fagley and Miller, 1990; Rettinger and Hastie, 2001), in our survey we encounter a rich variety of domains. Table 3.1 provides insights on the differences among the three groups on the domains. As expected, Executives reported mostly professional decisions (with an emphasis on business, human resources, and job), most Undergrads' decisions were in the private domain (organization, safety and ethics), and MBAs' decisions seem to be more balanced between the two domains.

TABLE 3.2: Final choice, framing, and status quo for the different groups
(percentage)

	Undergrads	MBAs	Executives	Total
Avg. Probability **p**	**61**	**63**	**59**	**62**
Avg. Attractiveness **q**	**60**	**55**	**55**	**57**
FINAL CHOICE				
RISKY	69	76	75	**74**
SAFE	31	24	25	**26**
FRAMING				
GAIN	29	24	21	**25**
NEUTRAL	51	41	55	**47**
LOSS	20	35	25	**28**
STATUS QUO				
SAFE DEFAULT	47	57	62	**55**
BOTH PROACTIVE	32	28	34	**30**
RISKY DEFAULT	21	15	4	**15**

3.1.2. *p* and *q*

Because there were no significant statistical differences among the three groups in the values of *p* and *q*, we aggregate the data and perform the subsequent analysis for the overall percentages (see Table 3). The aggregate data suggest that, on average, subjects are optimistic regarding the probability of success ($\bar{p}$ = 62%). On average, the sure outcome is also closer to the better outcome than to the worse outcome ($\bar{q}$ = 57%). The fact that $\bar{p} > \bar{q}$ suggests that, the *average* risky alternative has a slight advantage in terms of expected value. The difference between $\bar{p}$ and $\bar{q}$ is statistically significant (t-value = 2.916, p-value = 0.0037) and subjects seem to respond to this advantage by taking the risky option in 74% of the cases.

3.1.3. Framing, status quo and final choice

It is common that the reference point coincides with the outcome of the safe alternative. Accordingly, in almost half of the decisions (47%) the decision are framed as mixed, as opposed to gains or losses framing. In 25% of the cases, the safe alternative is perceived as a sure gain, whereas in 28% of the decisions the sure outcome is viewed as a sure loss. Ironically, mixed gambles, which are the most common, are empirically less understood than all-gains or all-losses gambles (Luce, 2000; Wu and Markle, 2004).

Finally, in 55% of the decisions the status quo is the default option. Both decisions are perceived as proactive in 30% of the cases, and in the remaining 15% the risky decision is the default [4].

Other cross analysis such as a possible relationship between framing and the types of consequences failed to find significant relationships.

3.2. Factors that influence the risk taking propensity

As already mentioned in the Introduction, a number of previous studies explored the factors explaining risk taking behavior in laboratory experiments. In what follows, we investigate whether their predictions apply to our survey or real decisions.

In Table 3.3, we compute simple statistics to explore whether the risky/safe choice depends on the domain, framing, status quo, and type of consequence. As indicated, 74% of decisions resulted in the choice of the

4. The percentage of "Safe is default" seems higher for Executives, but a p-value = 0.074 of the χ2-test reveals that, in the margin (at 10%), the null hypothesis of the independence between groups and the status quo cannot be rejected.

risky option. Further, it points to a clear relationship between the final choice and the domain of a decision. Most of the professional decisions resulted in the risky choice (88%), whereas subjects seemed to be more cautious in the private domain (62%).

Table 3.1 complements this analysis showing the percentage of risky/safe choices on the specific domains. We observe a clear *selection bias* associated with Start MBA, since our sample contains precisely subjects that have chosen the risky option. Decisions in the professional domains, such as Business and Human Resource resulted in the risky choice quite often. It is important to note that in these two domains the decisions were taken on behalf of a corporation. In this case, the observed risky behavior is in agreement with decision theory, which ascribes a larger risk tolerance to corporations than to individuals. In the private domain, Safety and Buy/Sell are the domains with the highest percentages of risk taking behavior. Organization (which refers to everyday arrangements), Personal Investment, and Traveling also seem to be associated with the safe choice. The risky choice is more frequent than the safe choice in all the other domains.

TABLE 3.3: Cross analysis of the percentage of subjects choosing the risky alternative as a function of domain, framing, status quo, and type of consequence

(percentage)

	Risky
TOTAL	74
DOMAIN	
PRIVATE	62
PROFESSIONAL	88
FRAMING	
GAIN	52
NEUTRAL	74
LOSS	92
STATUS QUO	
SAFE DEFAULT	81
SAFE NOT DEFAULT	64
MONEY	
MONETARY	74
NON-MONETARY	73

Table 3.3 indicates a strong relationship between the framing and the risk attitudes, which can be observed in the increase in the percentage of the risky choice as we move from gains (52%), to mixed (74%), and to losses (92%) framing. This observation is a clear evidence of the fact that framing has an influence on risk taking behavior outside the laboratory.

The influence of the status quo is somewhat puzzling: the percentage of risky choices increases when the safe alternative is perceived as default. There is not much difference between the cases where the default is the risky alternative and where both alternatives were proactive.

Finally, the type of consequence (monetary or not) does not seem to have any impact on risk attitudes.

To get a better understanding of our data, we fit a binary logistic regression to predict the final choice. For convenience, the dependent variable is denoted by *Pr(R)*, which stands for P(D_RISKY = 1). The independent variables are: the two binaries for framing (D_LOSS and D_GAIN), a binary for the domain (D_PROFESSIONAL), and two control variables, p and q. The latter two were incorporated using the transformation $Ln\,(p/(1-p))$ and $Ln\,((1-q)/q)$, respectively. This transformation, coupled with the logistic regression transformation for the dependent variable, yields $Pr\,(R)/(1-Pr(R))$ as a power function of $p/(1-p)$ and $(1-q)/q$, respectively. The model is consistent with the obvious prediction that if either $p = 0$ or $q = 1$, then $Pr(R) = 0$.

TABLE 3.4: Logistic regression model predicting the probability of making the Risky choice as a function of domain and framing (N = 212; Nagelkerke R^2 = 0.434; Overall correctly classified = 0.802)

Pr(D_RISKY)	B	p-value	Exp(B)
Constant	0.176	0.5706	1.193
D_PROFESSIONAL	**1.138**	**0.0111**	**3.121**
D_LOSS	**1.193**	**0.0368**	**3.295**
D_GAIN	–0.425	0.3775	0.654
Ln(p/(1-p))	**1.179**	**2E-07**	—
Ln((1-q)/q)	0.295	0.1685	—

Table 3.4 reports the logistic regression results, which yields the following prediction for the odds ratio of taking the risky choice:

$$\frac{Pr(R)}{1-Pr(R)} = 1.19 \cdot 3.3^{D\_LOSS}\, 0.6^{D\_GAIN}\, 3.1^{D\_PROFESSIONAL} \left(\frac{p}{1-p}\right)^{1.18} \left(\frac{1-q}{q}\right)^{0.29} \quad (3.1)$$

Equation (3.1) leads to interesting insights. It shows that framing has a strong influence on the final choice. Specifically, the coefficient associated with D_LOSS is significantly greater than 0, meaning that the risky option was chosen more often when the sure outcome was perceived as a loss. This prediction is in agreement with Prospect Theory, which proposes risk seeking behavior for losses. However, gain framing is not significantly different from mixed framing. If anything, the negative sign of the coefficient associated with D_GAIN suggests that subjects are more risk averse in all-gains gambles than in mixed gambles. This finding does not contradict Prospect Theory, which exhibits risk-averse behavior for both gains and mixed gambles of moderate probability.

As expected, the model predicts that subjects will take more risks in professional decisions than in private decisions (the odds ratio of taking the risky choice is multiplied by 3.1 if the decision is professional as opposed to private).

The model also predicts that the probability of making the risky choice increases with p and decreases with q. The coefficient of 1.18 associated to $Ln\ (p/(1-p))$ is not significantly different from one, a case in which the odds ratio of the risky choice increases in direct proportion with $p/(1-p)$. As expected, $Pr(R)$ also increases with $Ln\ ((1-q)/q)$: if the safe alternative is less attractive, then subjects are more likely to choose the risky alternative. However, the coefficient of 0.29 indicates that subjects are less sensitive to q than they are to p.

We tried a model with potential interaction effects, but did not find significant effects. We also checked for possible Start MBA selection bias by removing those decisions. The numerical results were similar, yielding the same qualitative insights.

Our results thus confirm —for real decisions— the finding that the framing has an influence on the risk taking behavior. They provide further support that risk attitudes are influenced by the domain of a decision. This influence of the domain is difficult to reconcile with the normative framework of analysis, which reduces all risky decisions to a choice among domain-free lotteries, having monetary equivalents as consequences.

3.3. Status quo, type of consequences and group are unrelated to risk attitudes

Besides framing and domain, do other factors such as group and type of consequence matter? In Table 3.5 we present an expanded logistic regression model. Apart from confirming that the coefficients of the variables in

Table 3.5 are stable, the regression results do not point to other significant factors. Specifically, once we account for framing, status quo (D_SAFE_DEFAULT) has no significant influence on the final choice.

TABLE 3.5: Expanded logistic regression model predicting the probability of making the risky choice (N = 212; Nagelkerke R^2 = 0.446; Overall correctly classified = 0.807)

Pr(D_RISKY)	B	p-value	Exp(B)
D_PROFESSIONAL	**1.425**	**0.0073**	**4.156**
D_LOSS	**1.127**	**0.0537**	**3.087**
D_GAIN	–0.430	0.3911	0.651
Ln (p/(1-p))	**1.184**	**4E-07**	**—**
Ln ((1-q)/q)	0.312	0.1572	—
D_SAFE_DEFAULT	0.172	0.6786	1.188
D_MONEY	–0.159	0.7308	0.853
D_EXECUTIVE	–0.653	0.247	0.520
D_UNDERGRAD	0.144	0.7838	1.155
Constant	0.220	0.699	1.246

It is interesting to note that the variable D_MONEY, which distinguishes monetary from non-monetary decisions, is not significant. This suggests that the type of consequence does not change the risk taking behavior. We also checked that the binary variables D_COMFORT, ..., D_CAREER do not have a significant influence once we account for framing and domain. This finding is encouraging: it reveals that the insights obtained in laboratory experiments using monetary consequences can be extended to other types of consequences, provided these consequences are commensurable (Tetlock, Kristel, Elson, Green & Lerner, 2000).

Finally, the fact that the variables controlling for group are not significant implies that risk attitudes do not vary across our three groups. This conclusion can be interpreted as good news for those hoping that insights obtained in laboratory experiments using undergraduates can be extended to other subject samples.

3.4. Status quo and reference points

In a series of experiments, Samuelson and Zeckhauser (1988) showed an exaggerated preference for the status quo (what is implemented if nothing

is done), which they justified using loss aversion. Schweitzer (1994) confirmed the status quo bias effect and further related it with loss aversion, ambiguity, and regret. Johnson, Hershey, Meszaros, and Kunreuther (1993) showed this status quo bias with field data on insurance choices. The link between loss aversion and status quo assumes that the status quo outcome and the reference point are identical. While this identification can be easily induced in artificial laboratory experiments, we want to verify whether our survey data supports this assumption.

Table 3.6 shows the relationship between the status quo and framing. As argued previously, the Safe alternative tends to become the reference point (49%). This percentage increases to 54% if the Safe alternative is the default, and decreases to 42% if not. While status quo is related to framing (χ^2-test yields a p-value = 0.000071), a change from 42% to 54% suggest a weak relationship between status quo and reference point.

TABLE 3.6: Cross analysis of framing and status quo

(percentage)

	Safe is default	Safe is not default	Total
N	**134**	**108**	**242**
FRAMING			
GAIN	12	38	**24**
NEUTRAL	54	42	**49**
LOSS	34	20	**28**

The data in Table 3.3 squarely contradict the status quo bias: when the Safe alternative is the default, 81% of the subjects choose the risky option, whereas when the Safe is not the default, only 64% choose *R*. Our logistic regression model of Table 3.5, with D_SAFE_DEFAULT being not significant, confirms that status quo has little influence on risk taking once we account for framing. This suggests that the reported attractivity of default options (Johnson and Goldstein, 2003) might be driven by factors different from loss aversion.

4. Conclusions

THE study of real world decision making is a broad research area that can be tackled for several angles. For example, in the study of naturalistic decision making (Klayman, 2001; Klein, Orasanu, Calderwood, and Zsambok, 1993), researchers examine the decision making process done by expert. Here, our goal has been to gain understanding of decision making under uncertainty by means of a survey that placed real world decisions in a simple decision analytic framework. This allowed us to test the influence of framing, as predicted by Prospect Theory, and other factors in the risk taking behavior of subjects. In line with the predictions of Prospect Theory, the results strongly support higher rates of risk taking behavior for losses, as compared to either mixed or gains framing. Furthermore, the risk taking behavior changes significantly with the domain; specifically, we find higher rates of risk taking behavior in professional decisions, as compared with private decisions. Thus, our investigation puts forward domain in addition to framing as a psychologically relevant factor in risk taking behavior. While the status quo has some influence in setting the framing of a decision, our regression results bring additional evidence that framing, and not status quo, is the driver of the risk attitude.

The results also support that risk attitudes do not depend on whether the decisions' consequences are of monetary or non-monetary (time, comfort, etc.) type and, do not vary across the subject samples considered. Hence, the insights obtained in laboratory experiments using monetary consequences and pools of undergraduates seem to apply to other types of consequences and subject samples. More generally, this work represents one additional step in the task of checking to which extent the insights obtained in the laboratory apply to actual decision making.

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