

How Politicians Make Decisions: A Political Choice Experiment

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The present paper reports on a political choice experiment with elected real-world politicians. A questionnaire on political and public issues is used to examine whether prospect theory predicts the responses of experts from the field better than rational choice theory. The results indicate that framing effects do not disappear with expertise.

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JEL Classifications: C91, D72, D81.

1 Introduction

Rationality and consistency are crucial assumptions to most theories in the social sciences. Particularly, in neoclassical economics and political sciences it is common to assume that all agents make their decisions coherently with the utility maximization doctrine. Rational choice theories under certainty and under risk have been established as descriptive models for the decisions of consumers, producers, voters, politicians, etc. Experiments and empirical observations have revealed that actual behavior and decisions frequently deviate from the neoclassical predictions. This evidence has led social scientists to develop descriptive analyses of choice, based on observed behavior and decisions. Kahneman and Tversky's prospect theory (1979; 1992) is an outstanding outcome of

this research. In contrast to rational choice theory, it allows people's preferences to depend on the circumstances they face. According to prospect theory, we make a decision dependent on our perception of whether the decision involves making a gain or a loss. This is at odds with the consistency or invariance assumptions of rational theory. Whether we perceive an outcome a loss or a gain – in turn – depends on our reference point (e.g., the status quo). If the outcome is better than the reference point we consider it a gain, if it is worse it is considered a loss. If it affects our perception, even the framing of a decision problem – the stating of an identical problem in negative or positive terms-can provoke a preference reversal. Prospect theory predicts people to seek risk in the domain of losses and to behave risk-averse in the domain of gains. Particularly important, in this context, is the notion of loss aversion presuming that people weigh gains less than losses. Last but not least, a cornerstone of prospect theory is the non-linear probability weighting function, according to which people value sure events different from chance events. Due to this “certainty effect”, the probability weighting function helps to accommodate, for instance, phenomena as the Allais' paradoxes – the common consequence and the common ratio effect.

In the present study we test rational choice theory – in particular, expected utility theory-against prospect theory in a political choice context. We collect data by a questionnaire on hypothetical political choices. The decision problems considered in our research replicate those of the classical experimental study in political sciences by Quattrone and Tversky (1988). Quattrone and Tversky reported systematic violations of expected utility theory in support of prospect theory. Their data provide evidence for framing effects and the common ratio effect. The respondents to their questionnaire were undergraduates at Stanford University or at the University of California at Berkeley. A not unexpected question the reader might ask is whether the results of the study are meaningful in the sense that students are only a proxy for political decision makers (except for voting). After all, students are not used to making decisions involving millions of dollars and the well-being of thousands of citizens. A related argument is that experienced professionals may have very different (risk) attitudes and perceptions than student subjects. In the psychological literature this is labeled an issue of “subject surrogacy”. In this paper, we take up the subject surrogacy issue and examine the external validity of the results of Quattrone and Tversky with a subject pool of experts on

political decision making. Specifically, we analyze the responses of elected politicians and compare them to a subject pool of students. The research question we address is thus whether experts violate rational choice theory and if their decisions differ significantly from those of non-expert subjects.

The subject surrogacy issue has been raised repeatedly in the literature. Actually, the choice of the subject pool has been an important source of criticism leveled against experimental inquiry methods.¹ Over recent decades several studies have, therefore, replicated a broad range of experimental settings with professionals from the field, only to find non-systematic differences with the standard samples, such as the Ball and Cech (1996) survey.² However, some studies in which risk and probability play a major role do report differences between students and experts.³ Some results indicate that professionals are more accurate at estimating probabilities,⁴ but the accuracy varies apparently between domains in which professionals have become experts as Shanteau (1992) suggests. In some domains, such as weather forecasting, experts predict probabilities very accurately, in others, such as clinical psychology, rather not.⁵ If experts really have a better developed perception of probability and risk than students, and also estimate small probabilities more accurately, as one possible implication, they would violate expected utility less frequently. In particular, this implication would affect the violation rate in

1 See Kinder and Palfrey (1993), and Plott (1982) for a discussion.

2 Ball and Cech (1996) review studies by Siegel and Harnett (1964), Hofstedt (1972), Abdel-Khalik (1974), Grether and Plott (1982), Hong and Plott (1982), Burns (1985), Abdolmohammadi and Wright (1987), Schurr (1987), DeJong et al. (1988), Mestelman and Feeny (1988), Dyer et al. (1989), King et al. (1992), Lo et al. (1993), and Anderson and Sunder (1995).

3 Dyer et al. (1989) report that the professionals in their auction showed risk-neutrality, whereas the students exhibited risk-aversion. In contrast to this, Anderson and Sunder (1995) find that professional traders are more risk-averse but more accurate in estimating probabilities than students. Potters and van Winden (2002) find professional lobbyists more in line with the game theoretic prediction than students.

4 Anderson and Sunder (1995), Önköl et al. (2003), and Glaser et al. (2003) among others suggest that professional traders estimate probabilities more accurately than students.

5 See Murphy and Winkler (1977), and Stewart et al. (1997) for evidence on the performance of weather forecasters and Goldberg (1959), Christensen-Szalanski and Bushyhead (1981) or Dawes (1988) for evidence on doctors and clinical psychologists. Rohrbaugh and Shanteau (1999) survey this literature.

the Allais' paradoxes. We address this issue when we expose the expert subjects to a problem set involving the common ratio effect.

The present study does not only examine the common ratio effect but mainly focuses on framing with respect to both risky and non-risky choices. Two of the four problem sets on framing involve a change from the domain of gains to the domain of losses. Hershey and Schoemaker (1980) associate such domain changes with the reflection effect, according to which people's preferences among negative prospects are a mirror image of their preferences among the corresponding positive prospects. The other two problem sets are more subtle, applying the ratio-difference principle of Quattrone and Tversky (1988). In these problems, framing only has a perceptual dimension induced by a change of a ratio while leaving the domain unchanged. The idea behind it goes back to psychophysics – “the study of the functional relation between the physical and the psychological value of attributes such as size, brightness, or loudness. For instance, lighting a candle has more impact on illumination when initial illumination is poor than when it is good” – as Quattrone and Tversky (1988, p. 728) define it.

Framing effects have been studied extensively by social scientists. Experimental evidence is mixed across framing types and subject pools.⁶ Overall one may conclude that in a risky framework subjects accept more risk when problems are framed in terms of losses rather than in terms of gains. Kühberger (1998) concludes on the basis of 136 research reports on framing risky decisions that experiments reveal preference reversals less frequently, the more they differ from the original framing problem of Tversky and Kahneman (1981) (Asian disease). In a non-risky framework, objects or events receive more favorable evaluations under conditions of positive framing (e.g., the success rate) than under conditions of negative framing (e.g., the failure rate) as Levin et al. (1998) point out.

Kühberger (1998) suggests that framing influences experts as well, but maybe to a lesser extent than students. On one hand, framing effects have been reported from studies on experts, for instance, by Schurr (1987), Roszkowski and Snelbecker (1990), Loke and Tan (1992), and O'Clock and Devine (1995). Experts in these studies were professional buyers

⁶ Kühberger (1998), Levin et al. (1998), and Traub (1999) provide literature surveys. Levin et al. (1998) distinguish four outcomes with respect to the prediction of prospect theory: (1) non-reversals, (2) opposite reversals, (3) choice shifts, and (4) choice reversals. We use the same categories as well.

engineers, mathematicians and auditors, respectively. Fagley and Kruger (1986), in contrast, find no framing effect with school psychology experts. As mentioned above, Shanteau (1992) suggests that professionals' decisions differ with the domain on which they have achieved expertise. A good question would be whether the results of experts in auditing or mathematics can be generalized.

Whether the decisions of politicians – as experts in the domain of political choice – in an experimental or hypothetical environment differ from non-expert subjects has not been studied before to the best of our knowledge. The comparative advantage of studying framing effects in this domain of expertise rather than another is that a politicians' persuasive power may hinge crucially upon the skills of handling framing effects, in depicting-according to the requirement – a glass as “half-full” or as “half-empty”.⁷ Since they are public persons, the politicians' fate relates significantly to the right touch of wording also.⁸ Hence, we test for framing effects in a meaningful domain of expertise.

Although we report the responses collected by Quattrone and Tversky (1988) in this paper, they only have limited validity as control with regard to the responses of our subject pool of politicians who have a PhD in economics. Quattrone and Tversky questioned students of sociology or psychology in the US such that expertise is not the only possible source of different results. On one hand, Brandts et al. (2002) reported that Spanish students are more individualistic in public goods experiments than American students.⁹ On the other hand, there is some evidence that economics and psychology students behave differently.¹⁰ Hence, we

7 Such skills are also important for other professionals such as diplomats or lawyers.

8 Traub (1999) reports that a German Minister of Family Affairs stumbled on the proposal to introduce “tax fines for the childless” which made it to the headlines in 1994. Though several indirect surcharges for the childless already existed in the German tax system, the proposal provoked indignation.

9 Also, Roth et al. (1995), and Buchan et al. (2002) reported significant differences across culture in bargaining and investment experiments, respectively.

10 Marwell and Ames (1981) report from public goods experiments that economics students behave more “rationally” than psychology and sociology students. Isaac et al. (1985), however, failed to reproduce such evidence. Fagley and Miller (1987) examined framing in decision making under risk. They reported a choice reversal with students from the college of education and a non-reversal with MBA candidates, the latter choosing less risk regardless of framing.

employ economics students at the University of Valencia as the control group.

The paper is structured as follows. Section 2 reviews the experimental design and alludes to the different subject pools. Section 3 describes the questionnaire and reports the findings of our research. The questionnaires are used to test the predictions of expected utility theory developed by von Neumann and Morgenstern (1947) and Savage (1954) against Kahneman and Tversky's (1979; 1992) prospect theory. Section 4 summarizes the main results and concludes.

2 Subject Pools and Design Details

In Sect. 3, we report on the answers to two questionnaires each involving five problem sets on political candidates and public referenda, which replicate the research of Quattrone and Tversky (1988). The first four problem sets are used to examine responses between subjects and the last one examines responses within subjects. The experiment involves two questionnaires, A and B. The questionnaire A contained the problems below stated 1A, 2A, 3A, 4A, 5A and 5B; the questionnaire B contained 1B, 2B, 3B, 4B, 5A and 5B. Each subject responded anonymously and privately to one questionnaire, either A or B, and were not informed about the existence of a second questionnaire.¹¹ We proceed in the same way as Quattrone and Tversky and collect the experimental data by means of hypothetical questions. As in Quattrone and Tversky (p. 722), "respondents were asked to imagine actually facing the choice described, and they were assured that ... there were no correct or incorrect answers." There are troubles with this approach, as Quattrone and Tversky (p. 720) notice

[...] The use of hypothetical problems raises obvious questions regarding the generality and the applicability of the finding. Nevertheless, we believe that the use of carefully worded questions can address key issues regarding people's values and beliefs so long as respondents take the questions seriously and have no particular reason to disguise or misrepresent their

11 There is a difference to the setting of Quattrone and Tversky, in fact. Quattrone and Tversky used a new cohort for almost every problem. In our study, all subjects were asked to respond to all five questions contained in their set of problems. We did not control for differential carryover effects or for practice effects; furthermore, we cannot be sure whether subjects went through the questionnaire in the order in which we presented the questions.

true preferences. Our results, of course, do not provide definitive conclusion about political decision making, but they may shed light on the formation of political judgment and stimulate new hypotheses that can be tested in national election surveys in the years to come. [...]

Indeed, for the purpose of testing the external validity of Quattrone and Tversky's experimental results this problem appears to be of minor importance, given that the reference study proceeds in the same way.

2.1 The Expert Subjects (ES)

There are several characterizations of expertise in the literature. Probably the most concise one is by Chi et al. (1982) who associate expertise with "the possession of a large body of knowledge and procedural skill" within a task domain.¹² Our study involves (hypothetical) political decisions to be taken on economic variables. According to the definition of Chi et al., thus, experts should have knowledge and experience in public allocation processes and economic policy decisions. The definition of the task domain may apply to two groups: politicians or bureaucrats (with a strong economics background). Whereas Potters and van Winden (2000) dealt with bureaucrats (i.e., civil servants), we focus on politicians' decisions.

All politicians of our sample have or had been in charge of large public budgets and, therefore, had been involved in decisions directly related to public spending or economic policies. The budgets over which they made their decisions were usually on a scale of billions of Euros. They were either public administration officials or economic policy advisors, or both. Thus, they had a direct relationship with policy making. They were or had been elected directly by voters or indirectly by political representatives in control of some public department. The list of political direct mandates

¹² The basic idea is that experts, relative to non-experts, have better and more complex representations of the task domain. Therefore, their decision strategies are richer and more complete (see also Davis and Solomon 1989). Shanteau (1988) outlines a partial list of characteristics of experts, including: (1) highly developed perceptual/attentional abilities, (2) an ability to decompose and simplify complex problems, (3) greater creativity when faced with novel problems, (4) ability to communicate their expertise to others, (5) strong sense of self-confidence in their abilities, and (6) extensive, up-to-date content knowledge. Rohrbaugh and Shanteau (1999) argue that "experts are usually identified as the most experienced, capable, and successful individuals within a specific domain".

occupied by our expert subject pool included the four elected parliaments and cabinets directly chosen in Spain (the European Parliament, the Spanish National Parliament, Regional Parliaments and Local Councils) and some non-direct mandates (e.g., mayors who have to be elected directly by the majority of the town councilors).¹³ Moreover, they were or have been members of one of the Spanish public universities and all had a PhD in economics.

A total of 32 expert subjects (hereafter ES) participated in the present study. To contact them, we searched the lists of four different universities (all the existing ones in the Valencia region) containing all PhDs in economics over the past 25 years. Within, we found 38 subjects with expertise on political decision making as described above and invited them personally to participate in the survey.¹⁴ In all but one case, in which the questionnaire and the instructions were mailed, we handed them over personally to the 32 volunteers. After a short briefing, subjects were left alone in their offices to fill in the questionnaire. Thereafter, respondents placed their questionnaires in a blank envelope and inserted them in a sealed box. The box was not opened until the last envelope had been inserted, thus, protection of data privacy was ensured.

2.2 *The Non-expert Subjects (NES)*

The control group of non-expert subjects (hereafter NES) consisted of economics and labor undergraduates at the University of Valencia. None of them had any experience with politics (other than being young voters).

A total of 309 students participated voluntarily. The experiment was conducted in classroom. After a short briefing, they went through their questionnaires which contained the aforementioned problems. The procedure was confidential and anonymous. The classroom setting, in

13 The mayors and councilors administrated towns of 50.000 to 750.000 inhabitants. The list of non-direct mandates subjects held included: economic policy advisory unit of the Spanish prime minister, member of regional governmental cabinets, political controller of Spanish public banks, regional governmental budget officer, general director for economics and finance of regional governments, general director for the public auditing institute of regional governments and board member of the national trade unions.

14 They received a general explanation alluding to the purposes of our study. Anonymity was ensured by a detailed clarification of our procedures.

principle, should replicate the conditions of Quattrone and Tversky (1988) with Spanish economics (2nd year) and labor students (3rd year students).¹⁵

3 The Results

This section reports the results of our research. It is organized in 4 subsections. The first two subsections, i.e., 3.1 and 3.2, focus on framing effects, in the third one, i.e., Sect. 3.3, we focus on the common ratio effect, and, finally, Sect. 3.4 provides comparisons between subject pools. Framing effects are defined as preference reversals induced by the framing of a choice problem (see, e.g., Traub, 1999, p. 26). In Sect. 3.1, we consider two problem sets in which the reference point is affected by framing. With the first problem set we examine the impact of framing on a risky choice; with the second one, we investigate the status quo bias and its common explanation of loss aversion by means of non-risky prospects. The possible outcomes can be perceived as gains or as losses in relation to the reference point. In Subsect. 3.2, we look at framing non-risky prospects, where the reference point is not affected directly. Framing in Sect. 3.2 involves psychophysical manipulation of the presented figures. The impact that framing has on response is examined by a 2 (framing) \times 2 (response) χ^2 analysis.¹⁶ We take into account the possibility of opposite reversals, i.e., significant choice shifts opposite to the predictions of prospect theory. Hence, our data will be subject to two-tailed tests, the null hypotheses are given by rational choice theory in each case. The results are summarized below in Tables 1 and 2.

3.1 Reference Point Dependence

Expected utility theory allows for risk aversion, which implies a concave shape of the utility function (the idea goes back to Bernoulli (1738)). As a consequence, people prefer a certain amount of money to

¹⁵ We tested homogeneity of both subject pools' responses before pooling them.

¹⁶ The size of the ES sample might suggest the use of a Fisher exact test. However, as the Fisher exact test does not lead to different conclusions at the 10% significance level, we report for the ES, coherently with the other samples, the results of the χ^2 test only. The results of the Fisher exact test can be obtained from the authors.

a risky prospect that yields the same expected value. The same idea is valid in prospect theory, though the “value function” is s-shaped: it is concave for gains, and convex for losses. The decision maker’s choice for losses, according to prospect theory, is the mirror image of the corresponding gains. If losses are at stake, people prefer a risky prospect to a certain loss in the amount of the prospect’s expected value. Whether a decision involves gains or losses depends on the decision maker’s reference point. The reference point corresponds to the reflection point of the value function. Following the problems of Quattrone and Tversky (1988), we illustrate the reference point concept in this and in the following subsection.

Problem 1A – gain framing condition ($n(ES) = 15$, $n(NES) = 147$, $n(QT) = 89$)¹⁷

Suppose there is a continent consisting of five nations: Alpha, Beta, Gamma, Delta and Epsilon. The nations all have very similar systems of government and economics, are long time members of a continental common market, and are therefore expected to produce very similar standards of living and rates of inflation. Imagine you are a citizen of Alpha, which is about to hold its presidential elections. The two presidential candidates, Brown and Green, differ from each other primarily in the economic policies they are known to favor and are sure to implement. These policies were studied by Alpha’s two leading economists who are of equal expertise and are impartial as to the result of the election. After studying the policies advocated by Brown and Green and the policies currently being pursued by the other four nations, each economist made a forecast. The forecast consisted of three predictions about the expected standard of living index (SLI). The SLI measures the goods and services consumed (directly or indirectly) by the average citizen yearly. It is expressed in Continental Monetary Units (CMU) per capita so that the higher the SLI the higher the level of economic prosperity. The three projections concerned

1. the average SLI to be expected among the nations Beta, Gamma, Delta and Epsilon
2. the SLI to be expected by following Brown’s economic policy
3. the SLI to be expected by following Green’s economic policy

The forecasts made by each economist are summarized in the following table:

¹⁷ The numbers n of respondents to this and all following problems are given in parentheses: the number of experts, non-expert subjects and Quattrone and Tversky’s subjects, respectively.

	Projected SLI in CMU per Capita		
	Other Four Nations	Brown's Policy	Green's Policy
Economist 1	43,000	65,000	51,000
Economist 2	45,000	43,000	53,000

Suppose that as a citizen of Alpha you were asked to cast your vote for Brown or Green. On the exclusive basis of the information provided, whom would you vote for?

The other group of respondents received an identical problem with the difference that the forecasts about the other four nations were altered.

Problem 1B – loss framing condition ($n(\text{ES}) = 17$, $n(\text{NES}) = 162$, $n(\text{QT}) = 96$)

	Projected SLI in AMU per Capita		
	Other Four Nations	Brown's Policy	Green's Policy
Economist 1	63,000	65,000	51,000
Economist 2	65,000	43,000	53,000

The other countries' SLI is induced as reference point in these problems, because the others were said to have a similar living standard. Thus, the reference point moves from an expected 44,000 CMU in Problem 1A to an expected 64,000 CMU in Problem 1B. According to prospect theory, outcomes projected for Brown and Green, hence, would be treated as gains in the former problem and as losses in the latter one. Risk or uncertainty is introduced through the notion that forecasts are impartial and of equal expertise, such that it is reasonable to believe that respondents gave equal probability weight to their projections. Note that the expected value of the Brown's policy (\$54,000) is about the same as the expected value of Green's policy (\$52,000), but Brown's policy has more spread and therefore appears riskier. Prospect theory involves a reflection effect, i.e., risk aversion in the domain of gains and risk seeking in the domain of losses. Thus, in Problem 1A prospect theory predicts more votes for Green than in Problem 1B. In contrast, rational choice theory expects similar choices in both problems because it considers the other countries' SLI as irrelevant. The results are presented in Fig. 1. This and all later figures are arranged such that according to the prediction of

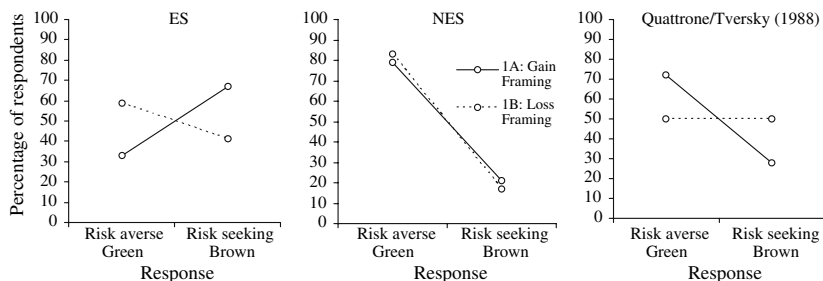


Fig. 1. The percentage of respondents voting Green or Brown within each framing condition

prospect theory you should see an “X”, a solid line crossing a dotted line from above; expected utility, in contrast, would suggest coinciding lines.

Quattrone and Tversky (1988) find support for a reflection effect, as they observe a choice shift from more risk aversion in Problem 1A to less risk aversion in Problem 1B.¹⁸ A 2 (framing) \times 2 (response) χ^2 analysis showed that framing and response are significantly related ($\chi^2(1) = 9.281$, $p = .002$), see also Table 1.

Yet, our data do not support the prediction of prospect theory. On one hand, the observed responses of the NES suggest no choice reversal as proposed by prospect theory ($\chi^2(1) = 0.722$, $p = .396$).¹⁹ On the other, the data on the experts reveal that under gain framing 79% of the expert subjects vote Brown whereas in the loss framing condition 59% of the ES vote Green. The changes of the modal choice thus oppose the prediction of prospect theory as shown in Fig. 1.²⁰ In other words, if we assumed the existence of a reference point, our data would suggest rather that experts

¹⁸ We apply the same classification scheme as Levin et al. (1998). Accordingly, a choice shift differs from a choice reversal in that the proportion of risky choices differs across conditions but is not both significantly greater than 50% in the negative condition and significantly less than 50% in the positive condition (Levin, 1998, p. 153).

¹⁹ We conclude that in the NES the choice between the two candidates was not significantly influenced by the projected SLI in the other countries. This observation can eventually result from a difference of cultural background. For instance, the Spanish prefer less paid but permanent positions over well paid but less secure ones. From this perspective, it might not seem so surprising that most NES choose the less risky candidate.

²⁰ The opposing choice to prospect theory induces a prospect of yielding a strong leader economy or one of same size under gain framing whereas a relatively sure outcome of not falling too far behind the others under loss framing.

are risk seeking under gain framing and risk averse in loss framing conditions than otherwise. Yet, given the small sample size of the expert subject pool, a test indicates no choice reversal ($(\chi^2(1) = 2.079, p = .149)$). Nevertheless, the data do not suggest that the responses of the ES are closer to the prediction of rational choice theory than the NES.

Levin et al. (1998) report a wide variety of evidence from choice reversals and non-reversals to opposite reversals in risky choice framing. They conclude that typically a choice shift occurs (and not necessarily a reversal²¹), i.e., risk aversion is more frequent under positive framing than under negative framing (Levin et al. 1998, p.181). This observation is consistent with the subject pool of Quattrone and Tversky (1988). In contrast to responses in Quattrone and Tversky (who report a 50% risk seeking in Problem 1B), the responses of the NES indicate risk aversion regardless of framing (79% and 72% respectively). This result is consistent with the findings of Hershey and Schoemaker (1980) and Fagley and Miller (1987). Fagley and Miller reported less risk seeking of business students in the domain of losses in comparison to students of the educational sciences.²² Evidence with expert subjects on (risky) framing is similarly inconclusive. On the one hand there is some evidence for a subject pool effect as Kühberger (1998) suggests (see also the discussion in the introduction). On the other hand, e.g., Fagley and Kruger (1986) report no subject pool effect in risky choice framing.

In the second problem of the questionnaire the predictions of prospect theory's value function and reference dependence are applied to a riskless choice. A fundamental property of the value function is that its shape looms steeper for losses than for corresponding gains, i.e., $-v(-x) > v(x)$. Kahnemann and Tversky (1979) call this property -that the displeasure of losing money is greater than the pleasure of gaining the same amount of money- the principle of loss aversion. As an important consequence of loss

21 In accordance with Levin et al. (1998), a choice reversal implies a significant share (above 50%) of responses as predicted by prospect theory in both framing conditions. Table 1 reports the results for the first four problem sets. To arrive at these results, we checked the significance with binomial tests, the results of which are available from the authors upon request.

22 Kühberger (1995) discusses alternative models that describe choice behavior under framing such as the fuzzy trace theory of Reyna and Brainerd (1991a; 1991b) and the probabilistic mental models theory of Gigerenzer et al. (1991). Particularly, the probabilistic mental models theory can also accommodate opposite reversals and choice shifts.

aversion, a certain payoff (the status quo) is preferred to a risky one with the same expected value. The same statement, however, is also consistent with the concavity of the utility function.²³ In classical utility theory, still, the greater impact of losses in comparison to gains is necessarily coupled with the presence of risk. Since loss aversion applies also to riskless choice problems we are able to contrast prospect theory with expected utility theory. Loss aversion implies that the status quo policy is more highly valued than a policy that yields the same expected value. If a decision maker is indifferent between two policies C and F from a neutral reference point he will prefer C [F] over F [C] if his reference point is C [F]. People will only switch to a new policy if they strictly prefer it to the old one. Samuelson and Zeckhauser (1988) introduced the term ‘status quo bias’ for this effect of reference position and reported evidence in a wide range of decisions. Quattrone and Tversky illustrate the status quo bias -the pattern that gives the incumbent politician an advantage over the rival candidate—in the following pair of problems.²⁴

Problem 2A – incumbent Frank ($n(ES) = 15$, $n(NES) = 147$, $n(QT) = 91$):

Imagine there were another presidential contest between two new candidates, Frank and Carl. Frank wishes to keep the level of inflation and unemployment at their current level. The rate of inflation is currently at 9% and the rate of unemployment is at 15%. Carl proposes a policy that would decrease the rate of inflation by 3% while increasing the rate of unemployment by 7%.²⁵ Suppose that as a citizen of Alpha, you were asked to cast your vote for either Frank or Carl. Please indicate your vote.

Problem 2B – incumbent Carl ($n(ES) = 17$, $n(NES) = 162$, $n(QT) = 89$):

Carl wishes to keep the level of inflation and unemployment at their current level. The rate of inflation is currently at 6% and the rate of unemployment

23 See Tversky and Kahneman (1991) for a treatise of loss aversion in a riskless choice.

24 Traub (1999) highlights empirical evidence for the comparative advantage of the office holder over the rival candidate in elections coming from Germany. The former chancellor Kohl was the first office holder since 1949 to lose a general election (after setting up a record of winning the elections four times).

25 The indicated levels differ from Quattrone and Tversky (1988) to increase the realism of the task. Spain’s levels of inflation and unemployment rates were 7.5% and 18.5% at the time of the experiment and the elasticity between inflation and unemployment was estimated at 3/7. Frank’s [Carl’s] policy of Quattrone and Tversky involved inflation and unemployment rates of 42% [23%] and 15% [22%], respectively. Hence, the unemployment rates are the same in our questionnaire but our indicated inflation levels are much lower.

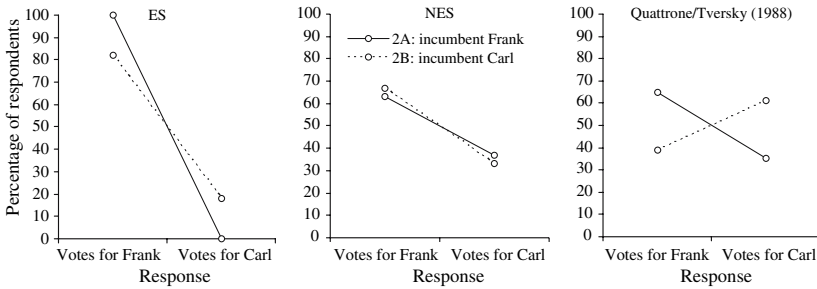


Fig. 2. The percentage of respondents voting Frank or Carl within each framing condition

is at 22%. Frank proposes a policy that would increase the rate of inflation by 3% while decreasing the rate of unemployment by 7%.

Note that the rates of inflation and unemployment implied by Frank's [Carl's] policy are 9% [6%] and 15% [22%], respectively. Only the location of the status quo differs between the problems. Due to loss aversion, prospect theory would predict more votes for Frank in Problem 2A than in Problem 2B and for Carl vice versa (given decision makers are indifferent between both policies from a third reference point position). Quattrone and Tversky (1988) report a choice reversal favoring prospect theory over expected utility theory; the modal response to both problems induced the status quo. A 2 (framing) \times 2 (response) χ^2 analysis showed that framing and response were significantly related ($\chi^2(1) = 11.735, p = .001$).

The majority of our two subject pools voted Frank in both framing conditions. This result indicates that subjects hardly react to changes in the inflation rate. One reason can be that inflation rates smaller or equal to 9% are not so worrying in comparison to 15% or 22% of unemployment. In favor of the status quo bias one can say that we observe a choice shift at least for the expert subjects. When Frank is the incumbent 100% vote him whereas he wins a vote of 82% when Carl is the incumbent. The result is significant at 10% ($\chi^2(1) = 2,921, p = .087$).²⁶ The data of the NES

²⁶ In the ES, the significant result is due to the fact that all 15 subjects in 2a choose Frank, while in 2b, three of seventeen subjects choose Carl. A question is how we should evaluate this choice shift in the direction of the status quo effect? This result makes us feel that our sample may still be too small to draw wide-ranging conclusions.

do not yet show any indication of a status quo bias. Frank receives even more votes when he represents the rival candidate. The χ^2 analysis reveals that there is no choice reversal ($\chi^2(1) = .550, p = .458$). Hence, we are not able to support the predictions of prospect theory with respect to reference point dependence.²⁷ In the following section we will have a look at more subtle framing conditions.

3.2 Ratio-difference Principle

In the previous section otherwise equivalent problems become distinct owing to a change in the reference point position. Though it is hardly stated in the theoretical literature, the fundamentals of the neoclassical theory build on the assumption of invariance to descriptive changes (cf. Arrow, 1982).²⁸ A choice reversal in such problems thus violates the principle of description invariance. This section provides an even sharper test of description invariance, as the considered problems differ only in positive and negative framing and affect neither the gain domain nor the loss domain of the decision maker. The standard example of such perceptual manipulation has been mentioned in the introduction: describing a glass filled up to the half mark as “half-full” is unquestionably equivalent to describing it as “half-empty”. Hence, preference reversals that arise upon subtle differences in wording cannot be justified through the reflection point effect and would underline the absolute need for a psychological analysis of choice. Quattrone and Tversky (1988) illustrate such failures of descriptive invariance with the following Problems 3 and 4.

Problem 3A – negative framing condition ($n(ES) = 15$, $n(NES) = 166$, $n(QT) = 126$):

Political decision making often involves a considerable number of trade-offs. A program that benefits one segment of the population may work for the disadvantage of another segment. Policies designed to lead to higher rates of employment have an adverse effect on inflation. Imagine you were faced with the decision of adopting one of two economic policies.

²⁷ It should be noted again that prospect theory predicts the status quo bias only if the decision maker is indifferent between 2 prospects. Since the majority of the NES selects Frank in both conditions they reveal preference for the corresponding policy.

²⁸ Arrow (1982, p. 8) states: “The chosen element depends on the opportunity set from which the choice is to be made, independently of how the set is described.”

If program J is adopted, 10% of the work force would be unemployed, while the rate of inflation would be 12%. If program K is adopted, 5% of the work force would be unemployed, while the rate of inflation would be 17%. The following table summarizes the alternative policies and their likely consequences:

Policy	Work Force Unemployed (%)	Rate of Inflation (%)
Program J	10	12
Program K	5	17

Imagine you were faced with the decision of adopting program J or program K. With the provided information, which would you select?

Problem 3B – positive framing condition ($n(ES) = 16$, $n(NES) = 142$, $n(QT) = 133$):

Policy	Work Force Employed (%)	Rate of Inflation (%)
Program J	90	12
Program K	95	17

Note that each program produces the same outcomes in both problems. After all, to say 10% of the workforce will be unemployed is equivalent to saying that 90% will be employed. The data of Quattrone and Tversky (1988) reveal a change of the modal response from program K in Problem 3A to program J in Problem 3B. The choice shift (36% and 54% adopt program J in 3A and 3B, respectively) violates descriptive invariance significantly, as a 2 (framing) \times 2 (response) χ^2 test reveals ($\chi^2(1) = 8.865$, $p = .003$). Quattrone and Tversky credit the decision makers' apparent sensitivity to the unemployment rate rather than to the employment rate to a psychophysical concept they call ratio-difference principle. Accordingly, the impact on perception is greater the larger the ratio of outcomes between the two alternatives. A change from program J to K would involve a ratio of 2 ($= 10\%/5\%$) under negative framing in Problem 3A, whereas under positive framing in 3B the ratio would be 0.947 ($= 90\%/95\%$). Since the ratio in the former problem is greater than in the latter, Quattrone and Tversky conjecture that program K stands out more focally in Problem 3A than in 3B. Hence, the unemployment rate brought about by program J should be perceived as a social nuisance in 3A rather than in 3B.

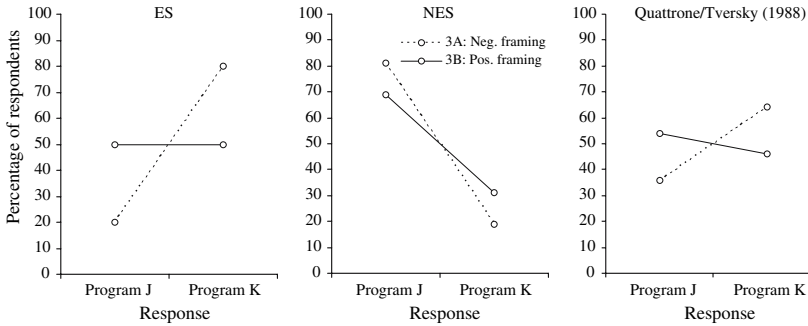


Fig. 3. The percentage of respondents choosing program J & K in each framing condition

Figure 3 displays subjects' responses to Problem 3. As the graph for the expert subjects indicates an "X"-pattern, their choices do take the same direction as the ones of the subjects of Quattrone and Tversky: 20% and 50% choose J under negative and positive framing, respectively. The χ^2 test confirms a choice shift for the expert subjects ($\chi^2(1) = 3.044$, $p = .081$). The choices of the NES sample do not change in the direction predicted by prospect theory and the χ^2 analysis indicates an opposite reversal ($\chi^2(1) = 5.645$, $p = .018$). Hence, neither the responses of the ES nor those of the NES sample support the prediction of expected utility theory.

There are many applications of the ratio-difference principle to political choice, as Quattrone and Tversky emphasize. The following pair of problems should demonstrate how framing statistics can influence people's perceived need for public goods provision.

Problem 4A – negative framing condition ($n(ES) = 14$, $n(NES) = 146$, $n(QT) = 125$):

The country of Delta is deeply interested in reducing the crime rate among its immigrants groups. The Department of Justice has been allocated 100 million of Delta's Monetary Units (DMU 100M) for establishing a crime prevention program aimed at immigrant youths. The program would provide the youths with job opportunities and recreational facilities, inas-much as criminal acts tend to be committed by unemployed youths who have little to do with their time. A decision must be made between two programs currently being considered. The programs differ from each other primarily in how the DMU 100M would be distributed between Delta's two

largest immigrant communities, the Alphans and the Betans. There are roughly the same number of Alphans and Betans in Delta. Statistics have shown that by the age of 25, 3.7% of all Alphans have a criminal record, whereas 1.2% of all Betans have a criminal record.

The following two programs are being considered. Program J would allocate to the Alphan community DMU 55M and to the Betan community DMU 45M. Program K would allocate DMU 65M to the Alphan community and to the Betan community DMU 35M. The following table summarizes these alternative programs:

Program	To Alphan Community	To Betan Community
Program J	55M	45M
Program K	65M	35M

Imagine you were faced with the decision between program J and program K. In light of the available crime statistics, which would you select?

The respondents of the second group received an identical problem with the only difference that the statistical records of both communities were now positively framed:

Problem 4B – positive framing condition ($n(ES) = 17$, $n(NES) = 156$, $n(QT) = 126$):

Statistics have shown that by the age of 25, 96.3% of all Alphans have no criminal record, whereas 98.8% of all Betans have no criminal record.

The data of Quattrone and Tversky reveal a choice reversal, as the 2 (framing) \times 2 (response) χ^2 test highlights ($\chi^2(1) = 22.644$ $p = .000$). We observe a choice reversal for the NES ($\chi^2(1) = 38.786$ $p = .000$), as well. In the case of the ES, 50% and 71% choose program J under negative and positive framing, respectively. Although Fig. 4 provides a similar graph for every subject pool, the choice change in the ES sample is statistically insignificant ($\chi^2(1) = 1.372$, $p = .242$).²⁹

Before discussing the different responses between subject pools in Sect. 3.4 we go into one of Allais' well-known paradoxes in Sect. 3.3.

²⁹ The ES sample size makes results difficultly comparable, as it was the case in Problem 1

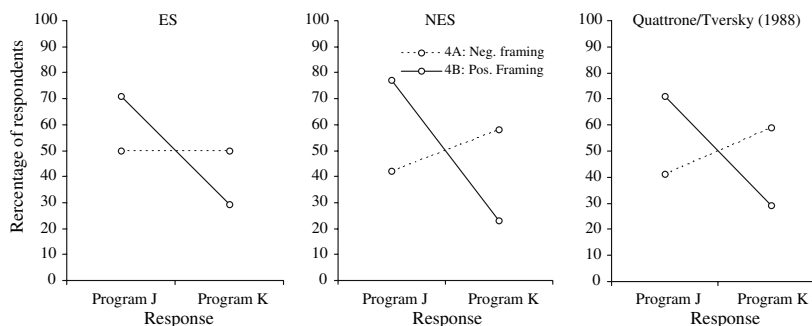


Fig. 4. The percentage of respondents choosing program J & K in each framing condition

3.3 The Common Ratio Effect

In the early fifties, Allais (1953) introduced two examples to the economics literature in which actual choice behavior may systematically deviate from the predictions of expected utility theory. One of these anomalies reported by Allais, the so-called common ratio effect, has challenged the assumption of well-defined preferences. The common ratio effect is usually presented in a pair of binary choice problems under risk in which one binary choice problem is derived from the other by multiplying the winning probability with a common factor. People violate expected utility theory if this common ratio modification of the winning probability induces a change in choice.

The last pair of problems addresses this kind of observed violations of expected utility theory in a within-subject treatment, i.e., respondents reply to both problems.

Problem 5A – sure/risky prospect ($n(ES) = 32$, $n(NES) = 308$, $n(QT) = 88$):

The state of Epsilon is interested in developing clean and safe alternative sources of energy. Its Department of Natural Resources is considering two programs for establishing solar energy within the state. If program X is adopted, then it is virtually certain that over the next four years the state will save 20 million Continental Monetary Units (CMU 20m) in energy expenditures. If program Y is adopted, then there is a 80% chance that the state will save CMU 30m in energy expenditures over the next four years and a 20% chance that because of cost overruns, the program will produce no savings in energy expenditures at all. The following table summarizes the alternative policies and their probable consequences.

Table 1. Summary of responses in framing problems^b

Problem	Expert Subjects		Non Expert Subjects		Quattrone Tversky (1988)	
	A	B	A	B	A	B
1 Brown	0.67	0.41	0.21	0.17	0.28	0.50
Green	0.33	0.59	0.79	0.83	0.72	0.50
N	15	17	147	162	89	96
Result ^a	Non-reversal		Non-reversal		Choice shift	
$\chi^2(1)$	2.079		0.722		9.281 ^{***}	
2 Frank	1.00	0.82	0.63	0.67	0.65	0.39
Carl	0.00	0.18	0.37	0.33	0.35	0.61
N	15	17	147	162	91	89
Result ^a	Choice shift		Non-reversal		Choice reversal	
$\chi^2(1)$	2.921 [*]		0.550		11.735 ^{***}	
3 Program J	0.20	0.50	0.81	0.69	0.36	0.54
Program K	0.80	0.50	0.19	0.31	0.64	0.46
N	15	16	166	142	126	133
Result ^a	Choice shift		Opposite reversal		Choice reversal	
$\chi^2(1)$	3.044 [*]		5.645 ^{**}		8.865 ^{***}	
4 Program J	0.50	0.71	0.42	0.77	0.41	0.71
Program K	0.50	0.29	0.58	0.23	0.59	0.29
N	14	17	146	156	125	126
Result ^a	Non-reversal		Choice reversal		Choice reversal	
$\chi^2(1)$	1.372		38.786 ^{***}		22.644 ^{***}	

^a A non-reversal indicates that framing has no significant impact (at 10% level) on choice as predicted by prospect theory. Both, choice shift and choice reversal indicate a significant change of choices in the direction of prospect theory. A choice reversal, furthermore, indicates that the modal choice is significantly greater than 50% in both framing conditions. Finally, an opposite reversal indicates that framing has a significant impact, but contrary to the prediction of prospect theory. ^b Comparison between subjects

*** <.01, ** <.05, * <.1 significance level (two tailed)

Policy	Savings in Energy Expenditures
X	CMU 20m with certainty
Y	80% chance of saving CMU 30m, 20% chance of no savings

Imagine you were faced with the decision of adopting program X or program Y. Which would you select?

Problem 5B – risky/risky prospect ($n(ES) = 32$, $n(NES) = 308$, $n(QT)=88$):

The state of Gamma is also interested in developing clean and safe alternative sources of energy. Its Department of Natural Resources is considering two programs for establishing solar energy within the state. If program A is adopted, then there is a 25% chance that over the next four years the state will save 20 million Continental Monetary Units (CMU 20m) in energy expenditures and a 75% chance that because of cost overruns, the program will produce no savings in energy expenditures at all. If program B is adopted, there is a 20% chance that the state will save CMU 30m in energy expenditures and an 80% chance that because of cost overruns, the program will produce no savings in energy expenditures at all. The following table summarizes the alternative policies and their probable consequences.

Policy ^a	Savings in Energy Expenditures
X'	25% chance of EMU 20m savings, 75% chance of no savings
Y'	20% chance of EMU 30m savings, 80% chance of no saving

^a Labels X' and Y' are used for ease of exposition. In the questionnaire we used labels A and B

Imagine you were faced with the decision of adopting program A or program B. Which would you select?

As summarized in Table 2, 75% and 62.5% of the expert subjects chose policy X and X', respectively. However, because the same subjects responded to both problems, we are going to analyze the frequency of the four possible combinations: XX', XY', YX' and YY'.

Note that Problem 5B is derived from 5A by multiplying the probability of savings with a common ratio of one fourth. The rational choices imply either the policy pairs XX' or YY', whereas the other combinations violate expected utility theory.³⁰ The literature refers to a violation in this context as the “common ratio effect”. Prospect theory accommodates the common ratio effect through its probability weighting function, a

³⁰ The independence axiom of expected utility theory implies that if X is preferred to Y then a probability mix of X, pX , $0 < p < 1$, must be preferred to pY , and *vice versa*.

Table 2. Summary of responses in the common ratio problem^a

Adopted program	ES (n = 32)		NES (n = 308)		Quattrone/Tversky (n = 88)	
	X'	Y'	X'	Y'	X'	Y'
X	0.53	0.22	0.31	0.28	0.31	0.43
Y	0.09	0.16	0.22	0.19	0.08	0.18
Certainty effect	Yes		Yes		Yes	

^a Comparison within subjects

monotonic nonlinear function of “stated” probability.³¹ The crucial properties of the probability weighting function with respect to Problem 5 are (1) overweighting of low probabilities, and (2) over-proportional underweighting of moderate and high probabilities. Hence, a reduction of each outcome’s stated probability by a common factor has a greater impact on the decision weight in the case of a certain outcome than on a risky one. This issue is referred to as the ‘certainty effect’. Thus, prospect theory would allow for the common value effect in Problem 5 if the involved choice pair is XY' . Actually, the common ratio effect occurs in our experiment more frequently in the direction predicted by prospect theory, i.e., XY' , than YX' (see Table 2). Of 10 ES (31%) whose choice pairs infringe the prediction of expected utility theory 7 (70%) deviate according to the certainty effect; as well, the choices of 86 of 154 NES (56%) exhibit this pattern. The result is significant for both the NES and for the ES as the results of a one-tailed sign test reveal ($p = .037$ and $p = .086$, respectively).

Given the high number of common ratio effects, rational choice theory cannot be supported in absolute terms. Nevertheless, within the ES pool we observe 69% consistent choices, which is relatively good compared to the other subject pools. Only one half of the responses in Quattrone and Tversky and the NES were consistent with the neoclassical model. A 2 (subject pool) $\times 2$ (consistent or inconsistent choice) χ^2 test indicates that the ES respond significantly more frequently consistent with rational

31 If a problem states the probability of an outcome as $0 < p < 1$, the decision weight assigned to the outcome is $0 < \pi(p) < 1$. The literature has shown that people’s perception of probabilities is inaccurate (see FN 9). Given the stated probability, the decision weight represents the perceived probability.

choice theory than the NES ($\chi^2(1) = 4.082, p = .043$).³² Still, almost one third (a 31%) of our experts are prone to the common ratio effect.

3.4 Subject Pool Effect

In this section, we highlight differences and similarities between subject pools and make an attempt to explain the differences. Before we do so, we repeat that our data is not directly comparable to Quattrone and Tversky, because they used a new cohort for each decision problem, whereas our subjects responded to six problems as pointed out above in Sect. 2. However, it should be noted that neither prospect theory nor expected utility theory make any prediction with respect to different subject pools. Whether the responses of one subject pool may differ from another is one of our main research questions. Therefore we run between-subjects tests and report them in the following subsection.

In the previous sections we generally find less support for the predictions of prospect theory than Quattrone and Tversky (1988). The between-subjects analysis carried out in Problem 5 showed significant differences between subject pools. The evidence on framing effects as reported in the problem sets 1–4, and surveyed in Figs. 1–4, follows a similar pattern though mixed. Table 3 analyzes the responses to these problems measuring the differences between the QT, ES and NES samples by means of a 2 (subject pool) \times 2 (response) χ^2 test for each problem A and B; significance is indicated by an asterisk.³³

In the last column of Table 3 the test statistics for Problem 4 are reported. If we consider, for instance, the differences between ES and NES with respect to question 4A, the resulting test statistic, which is approximately χ^2 distributed with one degree of freedom, is 0.353. This result indicates no significant differences between the samples; the results for the other pair-wise comparisons in this problem are similar. In contrast, results from the first three problems indicate significant differences

³² The same test procedure yields significant results, as well, when applied to the ES' choices and the data of Quattrone and Tversky ($\chi^2(1) = 3.738, p = 0.053$). Between the data of the NES and Quattrone and Tversky the result is insignificant ($\chi^2(1) = .035, p = .851$).

³³ The results of Problem 5 cannot be analyzed likewise with a χ^2 test procedure between subject pools, because the answers to questions A and B are dependent. However, we report in Sect. 3.3 the results of a χ^2 test to find that the ES violate rational choice theory less than the NES.

Table 3. Subject pool differences: $\chi^2(1)$ test results

Question	Problem 1		Problem 2		Problem 3		Problem 4		
	ES	QT ^a	ES	QT ^a	ES	QT ^a	ES	QT ^a	
NES	A	14.958 ^{***}	1.502	8.265 ^{**}	0.060	27.568 ^{***}	61.168 ^{***}	0.353	0.027
	B	5.584 ^{**}	31.049 ^{***}	1.625	18.359 ^{***}	2.355 ^{**}	6.441 ^{***}	0.340	1.437
QT ^a	A	8.556 ^{***}		7.556 ^{**}		1.471		0.438	
	B	0.450		10.631 ^{***}		0.098		0.000	

^a QT indicates the test results including the data of Quattrone and Tversky (1988)

*** < .01, ** < .05 significance level (two tailed)

and we reject the null hypothesis of no different responses in 4 out of 6 comparisons. These differences appear at first glance non-systematic since we have the same number of significant differences for the questionnaires A and B. In line with earlier research (Kühberger, 1998), framing effects seem not robust to changes of design issues and subject pools.

4 Conclusion

In this paper we have focused on the impact of expertise in a political decision making experiment. The reported exploration is based on Quattrone and Tversky's (1988) study of political choice problems. We compared their observations to the responses of both our subject pools (1) (experts) real-world politicians, and (2) (non-experts) economics student subjects.

As far as our sample size of expert subjects permits to draw conclusions,³⁴ our results may be summarized as follows. First, as Table 1 summarizes, the expert subjects do not seem to be immune to framing, so we confirm earlier findings of the literature as surveyed in Kühberger (1998) and Levin et al. (1998) in the domain of political decision making.

Second, our data do not reproduce the results of Quattrone and Tversky (1988) in all problems. The external validity of Quattrone and Tversky's results does not appear robust to changes in subject pools

³⁴ The results are based on 32 expert subjects. Though this is a small sample size, Potters and van Winden (2000)'s review suggest that there has never been any experimental study with more experts.

and design. In particular, the responses of the expert subjects deviate significantly from those of the student samples under reference point manipulations (Problems 1 and 2) and in decisions under risk (Problems 1 and 5).

Third, our results with inexperienced subjects support prospect theory much less than those of Quattrone and Tversky (1988). These significant differences might be related to different educational backgrounds, in line with Fagley and Miller (1987), culture effects, or to a combination of both. We have been unable to assess the relative importance of these factors within this experiment. Therefore, we must admit that our results are somehow inconclusive as we cannot offer any coherent economic, sociological or psychological theory to account for our data. We also fail to provide a coherent test that addresses the important issue whether the framing effects are different for the different subject pools. However, the magnitude of the observed differences shows that our understanding of the relevance of factors such as expertise and culture is at most partial. Hence, we assent to the demand of Ball and Cech (1993) for a replication of experiments with subjects from different populations.

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References

- Abdel-Khalik, A. R. (1974): "On the Efficiency of Subject Surrogation in Accounting Research." *The Accounting Review* 49: 743–50.
- Abdolmohammadi, M., and Wright, A. (1987): "An Examination of the Effects of Experience and Task Complexity on Audit Judgements." *The Accounting Review* 62: 1–13.
- Allais, M. (1953): "Le comportement de l'homme rationnel devant le risqué: critique des postulats et axiomes de l'école américaine." *Econometrica* 21: 503–46.
- Anderson, M., and Sunder, S. (1995): "Professional Traders as Intuitive Bayesians." *Organizational Behavior and Human Decision Processes* 64: 185–202.

- Arrow, K. J. (1982): "Risk Perception in Psychology and Economics." *Economic Inquiry* 20: 1–9.
- Ball, S. B., and Cech, P. (1996): "Subject Pool Choice and Treatment Effects in Economic Laboratory Experiments." In *Research in Experimental Economics* 6, edited by M. Isaac, pp. 239–92.
- Bernoulli, D. (1953): "Exposition of a New Theory on the Measurement of Risk." (original 1738) *Econometrica* 22: 23–36.
- Birnbaum, M. H. (2005): *New Paradoxes of Risky Decision Making*. Mimeo California State University, Fullerton.
- Buchan, N. R., Johnson, E. J., and Croson, R. (2002): "Trust, Reciprocity and Altruism in China, Korea, Japan and the United States." Mimeo, University of Wisconsin-Madison (*American Economic Review*, forthcoming).
- Burns, P. (1985): "Experience and Decisionmaking: a Comparison of Students and Businessmen in a Simulated Progressive Auction." In *Research in Experimental Economics* 3, edited by V. Smith. Greenwich: JAI Press.
- Davis and Solomon (1989): "Experience, Expertise, and Expert-performance Research in Public Accounting." *Journal of Accounting Literature* 8: 150–64.
- DeJong, D., Forsythe, R., and Uecker, W. (1988): "A Note on the Use of Businessmen in Sealed Offer Markets." *Journal of Economic Behavior and Organization* 9: 87–100.
- Dyer, D., Kagel, J., and Levin, D. (1989): "A Comparison of Naive and Experienced Bidders in Common Value Auctions: a Laboratory Analysis." *Economic Journal* 99: 108–15.
- Fagley, N. S., and Kruger, L. (1986): "The Effect of Problem Framing on the Program Choices of School Psychologists." Paper presented at the 94th Annual Convention of the American Psychological Association, August, Washington, DC.
- Fagley, N. S., and Miller, P. M. (1987): "The Effects of Decision Framing on Choice of Risky vs Certain Options." *Organizational Behavior and Human Decision Processes* 39: 264–77.
- Gigerenzer, G., Hoffrage, U., and Kleinbölting, H. (1991): "Probabilistic Mental Models: a Brunswikian Theory of Confidence." *Psychological Review* 98: 506–28.
- Glaser, M., Langer, T., and Weber, M. (2003): On the Trend Recognition and Forecasting Ability of Professional Traders. *CEPR Discussion paper* 3904, University Mannheim.
- Grether, D. M., and Plott, C. R. (1982): "Economic Theory of Choice and the Preference Reversal Phenomenon." *American Economic Review* 69: 623–38.
- Goldberg, L. R. (1959): "The Effectiveness of Clinicians' Judgments: the Diagnosis of Organic Brain Damage from the Bender-Gestalt Test." *Journal of Consulting Psychology* 23: 25–33.
- Hershey, J. C., and Schoemaker, P. J. H. (1980): *Organizational Behavior and Human Decision Processes* 25: 395–418.
- Hofstedt, T. R. (1972): "Some Behavioral Parameters of Financial Analysis." *The Accounting Review* 47: 679–92.
- Hong, J. T., and Plott, C. R. (1982): "Rate Filing Policies for Inland Water Transportation: an Experimental Approach." *The Bell Journal of Economics* 13: 1–19.

- Isaac, R. M., McCue, K., and Plott, C. (1985): "Public Goods Provision in an Experimental Environment." *Journal of Public Economics* 26: 51–74.
- Kahneman, D., Tversky, A. (1979): "Prospect Theory: an Analysis of Decision under Risk." *Econometrica* 47: 263–91.
- Kinder, D., and Palfrey, T. (1993): "On Behalf of an Experimental Political Science." In *Experimental Foundations of Political Science*, edited by D. Kinder and T. Palfrey. Ann Arbor: University of Michigan Press.
- King, R. R., Smith, V. L., Williams, A. W., and Van Boening, M. (1992): "The Robustness of Bubbles and Crashes in Experimental Stock Markets." In *Evolutionary Dynamics and Nonlinear Economics – a Transdisciplinary Dialogue*, edited by I. Prigogine, R. H. Day, and R. Chen. Oxford: Oxford University Press.
- Kühberger, A. (1995): "The Framing of Decisions: A New Look at Old Problems." *Organizational Behavior and Human Decision Processes* 62(2): 230–40.
- Kühberger, A. (1998): "The Influence of Framing on Risky Decisions: a Meta-analysis." *Organizational Behavior and Human Decision Processes* 75(1): 23–55.
- Levin, I. P., Schneider, S. L., and Gaeth, G. J. (1998): "All Frames Are Not Created Equal: a Typology and Critical Analysis of Framing Effects." *Organizational Behavior and Human Decision Processes* 76(2): 149–88.
- Lichtenstein, S., and Slovic, P. (1971): "Reversals of Preferences Between Bids and Choices in Gambling Decisions." *Journal of Experimental Psychology* 89: 46–55.
- Lindman, H. R. (1971): "Inconsistent Preferences Among Gambles." *Journal of Experimental Psychology* 89: 390–97.
- Lo, W., Cooper, D., Kagel, J. H., and Gu, Q. (1997): "An Experimental Study of the Ratchet Effect: the Impact of Incentives, Context and Subject Sophistication on Behavior." *Mimeo*.
- Lopes, L. L. (1987): "Between Hope and Fear: the Psychology of Risk." *Advances in Experimental Social Psychology* 20: 255–95.
- Lopes, L. L., and Oden, G. C. (1999): "The Role of Aspiration Level in Risky Choice: a Comparison of Cumulative Prospect Theory and SP/A Theory." *Journal of Mathematical Psychology* 43: 286–313.
- Loke, W. H., and Tan, K. F. (1992): "Effects on Framing and Mathematical Experience on Judgments." *Bulletin of the Psychonomic Society* 27: 361–67.
- Marwell, G., and Ames, R. (1981): "Economists Free Ride, Does Anyone Else? Experiments on the Provision of Public Goods, IV." *Journal of Public Economics* 15: 295–310.
- Mestelman, S., and Feeny, D. (1988): "Does Ideology Matter? Anecdotal Experimental Evidence on the Voluntary Provision of Public Goods." *Public Choice* 57: 281–86.
- Murphy, A. H., and Winkler, R. L. (1977): "Can Weather Forecasters Formulate Reliable Forecasts of Precipitation and Temperature?" *National Weather Digest* 2: 2–9.
- O'Clock, P., and Devine, K. (1995): "An Investigation of Framing and Firm Size on the Auditor's Going Concern Decision." *Accounting and Business Research* 25: 197–207.

- Önköl, D., Yates, J. F., Simga-Mugan, C., and Öztin, S. (2003): "Professional vs. Amateur Judgment Accuracy: the Case of Foreign Exchange Rates." *Organizational Behavior and Human Decision Processes* 91: 169–85.
- Plott, C. (1982): "Industrial Organization Theory and Experimental Economics." *Journal of Economic Literature* 20: 1485–527.
- Potters, J., and van Winden, F. (2000): "Professionals and Students in a Lobbying Experiment Professional Rules of Conduct and Subject Surrogacy." *Journal of Economic Behavior and Organization* 43: 499–522.
- Quattrone, G. A., and Tversky, A. (1988): "Contrasting Rational and Psychological Analysis of Political Choice." *American Political Science Review* 82(3): 719–36.
- Reyna, V. F., and Brainerd, C. J. (1991a): "Fuzzy-trace Theory and Framing Effects in Choice: Gist Extraction, Truncation, and Conversation." *Journal of Behavioral Decision Making* 4: 249–62.
- Reyna, V. F., and Brainerd, C. J. (1991b): "Fuzzy-trace Theory and Children's Acquisition of Mathematical and Scientific Concepts." *Learning and Individual Differences* 3: 27–59.
- Rohrbaugh, C. C., and Shanteau, J. (1999): "Context, Process, and Experience: Research on Applied Judgment and Decision Making." In *Handbook of Applied Cognition*, edited by F. Durso. New York: John Wiley.
- Roszkowski, M. J., and Snelbecker, G. E. (1990): "Effects of 'Framing' on Measures of Risk: Financial Planners are not Immune." *The Journal of Behavioral Economics* 19: 237–46.
- Roth, A. E., Prasnikar, V., Okuno-Fujiwara, M., and Zamir, S. (1991): "Bargaining and Market Behavior in Jerusalem, Ljubljana, Pittsburgh and Tokio." *American Economic Review* 81(5): 1068–95.
- Samuelson, W., and Zeckhauser, R. (1988): "Status Quo Bias in Decision Making." *Journal of Risk and Uncertainty* 1: 7–59.
- Savage, L. (1954): *The Foundations of Statistics*. New York: Wiley.
- Schmidt, U. (2004): "Alternatives to Expected Utility: Some Formal Theories." In *Handbook of Utility Theory*, vol. II, edited by P. J. Hammond, S. Barberá, and C. Seidl. Boston: Kluwer.
- Schurr, P. H. (1987): "Effects of Gain and Loss Decision Frames on Risky Purchase Negotiations." *Journal of Applied Psychology* 72: 351–58.
- Shanteau, J. (1988): "Psychological Characteristics and Strategies of Expert Decision Makers." *Acta Psychologica* 68: 203–15.
- Shanteau, J. (1992): "Competence in Experts: the Role of Task Characteristics." *Organizational Behavior and Human Decision Processes* 53: 252–66.
- Siegel, S., and Harnett, D. L. (1964): "Bargaining Behavior: a Comparison Between Mature Industrial Personell and College Students." *Operations Research* 12: 334–43.
- Starmer, C. (2000): "Developments in Non-expected Utility Theory: the Hunt for a Descriptive Theory of Choice under Risk." *Journal of Economic Literature* 38(2): 332–82.
- Traub, S. (1999): *Framing Effects in Taxation*. Heidelberg: Physica-Verlag.
- Tversky, A., and Kahneman, D. (1981): "The Framing of Decisions and the Psychology of Choice." *Science* 185: 1124–31.

- Tversky, A., and Kahneman, D. (1991): “Loss Aversion in Riskless Choice: a Reference-dependent Model.” *Quarterly Journal of Economics* 106(4): 1039–61.
- Tversky, A., and Kahneman, D. (1992): “Advances in Prospect Theory: Cumulative Representation of Uncertainty.” *Journal of Risk and Uncertainty* 5(4): 297–323.
- Von Neumann, J., and Morgenstern, O. (1947): *Theory of Games and Economic Behavior*, 2nd ed. Princeton: Princeton University Press.

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