



## 23 **1. Introduction**

24 In many countries, health insurance is only partly funded publically, and clients  
25 have to decide on how much extra coverage they want to obtain by purchasing  
26 supplemental private insurance (Bundorf & Simon 2006). For this decision,  
27 information about the risks at health expenses is useful. Thus, Winter et al. (2006)  
28 wrote, in a study on the Medicare Part D program for elderly clients introduced in the  
29 US on January 1, 2006, where private insurance companies and health maintenance  
30 organizations (HMOs) have to compete to offer supplemental insurance:

31 If the market components of Medicare Part D is to be successful, in the  
32 sense that it provides choices that consumers want, and achieves the  
33 efficiencies it seeks, it will probably be necessary for Medicare to expand its  
34 effort to reach all consumers and provide them with information and  
35 assistance in making wise choices. ... If elders are to be given sound advice  
36 on the merits of enrollment and alternative plans, community-based,  
37 privately financed advocacy organizations are likely to have to take the  
38 initiative. ... At present, even the most basic information on transition  
39 probabilities for pharmacy bills and health conditions that is needed for  
40 careful calculation of the value of insurance plans is not publicly available.  
41 (pp. 7933-7934).

42 McFadden (2006, p. 23, concluding paragraph) gave the same arguments.  
43 Developments as in the US simultaneously took place in the Netherlands, the country  
44 where our study was conducted. Plans to abolish complete public coverage for health  
45 insurance were developed in 1995, when this study was initiated by the Dutch health  
46 insurance company Zorg en Zekerheid, and were finally implemented on January 1,  
47 2006.

48 This paper reports an empirical study into providing clients with statistical  
49 information about health costs. We study the effects of such information on the  
50 clients' willingness to take insurance (WTT), for a sample of  $N = 476$  subjects  
51 representative of the lower 2/3 income class of the Dutch population. Our main  
52 interest concerns the desirability of such effects for the clients, i.e. whether it  
53 enhances choices that they want. In addition, our study provides descriptive insights  
54 into the risk and ambiguity attitudes of a representative sample of the lower 2/3  
55 income class of the Dutch population.

56 Clients of the Dutch health insurance company Zorg en Zekerheid (with  
57 compulsory insurance so that there was no selection bias) were asked for their WTT  
58 both before the receipt of information about statistics of health expenses, and after.  
59 Thus, the effect of the statistical information could be measured. We were also

60 informed about the health expenses of the clients by the insurance company. Thus we  
61 could measure how the WTT, and the effect of statistical information on WTT,  
62 depended on both risk aversion and health expenses. The extra statistical information  
63 that clients received entails a reduction of ambiguity (in its technical decision-  
64 theoretic sense), so that our data also give insights into ambiguity attitudes.

65 There is a wide interest in risk and ambiguity attitudes of the general public,  
66 rather than of the often-studied students (Donkers, Melenberg, & van Soest 2001;  
67 Hartog, Ferrer-i-Carbonell, & Jonker 2002; Harrison et al. 2004; Harrison & List  
68 2004; Starmer 2000). Our collaboration with Zorg en Zekerheid provided a unique  
69 opportunity to obtain such data. Common academic budgets do not allow for large-  
70 scale intensive experiments with representative samples from a population scattered  
71 over several cities and with each subject interviewed individually at their home, as  
72 could be done in this study. Thus, we could obtain a refined measurement of risk  
73 attitudes from the general public. Because risk aversion is rarely measured at the  
74 individual level in insurance studies, its positive impact on WTT, while widely  
75 assumed, has rarely been verified empirically before (see Barsky et al. 1997, who  
76 could not use refined measurements through individual interviews). The information  
77 about individual health expenses as we had is also rarely available. This information  
78 allowed an empirical verification of adverse selection at the individual level.

79 The effects of risk information on WTT are of interest from the marketing  
80 perspective, for example if an insurer seeks to maximize revenues and profits. We  
81 will, indeed, formulate recommendations for such applications. The main research  
82 question of this study, raised by Zorg en Zekerheid, was, however, a prescriptive one,  
83 to be considered from the perspective of the clients of Zorg en Zekerheid: To what  
84 extent do the effects of risk information help clients make insurance decisions that  
85 better fit their own preferences, and which form of statistical information is optimal  
86 for this purpose? We will obviously separate the empirical facts inferred from our  
87 experiment, and relevant to empirical applications, from the prescriptive  
88 interpretations added later. The design, definition of indexes, and statistical analyses  
89 will, however, be primarily oriented towards those aspects of the data that serve to  
90 solve our main research question. The effect of risk information on risky decisions of  
91 the general public, and the prescriptive desirability thereof, is of general interest. It is,  
92 for instance, relevant for preventive health care, traffic safety, counseling for risky

93 medical treatments, and banks informing clients about risk profiles of financial  
94 portfolios.

95 We considered WTT for supplemental insurance against a deductible of Dfl. 200  
96 (approximately \$140 in 1997) per year, the deductible envisioned in 1995 when the  
97 subjects were interviewed. The deductible introduced in the Netherlands in 2006 is  
98 somewhat lower (€100), and it is higher (\$250) for the Medicare part D program in  
99 the US. The supplemental insurance considered in this paper provides reimbursement  
100 for any deductible paid, so that full coverage is obtained after all.

101 Our empirical findings come from a natural environment and concern choices  
102 commonly faced by people when interacting with their insurance company. They  
103 shed new light on some controversial empirical questions, such as whether the general  
104 public is risk averse or risk seeking for losses, and whether ambiguity aversion and  
105 prospect theory's reflection effect hold for the general public. Since Keynes (1921),  
106 Knight (1921), and Ellsberg (1961), there have been many studies into the difference  
107 between risk (known probabilities) and uncertainty or ambiguity (unknown  
108 probabilities); see Gilboa (2004). These studies commonly considered artificial  
109 constructions of ambiguity, such as through urns with numbers of balls deliberately  
110 kept secret. Our natural stimuli will reveal phenomena different than those found  
111 with the commonly used artificial stimuli.

112 Further specific research questions addressed in this paper concern whether the  
113 effects of the various forms of statistical information on WTT interact with the risk  
114 aversion of the clients, and with their health expenses. We discuss whether the  
115 interactions found are desirable from various perspectives (marketing, societal,  
116 client), as well as which form of statistical information is most desirable from the  
117 various perspectives.

## 118 **2. Method**

119 Details of our experiment, in particular concerning the hypothetical and  
120 subjective nature of the survey questions, are discussed in Section 5 and in Appendix  
121 A.

122 *Participants.*—N=496 clients of Zorg en Zekerheid were sampled, all with Dutch  
123 as native language, aged 18–69. The sampling was done sequentially, maintaining  
124 representativeness regarding age, gender, and income for the various subgroups of  
125 interest in this research. The clients were all on national health service, which means

126 that they belonged to the lower 2/3 income class of the Dutch population. For our  
127 clients, insurance is compulsory so that being insured did not generate self-selection.  
128 The clients predominantly did not have an academic training, which makes them  
129 complementary to the participants recruited in most experimental investigations. The  
130 clients in our study were well motivated because the research was organized by their  
131 own health insurance company, and the general public is in general willing to  
132 contribute to health investigations (Bleichrodt & Pinto 2005).

133 *Procedure.*—Thirty professional interviewers were hired. They received a day's  
134 training as preparation, and visited all clients at their private homes. Interviews lasted  
135 approximately one hour per client, of which half an hour was dedicated to questions  
136 regarding the research reported here, and the other half hour was dedicated to another  
137 research regarding insurance for dental care. Clients were called by phone after the  
138 interview to verify that the procedures had been carried out correctly prior to payment  
139 of the interviewers. No interviewer had to be discarded.

140 *Stimuli; general.*—We only describe the variables relevant to this research. The  
141 stimuli were tested in a pilot study consisting of 10 clients, and were approved by a  
142 patients' interest group ("Regionaal Patiënten/Consumenten Platform Leiden"). In  
143 short, the independent variable is the form of statistical information given to the  
144 clients, and the dependent variable is the effect of information on WTT. Further  
145 factors are risk attitude and costs. We next describe these stimuli in detail.

146 *Risk attitude.*—Fourteen hypothetical choice questions about gambles for money  
147 were mailed to the clients before the interview, so that they could prepare. These  
148 questions were discussed in the beginning of the interview. In each question, a choice  
149 had to be made between a risky prospect and a sure amount of money. The first seven  
150 choices concerned gains, i.e. nonnegative amounts of money, and were described as  
151 wheel-of-fortune questions to the clients. The last seven choices concerned losses and  
152 were described as wheel-of-misfortune questions. Both the gain- and the loss-  
153 questions were preceded by one practice question. Appendix B presents the visual  
154 displays of two choices. Tables 1 and 2 display the probabilities and outcomes of the  
155 prospects. Only the nonzero outcomes and their probabilities are denoted. To save  
156 space, the tables hereafter also display choice proportions that will be discussed in the  
157 results section.

158  
159

159 TABLE 1. Risky choices for gains

	G1	G2	G3	G4	G5	G6	G7
risky prospect	(0.50, 300)	(0.50, 200)	(0.01, 200)	(0.05, 100)	(0.50, 96)	(0.95, 72)	(0.95,100)
safe option	20	100	10	14	39	55	78
proportion of risky choices	0.72	0.31	0.19	0.24	0.50	0.60	0.63

160 In G1 the choice is between a fifty-fifty prospect yielding Dfl. 300 or nothing, and a  
 161 safe option yielding Dfl. 20 for sure; the other choices are similar. In prospect choice  
 162 G1, 72% of the clients chose the risky fifty-fifty prospect of Dfl. 300 or nothing, and  
 163 28% chose the safe option of Dfl. 20 for sure; the other percentages are similar.

164

165 TABLE 2. Risky choices for losses

	L1	L2	L3	L4	L5	L6	L7
risky prospect	(0.05,-200)	(0.50,-200)	(0.01,-200)	(0.05,-100)	(0.10,-50)	(0.10,-200)	(0.95,-100)
safe option	-75	-100	-3	-8	-8	-23	-84
proportion of risky choices	0.76	0.47	0.54	0.56	0.54	0.50	0.33

166 In L1 the choice is between a prospect yielding a loss of Dfl. 200 with probability 0.05  
 167 and no loss otherwise, and a safe option yielding a loss of Dfl. 75 for sure. In prospect  
 168 choice L1, 76% of the clients chose the risky prospect of losing Dfl. 200 with  
 169 probability 0.05, and 24% chose the safe option of losing Dfl. 75 for sure.

170

171 Choices G1 and L1 serve to detect extreme risk aversion, for clients who  
 172 invariably choose the sure amount no matter how favorable the risky prospect is. In  
 173 choices G2 and L2, the sure outcomes are the expectations of the risky options. These  
 174 choices provide benchmarks for whether clients are risk averse, risk neutral, or risk  
 175 seeking. The other prospects were taken from Tversky & Kahneman (1992, G3, G4,  
 176 G7, L3, L4, L5, L6, L7) and from Birnbaum et al. (1992, G5, G6). The particular  
 177 outcomes and probabilities were chosen because in each of these choices the  
 178 mentioned references found 50% preference for either prospect, suggesting that they  
 179 optimally distinguish between individuals. For pragmatic reasons, we matched  
 180 dollars (the unit used in the references mentioned) and guilders (the unit used in our  
 181 experiment) numerically, and not in value. We incorporated various levels of  
 182 probability because there will be various levels of health among our clients and,  
 183 correspondingly, various probabilities of costs.

184 We also asked three risky choices that were framed as insurance decisions. In  
 185 each question, an annual premium was specified and a, never higher, annual average  
 186 of costs for the case of no supplemental insurance. The clients were asked to express  
 187 their subjective willingness to buy supplemental insurance on a scale from 1 (surely  
 188 will not buy) to 7 (surely buy). Table 3 displays the questions. Again, to save space,  
 189 the table also displays results of mean willingness to buy that will be discussed in the  
 190 results section.

191

192 TABLE 3. Prospect choices in an insurance context

	I1	I2	I3
premium	132	144	180
average costs	125	144	150
mean willingness to buy	0.45	0.55	0.51

193 Three insurance choice questions with annual premium and average costs specified.  
 194 In I1, the choice is between insurance at premium 132 or no insurance with average  
 195 costs 125. In I1, the mean subjective willingness to buy was 0.45.

196

197 *Information provision; three groups of clients, and three summary statistics per*  
 198 *client.*—Table 4 displays the forms of information considered in this paper, explained  
 199 next. A  $3 \times 3$  between-within design will result. The clients were divided into five  
 200 groups. Each group received information about a different summary statistic. Two  
 201 summary statistics, “badnews probabilities” of costs exceeding Dfl. 0 and costs  
 202 exceeding Dfl. 200, and “goodnews probabilities” of costs not exceeding these levels  
 203 ( $n = 203$ ), did not yield significant effects. Apparently, two such probabilities do not  
 204 entail enough information to affect choice. For brevity, these results will not be  
 205 reported. Three summary statistics (the between-subjects variable in our  $3 \times 3$  design)  
 206 remain:

207

208 (A) *Total costs*: Average annual health care costs, which is the sum of the costs  
 209 specified in (B) hereafter.

210 (B) *Specified costs*: Average annual costs specified for seven health care services: (a)  
 211 Hospital care; (b) physician; (c) paramedical care (physiotherapy, speech therapist,  
 212 remedial therapy, etc); (d) prescription drugs; (e) ancillary equipments (f) obstetrics  
 213 and maternity care; (g) transportation.

214 (C) *Probabilities* (“*probabilistic information*”): The probability of each of the  
 215 following four events: Dfl. 0 costs, costs between Dfl. 0 and Dfl. 100, costs between  
 216 Dfl. 100 and Dfl. 200, costs exceeding Dfl. 200.

217

218 Per client, the information about the summary statistics was provided at three levels  
 219 of aggregation:

220

221 (1) Population (throughout this paper: all clients of Zorg en Zekerheid).

222 (2) Reference group, i.e. clients of the same gender and age interval (18–29, 30–39,  
 223 40–49, 50–59, 60–69 years).

224 (3) Individual.

225

226 The level of aggregation is the within-subjects variable in our 3×3 design. At the  
 227 individual level, clients were informed about their personal costs over the last year.  
 228 This information does not comprise randomness and, hence, was not provided to the  
 229 clients who received probabilistic information. Thus, in total,  $3 \times 3 - 1 = 8$  forms of  
 230 information were considered, displayed in Table 4. The clients always received the  
 231 three aggregated levels of information sequentially, first about the population, then  
 232 about the reference group, and finally, if relevant, at the individual level.

233

234 TABLE 4: Eight different forms of information about costs, with respect to various  
 235 summary statistics (rows) and various levels of aggregation (columns)

236 237 238 239 240 241 242	within- between- subjects subjects	level of aggregation given first: population	level of aggregation given second: reference group	level of aggregation given last: individual
238	total costs	+	+	+
239	specified costs	+	+	+
240	probabilistic information	+	+	–

243 Each client faced all questions in one row.

244

245

246 *Costs.*—Unlike most other studies, we did not derive costs indirectly from  
 247 (subjective) assessments of clients (Finkelstein 2004). Instead, for the clients who  
 248 received information about their health costs over the preceding year (1994; total or  
 249 specified), this information was also provided to us by the insurance company. Thus,  
 250 we have the exact real costs available.



251

252 *Subjective willingness to take supplemental insurance.*—Clients were asked to  
 253 express their willingness to take supplemental insurance on a scale from 1 to 7. This  
 254 scale, normalized to a 0–1 scale, is used as the index of the willingness to take  
 255 supplemental insurance in the main analysis. It is denoted *WTT* henceforth. *WTT*  
 256 was measured before the provision of information, and after each of the three forms of  
 257 information that was provided to each client. Contrary to prior plans, we did not  
 258 specify a premium for reasons explained in Appendix A.

259 *Subjective evaluations of the information.*—For each form of information  
 260 received, four subjective evaluation questions were asked to the clients. The  
 261 questions concerned (a) clarity, (b) comprehensibility, (c) general usefulness, (d)  
 262 usefulness in decisions, and (e) whether the statistic was higher or lower than  
 263 expected, each on a seven-point scale. The clients were also asked at which level of  
 264 aggregation they would most like to receive information in the future.

265 *Analyses.*—The *effect of a form of information* was defined as the *WTT* directly  
 266 after receipt of that form of information, minus the first *WTT* that was measured  
 267 before any receipt of information. For example, the effect of individual-cost  
 268 information for a client was the fourth *WTT* elicited from the client minus the first.  
 269 Order effects are discussed in Section 5.

270 Clients with costs exceeding Dfl. 405 (the median cost) were classified as *high-*  
 271 *cost*, the others as *low-cost*. We received the information about individual costs only  
 272 for subjects who were given cost-information (total or specified;  $n = 184$ ). Because  
 273 the cost variable was highly skewed, we used a transformation for correlational  
 274 analyses, as follows:  $0 \rightarrow 1$  (16.8%),  $(0,100] \rightarrow 2$  (15.8%),  $(100,200] \rightarrow 3$  (10.3%),  
 275  $(200,1000] \rightarrow 4$  (26.6%), and  $(1000,\infty) \rightarrow 5$  (30.4%), with percentages of clients  
 276 indicated between brackets. The particular thresholds were chosen because of their  
 277 psychological meaning, where 200 is particularly important because it is the level of  
 278 the deductible.

279 *A risk-aversion index*, ordering clients regarding their degree of risk aversion,  
 280 was constructed as the average of three scores: (a) The number of safe choices in the  
 281 gain prospects; (b) the number of safe choices in the loss prospects; (c) the  
 282 willingness to buy in the insurance context. All of these variables were normalized to

283 a 0–1 scale before their average was taken. In this manner, the risk-aversion index is  
 284 automatically normalized too.

285 For the main research question of this paper, which *single* form of information  
 286 gives the best effect, we used paired *t*-tests to compare WTT before and WTT after  
 287 receipt of information.<sup>4</sup> Wilcoxon ranked signs tests revealed the same patterns and  
 288 are not reported. We use the following abbreviations for two-tailed paired *t*-tests; ms:  
 289  $p \leq 0.10$  (significant if one-tailed); \*:  $p \leq 0.05$ ; \*\*:  $p \leq 0.01$ ; \*\*\*:  $p \leq 0.001$ .

### 290 **3. Results on Risk Attitudes and Effects of Information**

291 20 clients were dropped because, due to lack of understanding or for other reasons,  
 292 they could not answer the questions; 476 remained. The main results concern the  
 293 interactions of the effects with risk aversion and costs, and will be presented in  
 294 Subsection 3.4.

#### 295 **3.1. Risk Attitudes**

296 Tables 1 and 2 in the preceding section already gave the proportions of risky  
 297 choices in the prospect choices. Choice G2 exhibits risk aversion ( $\chi^2 = 65.8$ ,  $df = 1$ ,  
 298  $p < 0.001$ ), and choice L2 risk neutrality ( $\chi^2 = 1.58$ ,  $df = 1$ ,  $p = 0.21$ ). For the three  
 299 risk-attitude questions framed as insurance, Table 3 in the preceding section gave the  
 300 means of subjective willingness to buy, normalized to a 0–1 scale.

301 We tested the internal consistency of the risk aversion scale by means of a  
 302 reliability analysis. Cronbach's alpha was 0.75, which exceeds the common  
 303 acceptability cutoff point of 0.70 (Nunnally & Bernstein 1994). No removal of any  
 304 item improved reliability.

305 The results of the prospect questions L2 and L6 suggest that slightly more than  
 306 50% of our sample is risk averse for the relevant outcome domain. Because our,  
 307 obviously debatable, policy recommendations in Section 6 will primarily concern  
 308 risk-averse clients, we used a conservative criterion for classifying clients as risk  
 309 averse: The more risk-averse half of our sample was classified as risk averse and the  
 310 other half as risk seeking. Besides correlational results, we also report analyses based

---

<sup>4</sup> We did not use analysis of variance because we were interested in single forms of information; only single forms of information will be implemented. The asymmetric role of WTT before receipt relative

311 on median splits. The latter reduce statistical power but their results are best suited  
 312 for the policy recommendations considered later.

313 The median of the risk aversion index constructed from the gains, losses, and  
 314 insurance questions, was 0.51.<sup>5</sup> The index was between 0 and 0.50 for 225 clients,  
 315 who were classified as risk seeking. The index exceeded 0.50 for 232 clients who  
 316 were classified as risk averse. This classification is used in our main analysis and is  
 317 discussed further in Section 4.

318 In agreement with common findings (Barsky et al. 1997), there was a positive  
 319 relation between risk aversion and being female, having a low income, a large family,  
 320 a low education, and a high age, but the relation was significant only for the latter two  
 321 variables ( $r = 0.12$ ,  $p = 0.01$  for both). These relations were the same for gains as for  
 322 losses, though usually stronger for gains. The risk aversion index for gains (G1–G7)  
 323 was positively related to the index for losses (L1–L7;  $r = 0.55$ ,  $p < 0.001$ ). Risk  
 324 aversion strongly influences WTT ( $r = 0.36$ ,  $p < 0.001$ ), as will be further illustrated  
 325 in Figures 1 and 2. WTT also correlates positively with the risk-aversion index for  
 326 gain-prospect choices ( $r = 0.10$ ,  $p = 0.03$ ) and the risk-aversion index for loss-  
 327 prospect choices ( $r = 0.12$ ,  $p = 0.02$ ).

### 328 **3.2. Effects of Information on WTT; Results of the Whole Sample**

329 Table 5 gives numerical statistics. It displays the WTT before and after the  
 330 receipt of information and, thus, shows the effects of information on average WTT for  
 331 the whole sample of clients. The most interesting results will also be depicted in  
 332 Figures 1 and 2.

333 The three forms of information about reference groups had effects similar to the  
 334 information about the population, but less pronounced. For brevity, these forms of  
 335 information will not be analyzed further. Information about individualized costs and  
 336 about probabilities neither have much effect on group means. These forms of  
 337 information will, however, reveal interesting effects in detailed analyses described  
 338 later, unlike the forms just excluded. The difference in  $WTT_{\text{before}}$  between total and

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to the WTTs after further illustrates that analysis of variance is not suited to answer our main research questions.

<sup>5</sup> It is a coincidence that this median happens to lie almost exactly at the 0.50 level of the risk aversion index.

339 specified costs is due to between-group randomness, and nonsignificant under an  
 340 independent samples t-test ( $t_{186} = 1.13, p = 0.26$ ).

341

342 TABLE 5. Mean and standard deviation (*SD*) of WTT before and after the receipt of  
 343 information of the whole sample

	Population	reference group	Individual
Total costs	WTT <sub>before</sub> : <b>0.51</b> (0.43) WTT <sub>after</sub> : <b><u>0.59</u>*</b> (0.43)	WTT <sub>before</sub> : <b>0.51</b> (0.43) WTT <sub>after</sub> : <b>0.56</b> (0.42)	WTT <sub>before</sub> : <b>0.51</b> (0.43) WTT <sub>after</sub> : <b>0.54</b> (0.44)
specified costs	WTT <sub>before</sub> : <b>0.58</b> (0.40) WTT <sub>after</sub> : <b><u>0.69</u>***</b> (0.38)	WTT <sub>before</sub> : <b>0.58</b> (0.40) WTT <sub>after</sub> : <b>0.64<sup>ms</sup></b> (0.39)	WTT <sub>before</sub> <sup>6</sup> : <b>0.59</b> (0.40) WTT <sub>after</sub> : <b>0.61</b> (0.42)
Probabilistic	WTT <sub>before</sub> : <b>0.54</b> (0.40) WTT <sub>after</sub> : <b>0.59<sup>ms</sup></b> (0.36)	WTT <sub>before</sub> : <b>0.54</b> (0.40) WTT <sub>after</sub> : <b>0.56</b> (0.36)	–

344 Significant effects (= changes in WTT) are underlined.

345

### 346 3.3. Brief Discussion of Whole-Sample Results

347 The increases of average WTT for the whole sample generated by population-  
 348 cost information may be of interest from the marketing perspective of maximizing  
 349 revenues of insurance policies. They, however, give no clear information about our  
 350 main research question, being how to help clients make decisions that are optimal for  
 351 themselves. There is no prior reason why it would be good or bad for clients to take  
 352 more or less insurance. Information relevant to the prescriptive perspective will be  
 353 revealed by analyses of subgroups, presented in the following subsections and in  
 354 Figures 1 and 2.

### 355 3.4. Interaction Effects of the Five Most Interesting Forms of Information

356 As explained in Subsection 3.2, five forms of information remain, about  
 357 population costs or individual costs, each specified either per seven services or only as  
 358 the sumtotal of these, and, fifth and last, probabilistic information (always referring to  
 359 the population and not to the reference group henceforth). We examine the  
 360 dependence of the effects of information on risk aversion and costs. Table 6 presents  
 361 correlations and partial correlations. Unfortunately, information about costs during  
 362 the preceding year was not available for the group that received probabilistic

<sup>6</sup> WTT<sub>before</sub> is not constant in the second row because of different missing subjects.

363 information.

364

365 TABLE 6. Correlations of effect with risk aversion and with costs for each of the five

366 forms of information

	total popu- lation costs	specified po- pulation costs	total indivi- dual costs	specified indi- vidual costs	probabilistic
risk aversion	0.02 (n = 81)	0.05 (n = 97)	0.07 (n = 81)	0.22* (n = 96)	0.18 (n = 82)
Costs	-0.11 (n = 81)	0.08 (n = 103)	0.08 (n = 81)	0.27** (n = 102)	–
Risk aversion controlling for costs	0.02 (n = 76)	0.07 (n = 92)	0.06 (n = 76)	0.19 <sup>ms</sup> (n = 91)	–
costs contro- ling for risk aversion	-0.12 (n = 76)	0.05 (n = 92)	0.07 (n = 76)	0.26* (n = 91)	–

367 The correlation of risk aversion with effect is 0.22 for the specified individual-cost  
368 information, and is 0.19 if controlling for costs; etc.

369

370 Most effects do not correlate significantly with risk attitude or costs. Only for  
371 specified individual costs, there are significant nonzero correlations of effects with  
372 risk aversion and with costs. These correlations are positive, i.e., the more risk averse  
373 people are, and the higher their costs, the more their WTT *increases* because of the  
374 new information.

375 The effects of costs and risk aversion are uncorrelated ( $r = 0.09$ ,  $n = 174$ ,  
376 nonsignificant). Partial correlations, controlling for the other factor, are virtually  
377 identical to uncontrolled correlations, and the beta-weights of risk aversion and costs  
378 in a regression are almost identical to their correlations.

379 The interaction between effect and high or low risk aversion is marginally  
380 significant for total individual costs ( $F_1 = 2.843$ ,  $p = 0.10$ ) and probabilistic  
381 information ( $F_1 = 3.224$ ,  $p = 0.08$ ), and significant for specified individual costs ( $F_1 =$   
382  $5.094$ ,  $p = 0.03$ ). The interaction between effect and high or low costs is significant  
383 ( $F_1 = 10.584$ ,  $p = 0.002$ ).

384

FIGURES 1–2. Effects of information provision on WTT (willingness to take insurance)

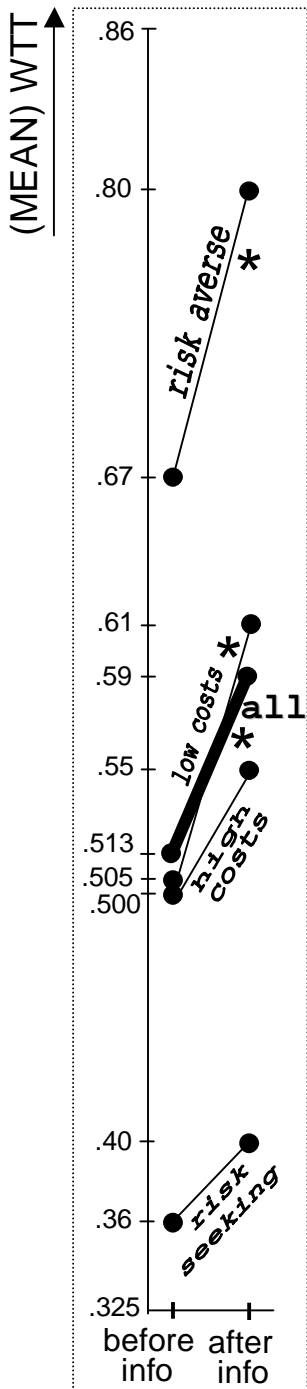


FIG. 1a.  
INFO ABOUT:  
**total  
population  
costs**

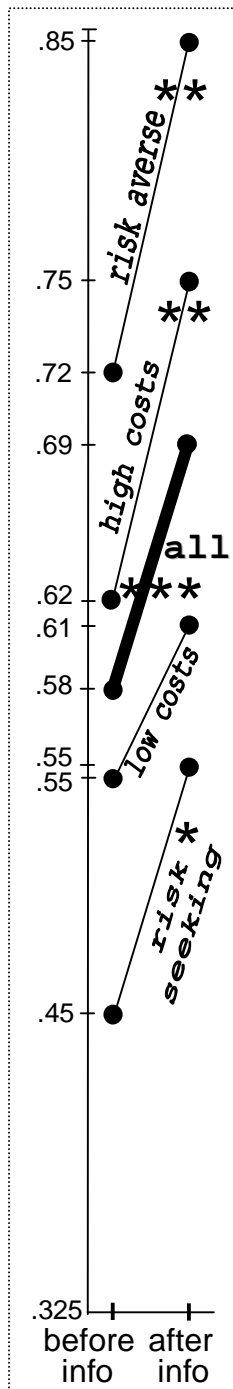


FIG. 1b.  
INFO ABOUT:  
**specified  
population  
costs**

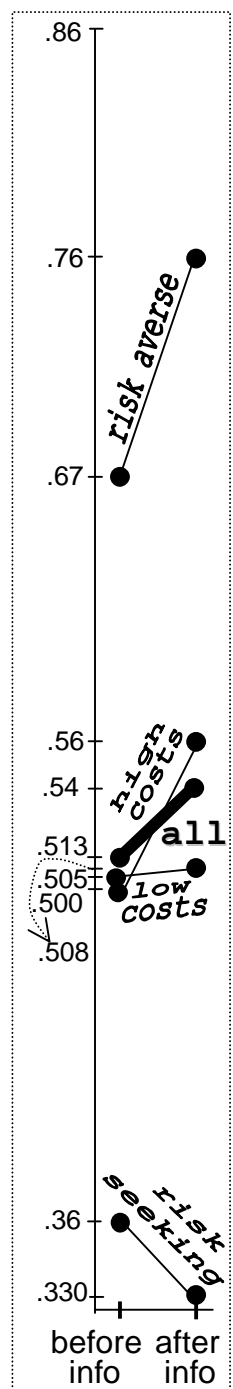


FIG. 2a.  
INFO ABOUT:  
**total  
individual  
costs**

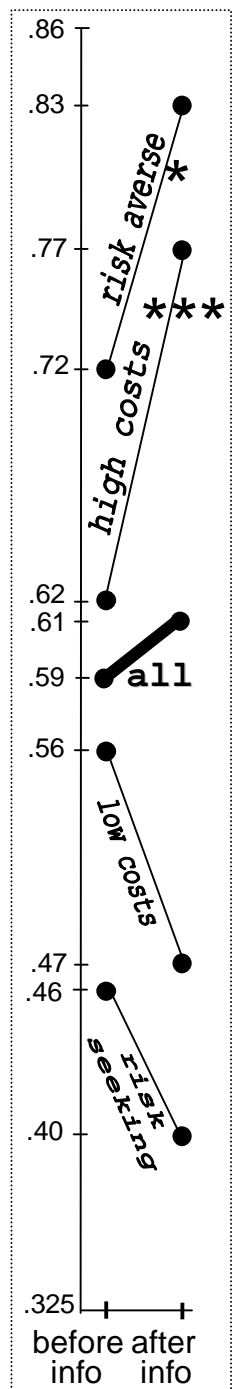


FIG. 2b.  
INFO ABOUT:  
**specified  
individual  
costs**

In the group that received total population-cost information (Fig. 1a), the mean of WTT of the risk-averse subjects was .67 before the receipt of information and .80 after, generating an effect significant at the .05 level.

386

387       The above claims are supported by analyses of subgroups. Table C.1 in  
388 Appendix C gives complete numerical results. The first four forms of information,  
389 about costs, are also depicted in Figures 1 and 2. These figures, while complex at first  
390 sight, serve well to convey the overall patterns in our data, as is explained next. Line  
391 segments connect WTT before receipt of info with WTT after, so that their increases  
392 and decreases reflect the effects of info. Each panel illustrates a form of information.  
393 In each panel, a fat line displays the average WTTs and effects for the whole group.  
394 The risk averse subgroup always had the highest WTTs and, thus, generates the  
395 highest line segments, and the risk seeking group generates the lowest. The high-cost  
396 group always generates the second-highest line segments, and the low-cost group  
397 generates the second-lowest. All line segments in Fig. 1a increase. Hence, total  
398 population-cost information increases WTT for all subgroups considered and,  
399 obviously, also for the whole group. Asterixes indicate that the increases are  
400 significant only for the whole group and for the risk averse group, but not for the  
401 other subgroups in Fig 1a. Fig. 1b displays similar results for the group that received  
402 information specified per health service. The changes are all in the same direction as  
403 in Fig. 1a, but to a more pronounced degree, and higher levels of significance are  
404 reached.

405       Figure 2 displays the results of individual-cost information instead of population-  
406 cost information. Fig. 2a concerns total-cost information, and suggests differential  
407 effects, with increased WTT for the risk averse clients and for the high cost clients,  
408 and not for others. The effects are not significant though. Fig. 2b concerns specified  
409 costs. The information again differentiates between individuals, but now to a more  
410 pronounced degree. Specifying costs amplifies the effects of total costs in both  
411 figures.

412       Table 7 summarizes the effects found. We presented the subgroup information in  
413 Figures 1 and 2 because the effects summarized in Table 7 are more easily inferred  
414 from visual inspection of these figures than from the numerical Table C.1 in the  
415 appendix.

416 TABLE 7. Effects exhibited by Figures 1 and 2; summary of  
 417 effects of information

		<i>increases WTT<sup>(b)</sup></i>	<i>differentiates individuals<sup>(c)</sup></i>
		population	individual
420			
421	total costs	Fig. 1a	Fig. 2a
422	<i>enhances effects<sup>(a)</sup></i> { specified costs	Fig. 1b	Fig. 2b
423			

424 (a): Compare Fig. 1b with Fig. 1a, and Fig. 2b with Fig. 2a.

425 (b): See Figs 1a and 1b.

426 (c): See Figs 2a and 2b, with increases in WTT for risk  
 427 aversion and also for high costs, and not for others.

428 Further, probabilistic information (data given in Table C.1) also increased the  
 429 WTT of risk averse clients, and not of risk-seeking clients, as did individual-cost  
 430 information. Costs and interactions therewith could not be observed for probabilistic  
 431 information.

### 432 3.5. Subjective Evaluations

433 The normalized means and standard deviations of the questions about clarity and  
 434 comprehensibility are  $M = 0.80$ ,  $SD = 0.24$ , and  $M = 0.83$ ,  $SD = 0.21$ . These  
 435 questions gave similar results for all three summary statistics (being total costs,  
 436 specified costs, and probabilistic information) and are not discussed further. The two  
 437 questions about usefulness distinguished more clearly between summary statistics.  
 438 As a usefulness scale we took the normalized average of these two questions. Its  
 439 means (standard deviations) are 0.74 (0.28) for specified costs, 0.58 (0.32) for total  
 440 costs, and 0.58 (0.28) for probabilistic information. The judged usefulness of  
 441 specified costs is significantly higher than of the other summary statistics ( $p \leq 0.001$   
 442 in each case); no other difference is significant.

443 For each summary statistic, the clients were asked which level of aggregation  
 444 they preferred. Table 8 displays the results for the summary statistics regarding costs.  
 445 The summary statistic giving probabilistic information (which could not be given at  
 446 the individual level) exhibited a similar pattern, with preference increasing with  
 447 individualization. These results suggest a preference for specified costs and for  
 448 individualized information.



449

450 TABLE 8. Proportions of preferences for levels of aggregation

	no preference	population	Reference group	individual
total costs	0.40	0.05	0.15	0.40
specified costs	0.22	0.10	0.21	0.47

451 For specified costs, 47% of the clients prefers to receive the information at the  
 452 individual level, 21% at the reference group level, etc.

## 453 **4. Discussion of the Findings, and Results on Ambiguity**

### 454 **4.1. Risk Attitude**

455 Our finding of considerable risk seeking for losses deviates from the universal  
 456 risk aversion often assumed in the economics and insurance literature. In our domain  
 457 of losses with moderate to high probabilities, risk seeking is predicted by prospect  
 458 theory (Abdellaoui 2000; Hershey & Schoemaker 1985; Kahneman & Tversky 1979;  
 459 Payne, Laughhunn, & Crum 1980; Tversky & Kahneman 1992). It can be explained  
 460 theoretically by an inverse-S shaped probability transformation, which has been  
 461 confirmed in many empirical studies (Abdellaoui 2000; Bleichrodt & Pinto 2000;  
 462 Gonzalez & Wu 1999). Such probability transformations do predict risk aversion for  
 463 small-probability losses, which is indeed the common case in insurance. Prospect  
 464 theory, thus, predicts prevailing risk aversion in insurance, which mostly concerns  
 465 small-probability losses, and only suggests risk seeking for moderate-to-high  
 466 probability losses such as in our data set. Similar risk seeking was found by Marquis  
 467 & Holmer (1996) in a re-analysis of the RAND study of Manning et al. (1987).

468 The major factor underlying risk aversion is probably loss aversion (Fischer et al.  
 469 1986; Langer & Weber 2001; Pennings & Smidts 2003), which concerns the  
 470 overweighting of losses relative to gains. Loss aversion plays no role in our domain  
 471 where no exchanges between gains and losses are involved. Hence, we avoided  
 472 mixed prospects, yielding both gains and losses, in our measurements of risk attitudes,  
 473 and do not consider loss aversion.

474 On average we find risk neutrality for the loss prospects (Questions L2 and L6).  
 475 Therefore, risk seeking is less frequent than suggested by prospect theory. This may  
 476 be caused by the context of insurance in our experiment, even if not stated explicitly  
 477 in the prospect choice questions. It is well known that an insurance context enhances  
 478 risk aversion (Hershey, Kunreuther, & Schoemaker 1982, p 949/950; McClelland,

479 Schulze, & Coursey 1993). Let us repeat that health insurance was compulsory for  
480 the clients of the insurance company Zorg en Zekerheid so that they are not more risk  
481 averse than the average 2/3 lowest income part of the Dutch population.

482 Our risk-attitude index comprises some insurance-related questions and it is,  
483 therefore, obvious that this index correlates positively with WTT. Less trivial, but not  
484 surprising either, is the positive relation between WTT and the risk attitudes for the  
485 gain- and loss-prospect choices. Empirical verifications thereof have, however, been  
486 almost absent from the literature so far. The reason is that risk attitude is usually  
487 unobservable in insurance studies. Besides Barsky et al. (1997), discussed later, we  
488 are only aware of Vistnes & Banthin (1997/1998). They asked about agreement with  
489 the claim “I’m more likely to take risks than the average person,” and found a  
490 negative relation between this index of risk seeking and demand for insurance.

491 Relative to the participants of Tversky & Kahneman (1992), our clients deviate  
492 from the predictions of cumulative prospect theory (Tversky & Kahneman found 50%  
493 risky choices in questions G3, G4, G7, L3, L4, L5, L6, L7), always in the direction of  
494 (“rational”) expected value maximization. This deviation may be caused by the  
495 different population, being average non-rich civilians instead of students. There is  
496 more agreement with the findings of Birnbaum et al. (1992), who found 50% risky  
497 choices in questions G5 and G6.

498 Prospect choices for gains have been studied extensively in the literature,  
499 although mostly for students. In our sample we find a considerable majority of risk  
500 aversion for gains, in agreement with the common findings in the literature. This risk  
501 aversion is most clearly seen in questions G2 and G5. There have not been many  
502 empirical investigations into prospects with loss outcomes. These prospects are,  
503 however, central in our study because they concern the relevant outcome domain, i.e.  
504 losses ranging from 0 to 200.

505 Kahneman & Tversky (1979) found reflection, with attitudes for losses mirroring  
506 those for gains, at the level of group averages, and there we roughly confirm their  
507 findings. Reflection should not be expected to hold in a very strict sense. Attitudes  
508 for losses do not completely and exactly mirror those for gains, but are usually less  
509 pronounced and closer to expected value. For a review of empirical evidence on the  
510 latter point, see Köbberling, Schwieren, & Wakker (2005). There is no evidence to  
511 support strict reflection at the individual level in the sense that very risk averse clients  
512 for gains will be very risk seeking for losses. Thus, Cohen, Jaffray, & Said (1987)

513 found no relation between risk attitudes for gains and those for losses at the individual  
514 level. Our evidence provides even stronger counterevidence, with risk aversion for  
515 gains correlating *positively* with risk aversion for losses rather than negatively.

#### 516 **4.2. Ambiguity Attitude**

517 An interesting phenomenon appears in the group of 103 clients who received  
518 specified population-costs information. For these clients, the cost-information that  
519 they received was usually higher than expected: For the average over the seven health  
520 services of the subjective questions with values 7 (costs of health service are much  
521 higher than expected) to 1 (costs are much lower than expected), the mean was  
522 significantly below the neutrality level 4 ( $t_{102} = -2.01$ ,  $p < 0.001$ ). Hence, likelihood  
523 effects through an increased belief in bad outcomes cannot explain the increased  
524 preference for safety in this group. This is unlike the group of 83 clients who  
525 received total population-cost information. For the latter group, the costs that they  
526 were informed about were usually lower than expected ( $t_{82} = 3.95$ ,  $p < 0.001$ ), and  
527 likelihood effects could explain the increased preference for safety.

528 For the 103 clients who received specified population-costs information, not only  
529 likelihood effects, but also strategic considerations, with average costs as a signal of  
530 price, are implausible. This holds the more so as the insurance company is a  
531 nonprofit organization and screening is not permitted.

532 More information about the probability distribution, i.e. a reduction of ambiguity  
533 in the technical decision-theoretic sense, while not systematically affecting beliefs,  
534 did systematically decrease the preference value of the uncertainty. By the current  
535 conventions of decision theory, this finding must be interpreted as ambiguity seeking,  
536 contrary to the hypothesis of universal ambiguity aversion that is most popular in  
537 decision theory today. We suggest that attitudes towards ambiguity (being closer or  
538 farther away from objective statistical probabilities) are less central in human decision  
539 making than commonly thought, and that other aspects generated this finding. The  
540 situation with the extra statistical information is less natural for the clients than the  
541 situation without it, because insurance decisions that people make many times in their  
542 life and are familiar with are virtually always made without statistical information.  
543 Thus, people prefer natural situations, where they can better justify their decision to  
544 others (Trautmann & Vieider 2006).

545 In general, naturalness of the decision situation, rather than remoteness to an  
546 objective-probability state of knowledge, affects preference. In the classical Ellsberg  
547 (1961) paradoxes, a gamble on urns with compositions kept secret is less natural than  
548 one where the composition is known, and this rather than remoteness to the objective-  
549 probability state drives preference (Viscusi & Magat 1992, p. 380). Many studies  
550 have argued for the importance of emotional aspects of uncertain information other  
551 than ambiguity (Chow & Sarin 2001; di Mauro & Maffioletti 2002; Fox & Tversky  
552 1995, 1998; Fox & Weber 2002; Heath & Tversky 1991; Kilka & Weber 1999;  
553 Tversky & Fox 1995; Wakker 2004). The difficulty to control for likelihood effects  
554 explains why studies of ambiguity attitudes have been restricted almost exclusively to  
555 artificial setups with information kept secret such as Ellsberg urns, setups that are  
556 systematically biased against the ambiguous events.

557 Another effect that can underly our finding concerns the reflection effect for  
558 ambiguity at the group level. It entails that prevailing ambiguity aversion for gains is  
559 combined with prevailing ambiguity seeking for losses. Most studies of ambiguity  
560 have considered gains, and little is known about ambiguity for losses. Keren &  
561 Gerritsen (1999) found ambiguity aversion for losses, as commonly assumed in  
562 theoretical studies, and contrary to the reflection effect. Several other studies,  
563 however, found ambiguity seeking for high-probability losses (di Mauro & Maffioletti  
564 2002; Goldsmith & Sahlin 1983; Ho, Keller, & Keltyka 2002; Hogarth & Kunreuther  
565 1985; Hogarth & Kunreuther 1989; Kahn & Sarin 1988; Viscusi & Chesson 1999), in  
566 agreement with the reflection effect. Mixed results are in Cohen, Jaffray, & Said  
567 (1987), Dobbs (1991), Einhorn & Hogarth (1986), and Mangelsdorff & Weber  
568 (1994). The empirical findings of ambiguity seeking for losses agree with our  
569 findings, and cast further doubt on the universal ambiguity aversion commonly  
570 assumed in theoretical studies.

### 571 **4.3. Emotional Factors**

572 Many recent studies in decision theory have emphasized the importance of  
573 emotional factors in decision making (Elster 1998). Emotional factors may explain  
574 the stronger effects found after specified-costs information and the increased WTT  
575 after population-cost information at the end of Section 3. Clients may react stronger  
576 to specified costs simply because these costs take more attention and, thus, arouse  
577 more negative emotions (Hsee & Kunreuther 2000). Similar splitting effects have

578 been observed in other fields (Bateman et al. 1997; Carson et al. 1992; Starmer &  
579 Sugden 1993; Weber, Eisenführ, & von Winterfeldt 1988).

580 The increased WTT that we found under risk aversion and not under risk seeking  
581 is opposite to regression to the mean: the group with a higher-than-average prior WTT  
582 exhibits an even higher WTT posterior. A psychological explanation could be the  
583 confirmation bias (reviewed by Klayman 1995), a phenomenon known under various  
584 other names (Suen 2004). It entails that people select only that part of new  
585 information that confirms their previous viewpoints, leading to more extreme  
586 viewpoints. The confirmation bias would, however, suggest similar effects for  
587 population-cost information, contrary to our findings.

#### 588 **4.4. Policy Implications**

589 The observed increase in WTT for high-cost clients, which enhances adverse  
590 selection,<sup>7</sup> may be desirable from the client's short-term perspective, but is  
591 undesirable from the societal perspective in the context of insurance (Hirshleifer  
592 1971; Rothschild & Stiglitz 1976). Information about risks usually decreases the  
593 willingness to share these risks. Adverse selection can lead to a premium spiral and  
594 the breakdown of insurance (Akerlof 1970; Finkelstein 2004).

595 The positive relations that we found between effect and risk aversion seem to be  
596 desirable. Risk aversion is usually considered the normative basis for insurance.  
597 When consumers are risk averse there can be a market for insurance with benefits for  
598 all, if moral hazard and transaction costs are not too large. The domain of this  
599 research, however, concerns small losses, ranging to Dfl. 200, that occur with  
600 moderate to high probabilities. For example, 83.2% of the clients in our sample had  
601 nonzero costs and 57.1% had costs exceeding Dfl. 200. Contrary to what theoretical  
602 studies of insurance often assume, empirical studies have found considerable risk  
603 seeking in such domains. We suggest desirability of insurance only for the risk averse

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<sup>7</sup> Adverse selection usually arises from asymmetric information. In our study, the insurance company possesses the information about individual expenses and it might seem that adverse selection cannot arise. However, the insurance company should specify premiums in a uniform manner beforehand and is not permitted to use the cost information to adjust premiums. Such a use of information would constitute a violation of the privacy rights of clients. Thus, screening is excluded (Shapira & Venezia 1999), and adverse selection can occur here as it does in cases of asymmetric information (Bundorf & Simon 2006).

604 clients in our sample. For risk neutral and risk seeking clients, their risk attitude  
 605 provides an argument against insurance. Stability of expenses and the solidarity  
 606 principle (helping risk averse clients to take insurance) remain as arguments in favor  
 607 of insurance for such clients.

608 The normative debate becomes more fundamental if the observed risk attitudes  
 609 are not taken as given, but are opened to debate. It can be argued that risk neutrality  
 610 is rational for the small stakes considered in this investigation. We assumed,  
 611 however, that risk attitudes are to be taken as they are. The normative discussions of  
 612 optimal decisions in McFadden (2006 pp. 20-21) and Winter et al. (2006, p. 7932) did  
 613 not consider subjective risk attitudes of clients, but used expected-value  
 614 maximization.

615 For a practical implementation of the provision of information about individual  
 616 costs, legal guarantees for privacy protection of clients would be the major concern.  
 617 This topic lies outside the scope of this paper.

## 618 **5. Discussion of Methods**

619 For gains, the median number of risky choices was 4, which, under expected  
 620 utility with power utility (“constant relative risk aversion”) corresponds with a utility  
 621 function  $U(x) = x^r$  for any  $0.77 \leq r < 1$ . Thus, the median risk aversion index  $1-r$  is  
 622 between 0 and 0.23. For losses, the median number of risky choices was 3, which,  
 623 under expected utility with power utility, corresponds with a utility function  $U(-x) =$   
 624  $-(-x)^r$  for any  $1.097 \leq r \leq 1.186$ . This function is close to linear, and is slightly  
 625 concave. We could similarly have related the number of risky choices of every  
 626 individual to powers of utility and risk aversion indexes. Such indexes and analyses  
 627 are, however, based on expected utility theory. There is much empirical evidence that  
 628 this theory is violated descriptively (Starmer 2000), and for this reason we preferred  
 629 not to use indexes as just described.

630 Our main conclusions, obtained through a median split analysis, are based only  
 631 on the following two assumptions: (a) Questions L2 and L6 provide a risk neutrality  
 632 benchmark; (b) Individuals are more risk averse as they choose more safe options.  
 633 These assumptions are uncontroversial. Hence we did not need to resort to models  
 634 such as prospect theory (Tversky & Kahneman 1992), that are descriptively better

635 than expected utility but are analytically more complex to use and are less widely  
636 known.

637 Because population-cost information always preceded reference-group  
638 information, which always preceded individual information, order effects and  
639 interactions may obviously have arisen. These may explain the weak effects of  
640 reference-group information. The individual-cost information was sufficiently  
641 different to suggest independent factors. Because of the large numbers of forms of  
642 information to be examined<sup>8</sup>, there were not enough clients for a counterbalanced  
643 setup. Given that sequential information could not be avoided, the chosen order of  
644 information, progressively individualized, is most natural (which was also a reason  
645 for not considering randomized orders). If order and interaction effects are deemed  
646 crucial, the effects of individual-cost information should be re-interpreted as effects of  
647 individual-cost information joint with the preceding information.

648 One explanation for the general increase of WTT after population-cost  
649 information may be that, given the skewed nature of health expenses, for most clients  
650 the population averages will be larger than their own expenses, so that this  
651 information makes them more pessimistic, generating an increase of WTT. Our  
652 primary research interest, however, does not concern the marketing perspective of  
653 maximizing WTT. It, instead, concerns the prescriptive purpose of helping clients  
654 making decisions optimal for them. For the latter, results differentiating between  
655 individuals are important, and this differentiation is not affected by general increases  
656 or decreases of WTT such as possibly generated by the order effects due to prior  
657 information about averages, information that does not differentiate between  
658 individuals. Some other order effects cannot be excluded either because of the fixed  
659 order of other questions in this research. For example, the risk-attitude questions  
660 were always asked at the beginning of the interview and thereby always preceded the  
661 WTT questions. Our main conclusions are based on differences within (“effects”)  
662 and between individuals, and these are not affected by fixed biases generated by such  
663 order effects.

---

<sup>8</sup> 5 between-subject levels of summary statistics (3 reported), and risk-averse/risk-seeking and high-costs/low-costs, yields  $5 \times 4 = 20$  subgroups. The insurance company Zorg en Zekerheid wanted as many forms of information to be tested as possible. By accepting order effects, we could test three times more forms of information.

664 An important step forward was made in experimental economics when the  
665 importance of real and performance-contingent, rather than hypothetical, incentives  
666 became widely understood (Binmore 1999; Smith 1982). Unfortunately, we could  
667 measure WTT only through hypothetical survey questions, due to practical  
668 limitations. It would be preferable to elicit WTT from real choices, such as in the  
669 famous RAND study (Manning et al. 1987), and this is a topic for future research.

670 We neither used real incentives in the measurement of risk attitude, even though  
671 they could have been implemented easily there. We omitted them deliberately, for the  
672 following reasons. First, our clients, taken from the general population, participated  
673 voluntarily to help their insurance company, and thereby were intrinsically motivated.  
674 We expected that the clients' motivation would be negatively affected (crowded out)  
675 by monetary rewards. The latter holds the more so as a health insurance company  
676 such as Zorg en Zekerheid, the company that initiated this research, is supposed to  
677 bring security, and not to engage its clients in frivolous gambling for money. Frey &  
678 Jegen (2001) extensively discussed crowding-out effects. In Bleichrodt & Pinto, 2/3  
679 of the subjects participating in a health experiment did not accept the €12 flat payment  
680 offered to them, and preferred to participate for free. In general, many health  
681 investigations are funded by charity donations.

682 The second reason for not using real incentives in our measurement of risk  
683 attitude is that, for the insurance questions considered in this experiment, the relevant  
684 outcomes are losses, and the implementation of losses is problematic. Third, for the  
685 simple choices with moderate stakes considered here, it has been commonly found  
686 that the presence or absence of real incentives does not affect clients' choices much  
687 (Camerer & Hogarth 1999, pp. 8, 34; for insurance decisions, see Irwin, McClelland,  
688 & Schulze 1992; see also Hertwig & Ortmann 2001). von Winterfeldt & Edwards  
689 (1986, pp. 222/223) and Pennings & Smidts (2000) discussed the general issue of  
690 using nonbehavioral data for predicting decisions.

691 Barsky et al. (1997) used survey questions to measure the risk attitudes of  $N =$   
692 11,707 participants in the Health and Retirement Study of 1992. The participants  
693 were given a hypothetical choice between a stable income for the rest of their life, or a  
694 fifty-fifty chance of either two or  $x$  times this income. In a first question,  $x = 2/3$  was  
695 chosen and, depending on the answer, either  $x = 1/2$  or  $x = 4/5$  was chosen in a second  
696 question. In this manner, four classes of increasingly risk averse participants could be



697 distinguished, containing 64.6%, 11.6%, 10.9%, and 12.8% of the participants.  
698 Unlike our study, Barsky et al. did have information about real behavior. They found  
699 that the hypothetical survey questions about risk attitude predicted actual behavior  
700 regarding health insurance, smoking, drinking, choosing risky employment, and  
701 investments.

## 702 **6. Conclusions**

703 The risk attitudes that we observed were between the predictions of prospect  
704 theory and expected value maximization. In particular, we found no risk aversion for  
705 loss outcomes, contrary to the classical economic predictions. Customer satisfaction  
706 was improved by information, most by specified individual-cost information.

707 A reduction of ambiguity seemed to decrease rather than increase the value of  
708 uncertain options, suggesting ambiguity seeking rather than aversion. Apparently the  
709 more familiar option, rather than the one with known probabilities, is preferred,  
710 contrary to the common interpretation of the Ellsberg paradox. In most real-life  
711 decisions probabilities are unknown. We therefore conjecture that no special aversion  
712 to unknown probabilities holds in real-life decisions.

713 The following policy recommendations result from our study, where specification  
714 of costs per health service always reinforces the effects of total-cost information.  
715 From the marketing perspective of maximizing the number of insurances sold,  
716 population-cost information is optimal. From the (short-term) individual perspective  
717 of the client, individual-cost information seems to be most desirable because it  
718 enhances insurance taking for risk averse clients and for clients with high costs. From  
719 the societal perspective, individual-cost information is interesting. Its drawback of  
720 adverse selection is probably too serious to be compensated by the advantages of  
721 favorable interaction with risk attitude, increased customer satisfaction, and increased  
722 awareness of medical expenses among the general public.

723 Prospect theory played a crucial role in this study. First, it explains why we did  
724 not find universal risk aversion in the risk-attitude questions for the relevant outcomes  
725 in this investigation. Second, it explains why additional information about  
726 probabilities led to higher risk aversion even if there were no apparent increases in  
727 perceived likelihoods of losses. We, finally, followed its recommendation that for the  
728 measurement of risk attitude for insurance, mixed gambles with both gains and losses  
729 are better avoided. The pronounced risk aversion found in mixed prospects is due to

730 loss aversion rather than to the risk attitude for losses as relevant for insurance. Thus,  
731 descriptive insights from prospect theory served to derive prescriptive implications in  
732 this study. We hope that this study, carried out with a large sample of non-academic  
733 clients and dealing with natural choices, can contribute to a further understanding of  
734 risk attitudes, ambiguity attitudes, the use of descriptive theories such as prospect  
735 theory for prescriptive applications, the effects of risk information on consumer  
736 decisions, and, finally, to the usefulness of statistical information to help clients make  
737 better insurance decisions.

## 738 **Appendix A**

### 739 **Discussion of Our Constructions of Scales**

740 Questions L2, and to some extent L6, while allowing a direct calibration of risk  
741 aversion versus risk seeking at the group level, in isolation are not very reliable  
742 indexes of risk aversion at the individual level. We, therefore, used the risk aversion  
743 index based on 17 items to order clients regarding their risk aversion. Given that  
744 findings on risk attitudes for losses are controversial, we included the gain questions  
745 in our experiment primarily to verify that our design in itself does not comprise  
746 deviations from common designs. In addition, gain questions are easier to understand  
747 for participants. We decided to include these items in the risk aversion index so as to  
748 increase reliability, supported by the significantly positive correlation between the  
749 gain- and loss risk aversion indexes and between the gain-index and WTT. A  
750 drawback is that gain questions concern different outcomes than the losses considered  
751 in insurance.

752 For the scale of risk attitude, we added the choices framed as insurance decisions  
753 for reasons of validity. Stability of costs constitutes an important motive, especially  
754 for our clients who have low incomes, to take supplemental insurance against an  
755 unforeseen payment of Dfl. 200, and is an essential component of their risk aversion,  
756 but static questions do not measure it. This motive contributes to the higher risk  
757 aversion found in insurance decisions than in other risky choices (Hershey,  
758 Kunreuther, & Schoemaker 1982, p. 949/950). We similarly maintained question L7  
759 even though it reduced reliability, because high-probability losses such as in L7 are  
760 relevant to many clients.

761 Because the willingness to take supplemental insurance is central in our analysis,  
762 we measured it in several ways in a pilot experiment. Besides the WTT question used

763 in our analyses<sup>9</sup>, the same question was asked but with the planned premium specified  
764 (Dfl. 11 per month). Further, in a willingness-to-pay question, clients answered which  
765 premium they were willing to pay for supplemental insurance, both per month and per  
766 year.

767 The WTT question without premium specified appeared to be easiest for the  
768 clients and gave the best results. In debriefings at the end of our pilot studies, clients  
769 adhered more to the results of these questions than of the other questions, and  
770 expressed preference for these questions. This finding first came as a surprise to us.  
771 From an economic perspective, the decision to buy insurance cannot be sensibly made  
772 without the premium specified. Psychologically, however, the evaluation of a  
773 commodity is more basic than, and prior to, a decision of whether or not to buy the  
774 commodity at some specific price. A disadvantage of WTT with a premium specified  
775 is that the problem is then perceived as a dichotomous decision problem, where either  
776 the insurance is to be bought or not. For WTT without a premium specified, clients  
777 better differentiated their evaluations. Willingness-to-pay questions are notorious for  
778 their empirical problems. In view of these findings we decided, contrary to our prior  
779 plans, to use WTT without premium specified in the main study. Obviously, the  
780 higher the WTT, the higher the premium that a client wants to pay. This was  
781 confirmed in statistical analyses not reported here.

782 For the averages of total and specified costs, only the averages of costs truncated  
783 at Dfl. 200 are relevant to the decision problem faced by the clients, the deductible  
784 being Dfl. 200.<sup>10</sup> We nevertheless used averages of untruncated costs because these  
785 are easier to understand for the clients and because an additional purpose of the  
786 provision of information was to make the clients more aware of health expenses in  
787 general.

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<sup>9</sup> The formulation of the question (translated from Dutch): “Imagine that a deductible will become compulsory within the near future. Then would you like to take supplemental insurance, so that you need not pay the first 200 guilders yourself? 1: certainly not ...; 7: certainly yes.” The question was read to the client by the interviewer.

<sup>10</sup> The average population costs truncated at Dfl. 200 was Dfl. 125 per year. The planned premium was approximately Dfl. 132 per year.

**Appendix B**

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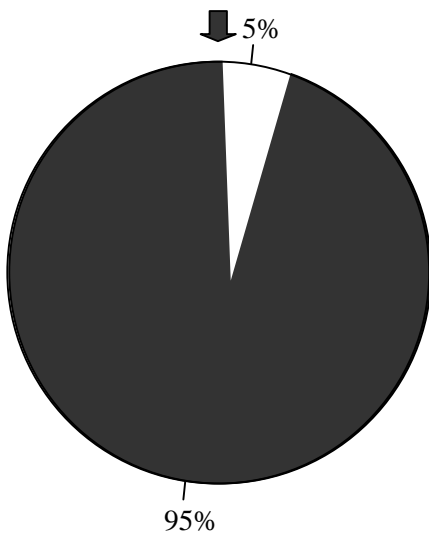
**The visual display of prospect choices G4 and L6**

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CHOICE A:

You turn the Wheel of fortune.  
If you end up in the white area,  
you receive 100 guilders. If  
you end up in the black area  
you receive nothing.



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CHOICE B:

You receive 14 guilders

MY CHOICE IS:

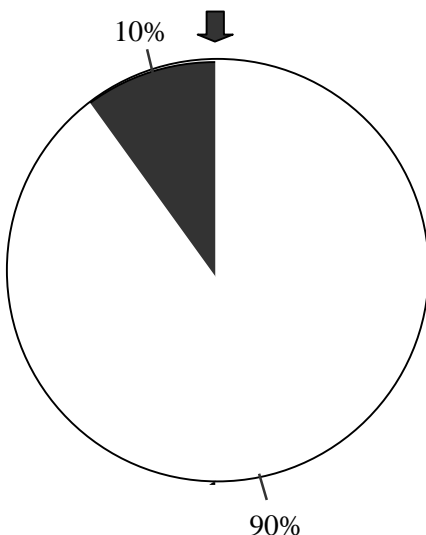
A      B

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CHOICE A:

You turn the Wheel of misfortune.  
If you end up in the black area, you  
have to pay 200 guilders. If you  
end up in the white area you pay  
nothing.



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CHOICE B:

You pay 23 guilders

MY CHOICE IS:

A      B

## 822 Explanation of the questionnaire “the wheel of fortune”

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824 The questionnaire consists of seven questions. Each time, you can choose between  
825 two options (choice A and choice B).

826

827 Choice A;

828 If you choose choice A, you have a chance of gaining an amount of money and a  
829 chance to win nothing. The “wheel of fortune” indicates how large your probability is  
830 of winning a specific amount of money.

831

832 Choice B;

833 If you choose choice B, you are sure to win a specific amount of money.

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## Appendix C

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## Complete Numerical Results of Subgroups

	total popu- lation costs	specified popu- lation costs	total indivi- dual costs	specified indivi- dual costs	probabilistic
Risk averse	Before: <b>.67</b> (.41) after: <b>.79</b> * (.35)	before: <b>.72</b> (.33) after: <b>.85</b> ** (.25)	before: <b>.67</b> (.41) after: <b>.76</b> (.37)	before: <b>.72</b> (.33) after: <b>.83</b> * (.27)	before: <b>.65</b> (.38) after: <b>.76</b> * (.30)
Risk seeking	Before: <b>.36</b> (.39) after: <b>.39</b> (.40)	before: <b>.45</b> (.42) after: <b>.55</b> * (.43)	before: <b>.36</b> (.39) after: <b>.33</b> (.40)	before: <b>.46</b> (.42) after: <b>.40</b> (.43)	before: <b>.44</b> (.39) after: <b>.44</b> (.33)
costs high	Before: <b>.50</b> (.44) after: <b>.55</b> (.44)	before: <b>.62</b> (.37) after: <b>.75</b> ** (.35)	before: <b>.50</b> (.44) after: <b>.56</b> (.45)	before: <b>.62</b> (.37) after: <b>.77</b> ** (.35)	—
costs low	Before: <b>.50</b> (.41) after: <b>.61</b> <sup>ms</sup> (.42)	before: <b>.55</b> (.42) after: <b>.61</b> (.41)	before: <b>.50</b> (.41) after: <b>.51</b> (.44)	before: <b>.56</b> (.42) after: <b>.47</b> (.43)	—
Risk averse & costs high	Before: <b>.68</b> (.40) after: <b>.70</b> (.41)	before: <b>.71</b> (.31) after: <b>.87</b> ** (.24)	before: <b>.68</b> (.40) after: <b>.73</b> (.40)	before: <b>.71</b> (.31) after: <b>.92</b> ** (.15)	—
Risk averse & costs low	Before: <b>.64</b> (.43) after: <b>.89</b> (.26)	before: <b>.71</b> (.37) after: <b>.83</b> (.26)	before: <b>.64</b> (.43) after: <b>.79</b> (.36)	before: <b>.71</b> (.37) after: <b>.70</b> (.35)	—
Risk see- king & costs high	Before: <b>.33</b> (.41) after: <b>.41</b> (.43)	before: <b>.50</b> (.44) after: <b>.62</b> (.43)	before: <b>.33</b> (.41) after: <b>.40</b> (.44)	before: <b>.50</b> (.44) after: <b>.58</b> (.45)	—
Risk see- king & costs low	Before: <b>.37</b> (.34) after: <b>.34</b> (.35)	before: <b>.42</b> (.43) after: <b>.49</b> (.42)	before: <b>.37</b> (.34) after: <b>.23</b> * (.33)	before: <b>.44</b> (.43) after: <b>.28</b> <sup>ms</sup> (.38)	—

837 TABLE C.1. Mean WTT before and after receipt of information, for five forms of

838 information and for risk averse, risk seeking, high cost, and low cost clients.

839 Significant changes (effects) are underlined.

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840

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