OVERCOMING CONSUMER BIASES IN THE CHOICE OF PRICING SCHEMES: A LAB EXPERIMENT

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Overcoming Consumer Biases in the Choice of Pricing Schemes: A Lab Experiment*

Natalia Shestakova†

Abstract

This paper uses experimental data to investigate possible biases in consumers' choice of pricing schemes when their demand is perfectly inelastic but uncertain. I consider three-part pricing schemes (i.e. fixed fee, included units, extra-unit price). The analysis suggests a strong bias towards the pricing scheme with the number of included units equal to the expected demand. I interpret this bias as an "anchoring effect" of the expected demand on consumer decisions. Interestingly, subjects invest less effort into the choice problem when the opportunity cost of a mistake is higher. Still, the higher opportunity cost of a mistake helps subjects overcome the bias.

Abstrakt

Tento článek používá experimentální data k vyšetřování možných předsudků v rozhodování spotřebitelů při výběru oceňovacích schémat v případech, kdy poptávka je perfektně neelastická, ale nejistá. Uvažuji třídílné oceňovací schéma (pevný poplatek, zahrnuté jednotky, extra cena za jednotku). Analýza naznačuje silný předsudek směrem k oceňovacímu schématu s počtem zahrnutých jednotek rovnému očekávanému počtu poptávaných jednotek. Interpretuji tento předsudek jako "upevňovací efekt" očekávané poptávky na spotřebitelovo rozhodnutí. Zajímavé je, že subjekty investují méně úsilí do problému s rozhodováním, když náklady ušlých příležitostí omylu jsou větší. Stále ale platí, že větší náklady ušlých příležitostí za chybu pomáhají subjektům překonat předsudek.

Keywords: heuristics, price discrimination, experiment

JEL classification: D42, D83

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1 Introduction

Consumer life is full of choices. Often, consumers are faced with the problem of choosing a pricing scheme. Examples include tariffs for utilities and telecom services, credit card contracts, saving and insurance plans, and many others.[1] This paper investigates how consumers deal with such choices, whether they make them optimally, and how the efficiency of these choices can be improved.

Traditional economics assumes that all consumer choices are optimal. Price discrimination is one field that relies on this assumption. The optimality assumption asserts that consumers choose pricing schemes that are the best for their demand profiles.[2] One question here is which schemes are the best, especially when the demand is uncertain. Are they those that minimize expected consumption costs, or those that guarantee the lowest range of possible consumption costs, or those that help consumers to commit to certain behavior?

From an analytical point of view, it is simpler to treat the choice that minimizes expected consumption costs as optimal and to explain observed deviations by specific consumer preferences. This is often done in the literature.[3] In this paper, I define the pricing schemes that minimize expected costs as optimal, but take into account that risk-averse consumers may consciously prefer schemes with higher expected costs but lower range of possible costs. One result of the paper is that risk aversion does not explain major deviations from optimality. This is in line with the literature on bounded rationality.

The literature on bounded rationality suggests that deviations from optimally are an outcome of thought process rather than non-standard preferences. The thought

[1]One example is the choice of mobile phone plans in the Czech Republic. The range of plans that were on the market as of April 2008 is illustrated in Fig. 1 in the Appendix.

[2]Seminal papers are Mussa & Rosen 1978[20] and Maskin & Riley 1984[18]. More recent examples can be found in, e.g., Armstrong 1996[2] and Hamilton & Slutsky 2004[15]. A good textbook reference is Laffont & Martimort 2002[17].

[3]As an example, Della Vigna & Malmendier 2006[6] explain deviations from optimality in consumer choice of health club contracts with time-inconsistent preferences and demand for commitment. Time inconsistent preferences are often used as an explanation for "strange" behavior.

process is called "heuristics" and deviations from optimality are called "biases". Even though the notion of bounded rationality was introduced by Simon already in the 1950s (see e.g., Simon 1955[23]), these concepts were popularized through the work of Kahneman and Tversky in the 1970s. More recently, work on heuristics has been done by the ABC research group (see e.g., Gigerenzer et al. 1999[13]), who propose that the usage of heuristics is efficient, despite that in some cases it leads to deviations from optimality. The research on heuristics in economics is mostly focused on the choice of gambles (see e.g., Brandstatter et al. 2006[3] and Rubinstein et al. 2010[22]). The present paper contributes to the literature by applying the concept of heuristics to the choice of pricing schemes.

I analyze consumers' choice of pricing schemes using data from a lab experiment. In the experiment, each subject is endowed with a budget and is assigned a demand for a hypothetical good. The demand is randomly drawn from a uniform distribution over a specified interval. The draw is independent for every consumption period. Subjects cannot affect the demand (that is, it is perfectly inelastic with respect to all prices) and they do not know it ex-ante. They have to select a pricing scheme in order to consume the good. A number of three-part pricing schemes (e.g. fixed fee, included units, and extra-unit price) are available. The part of the budget that remains after consumption, constitutes the payoff from the experiment. This induces subjects to choose a pricing scheme that minimizes their expected consumption costs.

The main result is the observed bias in consumers' choices towards the pricing scheme with the number of included units equal to the expected demand. The bias suggests the presence of an "anchoring effect" in the pricing-scheme choice: consumers are more attracted by options that in some way match their demand. The analysis leads to the conclusion that subjects are more likely to overcome this bias when both absolute and relative opportunity costs of a mistake are high. The opportunity cost of a mistake is measured as the difference in expected consumption costs between available pricing schemes.

To program the experiment, I use the Mouselab tool.[4] It records the process of information acquisition and measures the time spent on different tasks. I use these data to measure subjects' effort invested in the pricing-scheme choice. Analysis of these data gives insight on how the opportunity cost of a mistake affects the probability of choosing the optimal pricing scheme: subjects invest less effort into the choice problem when the opportunity cost of a mistake is higher. I propose that this happens because the higher opportunity cost of a mistake makes it easier to identify the optimal pricing scheme.

The findings of the paper are important from a theoretical point of view and have a number of policy implications. Regarding theory, the findings suggest that the incentive compatibility constraint in price discrimination models can be relaxed. Particularly, high-demand consumers are likely to stick to the pricing schemes that signal a match with their demand, even though such schemes are not optimal. Regarding policy implications, regulating authorities can be advised to require companies to avoid menus of pricing schemes with low opportunity costs of a mistake.

The paper is organized as follows. The next section reviews the related literature in more detail. Then, in the theory section, I formalize the consumer problem, list the hypotheses to be tested, and discuss the underlying intuition. In the experiment section, I explain the design and present the implementation details. I then discuss the main results and conclude.

2 Related Literature

This paper describes the results of an experiment designed to identify consumer biases in the choice of pricing schemes, their sources, and factors that can potentially reduce the biases. The idea of biases and heuristics in consumer judgements stems

[4]This tool was previously used in Johnson et al. 2002[16] to demonstrate that subjects deviate from backward induction in sequential bargaining games, and in Gabaix et al. 2006[12] to show that the directed cognition model predicts the sequence of steps in the information acquisition process better than the fully rational model.

from the work of Kahneman & Tversky in the 1970s. Of the biases they introduced, "anchoring and adjustment" bias is the most relevant one for the present study.

Among recent studies, Simonson & Drolet (2004)[24] experimentally measure anchoring effects on consumers' and sellers' reservation prices. They conclude that arbitrary numbers, e.g. the last digits of personal IDs, can serve as anchors when buyers decide about their highest willingness-to-pay, but has no effect on sellers' willingness-to-accept. Though this is (probably) the most closely related study, it still differs substantially from the present one. In the present paper, subjects do not need to decide how much they value a good; instead, they have to select a pricing scheme that allows them to consume the good at the lowest cost. Also, their expected demand, which plays the role of a possible anchor, is a part of the experimental design.

I am not aware of any experimental evidence on biases in pricing-scheme choice. However, such biases are discussed in the context of field data. For example, DellaVigna & Malmendier (2006)[6] use data on contract choice and subsequent attendance from three U.S. health clubs. They document a substantial proportion of people choosing expensive monthly contracts, with an attendance rate too low to justify this choice over a 10-visit pass. The leading explanation for this choice phenomenon is consumer overconfidence in their future attendance rates. Similarly, using data on credit card contract choice and subsequent borrowing behavior from a market experiment conducted by a large U.S. bank, Agarwal et al. (2006)[1] report a substantial fraction of consumers who choose ex-post suboptimal contracts. They also find that consumers are more likely to revise their choice when the cost of their original mistake is higher. Contrary to DellaVigna & Malmendier (2006) and Agarwal et al. (2007), Miravete (2003)[19] finds that, on average, consumers make correct tariff choices on the local telephone services market.

All three studies mentioned above use observational field data, which are the outcomes of consumers' prior beliefs regarding demand realization, their knowledge of demand elasticities, and their ability to affect demand realization, as well as attention and effort devoted to the pricing-scheme choice per se. This combination of factors possibly affecting the quality of the pricing-scheme choice makes identification of the most influential factors nearly impossible. In the experiment documented in this paper, the possible levels of demand realization and their probabilities are explicitly given to subjects, and the demand is perfectly inelastic, which also excludes the possibility to affect its level. These design features minimize the role of the first three factors, and allow focusing only on the role of devoted attention and effort on the quality of the pricing-scheme choice. This helps with identifying biases related to the choice process rather than to the ability to predict future demand realization.

The experiment reported on here and possible follow-up experiments can contribute to the literature on bounded rationality in industrial organization (see Ellison (2006)[9] for a review). So far, mainly consumers' dynamic inconsistency and their imperfect abilities to predict their future demand have been used to motivate models in this field of research (DellaVigna & Malmendier (2004)[5], Eliaz & Spiegler (2006, 2008)[7, 8], Esteban et al. (2005, 2007)[10][11], and Grubb (2009)[14] are a few examples). Exceptions are Piccione & Spiegler (2009)[21] and Chioveanu & Zhou (2009)[4] who assume that consumers might be "confused" with the "frames" that firms choose to deliver price information, and then study firms' optimal decisions regarding the complexity of frames and level of prices. The present paper offers another bias in consumer pricing-scheme choice that can be potentially exploited by profit-maximizing firms.

3 Research Hypotheses[5]

3.1 Consumer Problem

Assume that individual demand for a homogeneous good, X, is perfectly inelastic with respect to all prices as well as income. Every period, it is randomly and independently drawn from a uniform distribution with the support $[\bar{X} - \sigma, \bar{X} + \sigma]$, such that the expected demand is $\bar{X}$. A consumer is endowed with a budget, B, which is the same every period. The less she spends on the consumption of X, the higher the share of the budget remains. This is an incentive to minimize expected consumption costs.

To minimize expected consumption costs, the consumer has to make a proper pricing-scheme choice. Four pricing schemes, $j = \{1, 2, 3, 4\}$, are available for the good X. All four schemes have the same structure: a fixed fee, F_j, is to be paid at the beginning of every consumption period, then a bundle of included units, I_j, can be consumed within this period for no extra charge, and an extra-unit price, p_j, is to be paid for every unit consumed on top of the included units. Once the pricing-scheme choice is made, the consumer cannot revise it. Her pricing-scheme choice and demand realization determine consumption costs in a sequence of periods. Importantly, demand realization in every period is a new and independent draw.

I put two constraints on the menu of available pricing schemes. First, the number of included units across the schemes is such that $I_1 < I_2 \leq \bar{X} - \sigma < I_3 = \bar{X} < \bar{X} + \sigma \leq I_4$. Second, the extra-unit prices are such that $p_1 > p_2 > p_3 > p_4$. This resembles most common menus of three-part pricing schemes in markets. A numerical example of schemes used in the experiment is provided in Table 1. For the listed menu of schemes, the expected consumption costs are computed, as well as costs of consuming the lowest possible, the highest possible, and the expected demand.

[5]Note that while some hypotheses are mutually exclusive, it is not the general case.

	Included I_1	Included I_2	Included I_3	Included I_4
Fixed fee	145 ECU	230 ECU	300 ECU	325 ECU
Included units	30 unit	40 units	50 units	60 units
Extra-unit price	9 ECU	8 ECU	7 ECU	6 ECU
Expected consumption costs	325 ECU	**310 ECU**	319.09 ECU	325 ECU
Costs of consuming $\bar{X} - \sigma = 40$	235 ECU	230 ECU	300 ECU	325 ECU
Costs of consuming $\bar{X} = 50$	325 ECU	310 ECU	**300 ECU**	325 ECU
Costs of consuming $\bar{X} + \sigma = 60$	415 ECU	390 ECU	370 ECU	325 ECU
$EU = \sum_{X=40}^{X=60} \left(-10e^{-0.17X}\right) p_X$	-10307.7	-154.43	-5.43	**-.027**

Table 1: Numerical example of the menu of pricing schemes used in the experiment. ECU stands for "Experimental Currency Units". In this example, per-period budget is $B = 360$ ECU.

Define the variation in consumption costs as the difference between the costs of consuming the highest possible and the lowest possible demand. By construction, this variation is different for different pricing schemes. The variation is the highest under the scheme "Included I_1" (180 ECU), is lower under the scheme "Included I_2" (160 ECU), even lower under the scheme "Included I_3" (70 ECU), and there is no variation under the scheme "Included I_4". This pattern holds for all menus of pricing schemes used in the experiment.

A rational risk-neutral consumer cares about variations in consumption costs as long as they affect the expected consumption costs. For such a consumer, the first-best scheme is the one that minimizes the expected consumption costs. In the numerical example in Table 1, it is the scheme "Included I_2". The assumptions of full rationality and risk-neutrality lie behind the original (null) hypothesis.

Hypothesis 1. The probability of choosing the pricing scheme that minimizes expected consumption costs is equal to 1.

Previous studies have shown that consumers are generally risk-averse, and the lowest estimated coefficient of constant risk aversion is 0.17. Applied to pricing-scheme choice, risk aversion implies that the first-best scheme is not necessarily the one that minimizes the expected consumption costs. In the numerical example, I use a constant risk-aversion utility function to find which scheme is the first-best for the risk-averse consumer. It appears to be the scheme "Included I_4", which is not the same as the expected-costs-minimizing pricing scheme. This leads to the following hypothesis.

Hypothesis 2. The probability of choosing the pricing scheme that minimizes the expected consumption costs is different from 1 due to consumers' risk aversion.

The hypothesis implies that consumers do not choose the pricing scheme that minimizes the expected consumption costs when the variation in possible consumption costs under this scheme is too high (in the numerical example, this is the scheme "Included I_2" with expected consumption costs of 310 ECU and variation in possible consumption costs equal to 180 ECU). In this case, risk-averse consumers go for a scheme with higher expected consumption costs but lower variation in possible consumption costs (in the numerical example, this is the scheme "Included I_4" with expected consumption costs of 325 ECU and variation in possible consumption costs equal to 0 ECU). The last scheme is their first-best. However, in the problem that I consider here, risk aversion should not be strong. The reason is that consumers choose a pricing scheme for a sequence of periods, while demand realization is independent in every period.

Though the definition of first-best pricing scheme is different in the previous two cases, both hypotheses above predict unit probability of choosing the first-best scheme. That is, the risk-neutral consumer always chooses what is the best for her, and it is always the scheme that minimizes the expected consumption costs. At the same time, the risk-averse consumer always chooses what is the best for her, and it is not always the scheme that minimizes the expected consumption costs. Both hypotheses assume no cognitive costs of identifying the first-best scheme. The next hypothesis allows for the possibility that the cognitive effort required for doing so is sometimes too high.

Hypothesis 3. Consumers deviate from the first-best pricing-scheme choice because they do not invest enough effort into finding such a scheme.

This hypothesis does not specify how exactly consumers deviate from the first-best choice. It implicitly assumes that all deviations are random, at least when they are aggregated across consumers. No systematic pattern in the deviations is equivalent to no cognitive biases in the pricing-scheme choice. However, as such biases are observed in many other domains, they are also likely to appear in the pricing-scheme choice. The main question of this paper is whether it is indeed so.

Biases can be present in the pricing-scheme choice due to special heuristics used for making the choice. In the next subsection, I discuss two possible heuristics. The first heuristic is to choose the scheme with the lowest costs of expected consumption. In the numerical example, the expected consumption is 50 units, and the scheme that has the lowest costs for consuming 50 units is the scheme "Included I_3". The second heuristic is to choose the scheme with the number of included units being equal to the expected demand. In the numerical example, it is again the scheme "Included I_3". In the experiment, it is generally the case that both heuristics lead to bias towards the scheme "Included I_3". The discussion directly applies to the case of risk-neutral consumers, but it can also be extended to the case of risk-averse consumers.

3.1.1 Role of Heuristics

One possible heuristic is to choose the scheme with the lowest costs of expected consumption. For the schemes "Included I_1", "Included I_2", and "Included I_4", the costs of expected consumption are always equal to the expected consumption costs. However, it is never the case with the scheme "Included I_3". Precisely, the cost of expected consumption is always lower than the expected consumption cost under this scheme. The effect of the specified heuristic is formalized in the next hypothesis.

Hypothesis 4. Other things equal, the probability of choosing a particular pricing scheme is higher when this scheme has lower costs of expected consumption than any other scheme.[6]

This hypothesis predicts that the scheme “Included I_3” is always chosen when it is the first-best, and it is often chosen when another scheme is the first-best. This does not apply to any other pricing scheme. Hence, the heuristic “choose the scheme with the lowest costs of expected consumption” leads to bias towards the scheme “Included I_3”.

Another possible heuristic leads to the same bias. This heuristic is to choose the scheme with the number of included units being equal to the expected demand. In this case, the bias appears because consumers rely too heavily on such a piece of information as the number of included units. This potentially happens because the expected demand serves as an anchor. To distinguish the anchoring effect from the effect of the previous heuristic, I test the following hypothesis.

Hypothesis 5. Other things equal, the probability of choosing the scheme “Included I_3” is higher due to the number of included units being equal to the expected demand.

The hypothesis says that a higher probability of choosing the scheme “Included I_3” cannot be explained by any other factors, including the heuristic “choose the scheme with the lowest costs of expected consumption”, or risk aversion.

3.2 Overcoming Biases in Pricing-Scheme Choice

I define biases in pricing-scheme choice to be systematic deviations from the first-best. It is not a bias when a risk-averse consumer chooses a scheme that does not minimize the expected consumption costs but has the lowest variation in possible consumption costs. But it is a bias when any consumer chooses the scheme “Included I_3” only because this scheme has the number of included units equal to the expected demand. Biases are often a result of heuristic thinking. In this section, I discuss factors that may bypass heuristics and, hence, reduce biases. Again, if not mentioned

[6]Note again that this does not imply that the scheme “Included I_3” is the first-best even for the risk-neutral consumer.

otherwise, I restrict the discussion to the case of risk-neutral consumers.

3.2.1 Opportunity Cost of a Mistake

Optimization-under-constraint models suggest that when optimization requires some effort, consumers compare the costs and benefits of this effort prior to undertaking it. Define the difference between the expected consumption costs of the scheme to be chosen, EC_j, and the minimized expected consumption costs, EC_{FB}, as the opportunity cost of a mistake. Then the benefit from investing more effort into the pricing-scheme choice is equal to the opportunity cost of a mistake. To learn the opportunity cost of a mistake implies that a consumer learns the minimized expected consumption costs. In this case, there is no reason for a risk-neutral consumer to choose a scheme that does not minimize expected consumption costs.

I assume that consumers do not know the opportunity cost of a mistake precisely, but their expected opportunity cost of a mistake is proportional to the actual one. So is the expected benefit from investing more effort into the pricing-scheme choice. Under the assumption that the cost of effort does not depend on the opportunity cost of a mistake, the following hypothesis is made.

Hypothesis 6. Other things equal, consumers invest more effort in the pricing-scheme choice when the opportunity cost of a mistake is higher (because they anticipate a higher benefit).

The underlying assumption of no connection between the cost of effort and the opportunity cost of a mistake is questionable. It is likely that the required effort is (exogenously) lower when the opportunity cost of a mistake is higher. The reason is that it becomes easier to identify which scheme minimizes the expected consumption costs. Once the required effort is lower, the invested effort is (endogenously) also lower. This is the next hypothesis.

Hypothesis 7. Other things equal, consumers invest less effort in the pricing-scheme choice when the opportunity cost of a mistake is higher (because the problem of finding the best scheme becomes easier).

Comparison of the previous two hypotheses suggests that the effect of the opportunity cost of a mistake on the effort invested in the pricing-scheme choice is not obvious. However, in both cases, it has a positive effect on the probability of choosing the scheme that minimizes expected consumption costs (for the risk-neutral consumer). In the first case, it is an indirect effect that comes through inducing consumers to invest more effort. In the second case, it is a direct effect of making the problem easier. This leads to the following hypothesis.

Hypothesis 8. Other things equal, the probability of choosing the scheme that minimizes the expected consumption costs is higher when the opportunity cost of a mistake is higher.

This hypothesis implies that by increasing the opportunity cost of a mistake, it is possible to reduce heuristic thinking at least to some extent. This, in turn, reduces the biases in pricing-scheme choice.

3.2.2 Absolute vs. Relative Opportunity Cost of a Mistake

The discussion in the preceding subsection is about the absolute opportunity cost of a mistake, that is, the difference between EC_j and EC_{FB} regardless of their values. There, I note that risk-neutral consumers are not likely to choose other than the expected-cost-minimizing scheme if they know this difference precisely. I assume that consumers form beliefs regarding this difference. In the process of forming such beliefs, the values of EC_j and EC_{FB} might appear to be relevant. In that case, the relative opportunity cost of a mistake matters for the probability of choosing the first-best pricing scheme. The relative opportunity cost of a mistake is defined as $(EC_j - EC_{FB})/EC_{FB}$.

Hypothesis 9. Other things equal, the probability of choosing the scheme that minimizes the expected consumption costs is higher when the relative opportunity cost of a mistake is higher.

Note that the relative opportunity cost of a mistake is higher when the expected consumption costs are lower. This leads to a paradox, namely that consumers are more willing to save the same amount of money on cheap goods (like a calculator) than on expensive goods (like a suit).

3.2.3 Level of Uncertainty

In this paper, I use risk aversion as a potential explanation for deviations from the expected-cost-minimizing choices. Risk-averse consumers consciously prefer schemes with higher expected consumption costs but lower variations in possible consumption costs. A higher level of uncertainty is associated with a higher variation in possible consumption costs under the schemes "Included I_1", "Included I_2" and "Included I_3". This implies that risk-averse consumers are more likely to choose the scheme "Included I_4" with no variation in possible consumption costs, when the level of uncertainty is higher. This is formalized in the following hypothesis.

Hypothesis 10. Other things equal, the probability of choosing the scheme that minimizes the expected consumption costs is lower when the level of uncertainty is higher.

This effect of uncertainty is related to improving the efficiency of pricing-scheme choice. So, reducing uncertainty might be important from this perspective.[7]

4 Experiment

4.1 Design

Depending on the session, the experiment consists of 27 or 30 tasks. Every task is represented by a pricing-scheme choice and six consumption periods. In a task t, a subject i has to select one pricing scheme out of four offered to him/her. Overall,

[7]In this paper, I do not deal with heuristics and resulting biases related to the presence of uncertainty. For detecting such heuristics, research on lotteries is more appropriate.

the experiment is designed such that subjects' incentives to maximize their expected earnings are equivalent to their incentives to choose the pricing scheme with the lowest expected consumption costs. The role of risk aversion is minimized by imposing six consumption periods.

At the stage of pricing-scheme choice, a subject knows that the chosen pricing scheme is used to compute his/her consumption expenditures in the subsequent six consumption periods. At the consumption stage, no action is required from a subject. His/her demand for a period r of a task t, D_{tir}, is drawn randomly and independently from a discrete uniform distribution with the support $\left[\bar{X} - 5\varepsilon_{\text{ti}}, \bar{X} + 5\varepsilon_{ti}\right]$, where $\varepsilon_{ti} = \{1, 2\}$ is the uncertainty measure.[8]

Based on the demand realization and the prior pricing-scheme choice, the consumption expenditures, C_{tir}, are computed. Then the computed consumption expenditures are subtracted from the endowed per-period budget, B_{tir}, to determine the subject's earnings. Earnings in task t are equal to the sum of earnings in all periods of this task. Instructions contain this general information about the experiment. The experimenter reads them at the beginning of the experiment, and they stay open in a separate window on the computer screen during the experiment.[9]

At the stage of pricing-scheme choice, the values of $\bar{X}$, ε_{ti}, and $\{B_{tir}\}_{r=1,\ldots,6}$ are explicitly shown on the screen (Fig. 2 in the Appendix). A subject can learn the parameters of the pricing schemes, $\{F_{tij}, I_{tij}, p_{tij}\}_{j=1,\ldots,4}$, at no monetary cost by clicking on the specified part of the screen. He/she can open only one parameter at a time. The Mouselab Web tool records the sequence of information acquisition together with the time span for which every parameter is displayed on the screen.

[8] Note that the support set consists of 11 elements for every level of uncertainty. When $\varepsilon_{ti} = 1$, the set is $\{45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55\}$ units. When $\varepsilon_{ti} = 2$, the set is $\{40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60\}$ units. In both cases, the same number of arithmetic operations is needed for computing the expected costs.

[9] The instructions from the last three sessions are at http://home.cerge-ei.cz/shestakova/anchorWEB/start.html. They differ ffom the instructions for the first two sessions by the number of experimental tasks, the expected earnings expressed in ECU, and the transfer rate from ECU to CZK. To enter the experiment, contact the author for a valid subject number.

Subjects can take notes during the experiment. They can, for instance, copy all the parameters they are interested in on paper. During the pricing-scheme choice, a simple calculator is available for making necessary computations. I also collect data on performed calculations.

A subject i learns his/her demand realization and corresponding earnings for every period of task t right after he/she makes the pricing-scheme choice (Fig. 3 in Appendix). Prior to the main experiment, there are two practice tasks to get subjects familiarized with the structure of the experiment. They do not get earnings from the practice tasks.

Subjects work through the experiment at their own pace. After they complete all tasks, the total earnings, which are the sum of earnings in all tasks, appear on the screen (Fig. 4 in Appendix).[10] In the experimental tasks, all monetary values are measured in experimental currency units (ECU). The final earnings are transfered to Czech crowns (CZK)[11] at the rate 1 ECU to 0.05/0.045 CZK depending on the number of tasks in the session.

In the conducted experiment, $\bar{X} = 50$ for all subjects in all tasks in all sessions. In Session 1, $\varepsilon_{ti} = 1$ for all t and i. In Session 2, $\varepsilon_{ti} = 2$ for all t and i. In Sessions 3-5, subjects are randomly assigned into one of four treatments. In every treatment, there are tasks with both $\varepsilon_{ti} = 1$ and $\varepsilon_{ti} = 2$, so that the effect of uncertainty can be estimated using both within- and between-subject variations. The bundles of inclusive units are the same for all subjects in all tasks in all sessions: $I_{ti1} = I_1 = 30$, $I_{ti2} = I_2 = 40$, $I_{ti3} = I_3 = 50$, and $I_{ti4} = I_4 = 60$ for all t and i. The extra unit prices vary across tasks but they are the same for all subjects within the same task: $p_{tij} = p_{tj}$ for all i. The fixed fees also vary across tasks and there are slight variations across subjects from different treatments within one task.[12] The per-period budget

[10]The sum of earnings in all tasks rather than earnings from a randomly chosen task is paid mainly due to the fact the maximum expected earnings in some tasks are twice higher than in others. This information is not supposed to be explicitly revealed to subjects, while it would have to be revealed if only earnings from a randomly chosen task were paid.

[11]1 Czech crown is approximately 0.05 U.S. dollars.

[12]Variations in fixed fees are only needed to equalize the expected payoffs of the "Included 50"

varies across tasks but not across subjects within one task; it is also the same in all six periods within one task, $B_{tir} = B_t$. All the above variations are such that the expected earnings from a scheme j in a task t are the same for all subjects in all treatments.

A potential effect of risk-aversion is addressed in the results section. Otherwise, I assume risk-neutrality of subjects. Under this assumption, the scheme that minimizes the expected consumption costs is the first-best scheme. For convenience, I rank the remaining schemes into the second-, third-, and fourth-best based on the associated expected earnings. The last two schemes are always associated with the same expected earnings.

To test the hypotheses introduced in the previous section, certain variations across tasks are imposed (Table 2). In all experimental sessions, there are 9 tasks where the scheme "Include 30" is the first best, 9 tasks where it is the scheme "Included 40" and 9 tasks where it is the scheme "Included 50". Sessions 3-5 have three extra tasks where two schemes, "Included 60" and one of the above are both the first best. The tasks further vary in the highest expected per-period earnings, which is either 100 ECU (high-stake tasks), or 50 ECU (low-stake tasks). The difference between the first-best and the second-best schemes varies between 0 ECU and 30 ECU, and the difference between the second-best and the third-best schemes varies between 0 ECU and 10 ECU. The generated difference between the first-best and the third-best schemes is between 10 ECU and 40 ECU.

Testing for the usage of "choose the scheme with the lowest costs of consuming $\overline{X} = 50$ units" heuristic is possible due to the presence of tasks where this heuristic does not correctly identify the first-best scheme. These are 3 tasks with $\varepsilon_{ti} = 1$ and 9 tasks with $\varepsilon_{ti} = 2$. For convenience, these tasks are referred to as ones with a "misleading design". These are also tasks with lower costs of a mistake (see Table 2).

scheme in tasks with different uncertainty levels.

4.2 Implementation

Data from the web-based experiment were collected in five sessions. Except for Session 2, where they were CERGE-EI preparatory semester students, subjects were undergraduate students registered in the database for experiments.[13] They were invited to the CERGE-EI computer lab, which has 18 machines. Sessions were conducted in July - August 2010. A total of 71 participants showed up. Available individual characteristics are summarized in Table 3.

The average time spent on the experiment was 45 minutes, and the average earnings were 541 CZK. For those subjects who spent less than average time on the experiment, the average earnings were 533 CZK. For those subjects who spent more than average time on the experiment, the average earnings were 556 CZK. The difference is small but statistically significant.

The distribution of expected-cost-minimizing choices across the tasks is presented in Table 4. The difference in the proportion of such choices across those who spent less and more than average time on the experiment is also significant. The proportions are 52.4% for the first group, and 66.4% for the second group.

5 Results

If not mentioned otherwise, I only use data from 27 tasks where the expected-cost-minimizing scheme is unique. The reason is that in the remaining 3 tasks, where two schemes are expected-cost-minimizing, there is no variation in the main task characteristics. Therefore, the estimated effects of task characteristics can become inconsistent. I use the data from these three tasks to see whether there is a strong preference for the scheme "Included 60". This scheme has no variation in possible consumption costs, and hence should be attractive to risk-averse subjects.

[13] Students can register in the database through the webpage: http://www.experimenty.eu/public/.

5.1 Biases in Pricing-Scheme Choice

Rational risk-neutral consumers always choose pricing schemes that minimize their expected consumption costs. These are the first-best schemes for them. The first result says that there is a substantial number of deviations from optimizing behavior in the pricing-scheme choice (see also Table 5).

Result 1. The proportion of pricing-scheme choices that minimize expected consumption costs is 55.56%. This proportion is 69.7% in the tasks where the scheme "Included 50" minimizes expected consumption costs, and 48.5% in those tasks where it is either "Included 30" or "Included 40".[14]

The first result says that subjects' choice is less likely to deviate from the expected-cost-minimizing schemes when this scheme is "Included 50". That is, the deviations are present and they are not random. This result rejects both Hypotheses 1 and 3. Two explanations for this result are possible.

The first explanation is risk aversion (Hypothesis 2). It shifts subjects' choices towards the scheme with a lower variation in possible consumption costs. I impose a constant risk-aversion utility function and use the lowest estimate for the coefficient of absolute risk aversion, $r_A = 0.17$, to predict pricing-scheme choices for potentially risk-averse subjects. The predicted choices deviate from the expected-cost-minimizing ones more often when the expected-cost-minimizing one is "Included 30" or "Included 40", than when it is "Included 50". Moreover, risk aversion predicts that the deviations from the expected-cost-minimizing choices are towards the scheme "Included 60".

The second explanation for Result 1 is heuristic thinking (Hypotheses 4 and 5). As follows from the discussion in Section 3.1.1, heuristics thinking shifts subjects' choices towards the scheme "Included 50". Naturally, there are fewer choices that deviate from the expected-cost-minimizing schemes when such a scheme is "Included

[14]All differences mentioned in the results are statistically significant if not otherwise mentioned. Standard errors and confidence intervals can be found in the corresponding tables.

50”.

As the next step I test whether the deviations from the expected-cost-minimizing choices are more likely to be towards “Included 50” or “Included 60” (see Table 6). I use only the tasks where the expected-cost-minimizing choice is “Included 30” or “Included 40”. The next result favors heuristic thinking (Hypotheses 4 and 5) more than risk-aversion (Hypothesis 2).

Result 2. When the expected-cost-minimizing scheme is “Included 30”, the scheme “Included 50” is chosen more often (34.5% of cases) than the scheme “Included 60” (15.1% of cases). Also, when the expected-cost-minimizing scheme is “Included 40”, the scheme “Included 50” is chosen more often (25.7% of cases) than the scheme “Included 60” (12.5% of cases).

Finally, I use the three extra tasks from Sessions 3-5 to test the preference for the scheme “Included 60”. In those tasks, the scheme “Included 60” and one of the remaining schemes both minimize expected consumption costs. The next result summarizes the differences in the proportion of subjects who chose “Included 60” over one of the remaining schemes.

Result 3. There is no difference between the probability of choosing “Included 60” and “Included 50” when both of them are associated with the highest expected earnings. The probability of choosing “Included 60” is higher than the probability of choosing the second scheme associated with the highest expected earnings, when this scheme is “Included 30” or “Included 40”.

This result indicates that some subjects are risk averse. However, the role of risk aversion in the pricing-scheme choice is not stronger than the role of heuristic thinking.

5.2 Overcoming Biases

Table 4 rates tasks based on the subjects’ performace. It illustrates that subjects perform better, that is, more of them choose the scheme that minimizes expected costs, in those tasks where the maximum expected payoff is higher, and where the cost of a mistake is higher. This observation is supported by the t-tests reported in Table 6. In addition, performance in the tasks with $\varepsilon_{ti} = 1$ is better than in the tasks with $\varepsilon_{ti} = 2$, and in the tasks with no misleading design it is better than in the tasks with misleading design.

The differences reported in Table 6 point at correlations but do not yet provide evidence for causal effects. The reason is that there is also a correlation between the task characteristics. In particular, misleading design is more common for tasks with a higher uncertainty level and a lower opportunity cost of a mistake. Also, the maximum expected payoff is, on average, higher for tasks witt a higher cost of a mistake. To estimate the causal effects, multivariate analysis is needed. Hence, I use the above task characteristics together with available individual characteristics as explanatory variables in the model for the probability of the first-best pricing-scheme choice. In the discussion that follows, the first-best choice is the expected-cost-minimizing one. The model is the following:

$$FB_{ti} = \alpha + \beta Z_t + \gamma X_i + \delta_1 UNCERT_{ti} + \delta_2 MISLEAD_{ti} + \nu_{ti},$$

where X_i is a vector of available individual characteristics,[15] $UNCERT_{ti}$ is dummy for the uncertainty level, $MISLEAD_{ti}$ is dummy for misleading design, and Z_t is a vector of remaining task characteristics in task t for subject i. The estimates of the linear probability and the probit models are presented in Table 8. First, they confirm that the deviations are least common when "Included 50", the scheme with the number of included units equal to the expected demand, is the first-best (see also Result 1).

Result 4. Other things equal, the share of first-best choices is 13.5 p.p. higher

[15] From all individual characteristics, only gender and field of study have significant effects on the probability of choosing the first-best scheme. Therefore, I exclude other individual characteristics from the final model specification.

when the first-best scheme is “Included 40” and 24 p.p. higher when the first-best scheme is “Included 50”. Tasks where the first-best scheme is “Included 30” are the baseline.

Once again, this result says that subjects are more likely to select the scheme that minimizes their consumption costs, when this scheme is “Included 50”. Result 2 suggests that the most likely reason is that subjects use heuristic thinking. The next two results distinguish between the two possible heuristics.

Result 5. Other things equal, the probability of making the first-best pricing-scheme choice is 13.5 p.p. lower in the tasks with misleading design than in the remaining tasks.

This result supports Hypothesis 4, that subjects tend to choose the scheme with the lowest costs of expected consumption. In those tasks where this heuristic does not identify the expected-cost-minimizing scheme correctly, subjects are less likely to choose it. If Hypothesis 4 fully explains the observed bias towards the scheme “Included 50”, then there should be no systematic deviations in the tasks with non-misleading design. However, the next result says the opposite (Table 9).

Result 6. Consider only the tasks with a non-misleading design. Other things equal, the share of the first-best choices is 14.2 p.p. higher when the first-best scheme is “Included 40”, and 23.9 p.p. higher when the first-best scheme is “Included 50”. Tasks where the first-best scheme is “Included 30” are the baseline.

This result supports Hypothesis 5, that subjects tend to choose the scheme with the number of included units equal (or being close) to the expected demand. That is, the expected demand causes an anchoring effect in the pricing-scheme choice.

The preceding results indicate a strong bias towards the pricing scheme “Included 50” for the consumer with perfectly inelastic demand drawn from the range $[50-5\varepsilon_{ti}, 50+5\varepsilon_{ti}]$ idependently for every period. Next, I estimate the effects of factors that can potentially reduce the bias. From an economic perspective, the most powerful factor is the cost of a mistake. I measure this factor with the difference in expected consumption costs between the first-best and the second-best schemes. It does, indeed, have a positive effect on the quality of pricing-scheme choice (Table 10).

Result 7. Other things equal, the share of first-best choices is 7.9 p.p. higher in tasks with a higher cost of a mistake.

The result supports Hypothesis 8. To identify how the improvement in performance is achieved (Hypothesis 6 or 7), I estimate the effect of the cost of a mistake on the actually invested effort (Table 10). I measure the actually invested effort using the data collected with the Mouselab tool.

Result 8. Other things equal, subjects spend less effort measured by time (by 28.08 seconds), number of clicks on the pricing schemes' parameters (by 1.22 clicks) and number of computations made on the provided calculator (by 0.12 computations) in tasks with a higher cost of a mistake.

This result clearly favors Hypothesis 7 over Hypothesis 6. That is, a higher cost of a mistake makes it easier for subjects to find the first-best pricing-scheme, rather than incentivizing them to treat the problem more carefully. This result also indicates that subjects respond to the attributes of the problem. Once they respond to the absolute cost of a mistake, it is also possible that they respond to the relative cost of a mistake (Hypothesis 9). I use the level of expected payoff as an indicator for the relative cost of a mistake. A higher level of expected payoff implies a lower level of expected consumption costs and, hence, a higher relative cost of a mistake for a given absolute cost of a mistake. The next result summarizes the effect of the expected payoff (Table 8).

Result 9. Other things equal, the share of first-best choices is 4.4 p.p. higher in tasks with a higher expected payoff.

This result implies that subjects repond not only to the absolute but also to the relative cost of a mistake. To stress the meaning of this result, subjects are more likely to choose the first-best scheme in the task where its expected payoff is 100 ECU and the second-best scheme's expected payoff is 90 ECU than in the task where the first-best scheme's expected payoff is 50 ECU and the second-best scheme's expected payoff is 40 ECU. The effort required for finding the first-best scheme and the marginal payoff from doing so is the same in both cases.

The result can be explained as that subjects use the expected payoff of one scheme as a [false] signal of how much they can benefit by investing more effort into finding the first-best scheme in the corresponding task. This explanation is also supported by the effect of the expected payoff on the actually invested effort (Table 10).

Result 10. Other things equal, subjects spend more effort measured by time (by 17.88 seconds) and number of computations made on the provided calculator (by 0.7 computations) in tasks with a higher expected payoff.

Result 7 suggests that the bias towards the scheme "Included 50" can be reduced by increasing the absolute cost of a mistake. Result 9 adds that the effect is stronger for the case of cheaper goods, as the relative cost of a mistake is higher then. Another way to improve the efficiency of pricing-scheme choice is to reduce the effect of risk aversion. This can be done by decreasing the uncertainty range. However, the next result shows that the uncertainty range has no effect on the probability of choosing the expected-cost-minimizing scheme.

Result 11. Other things equal, the uncertainty range does not have a significant effect on the probability of the first-best pricing-scheme choice.

The low degree of risk aversion presented in the considered consumer problem can explain the previous result. However, it is worth noting that the misleading design is more common in the tasks with a higher uncertainty range. The misleading design, in turn, has a negative effect on the probability of choosing the first-best pricing scheme. Hence, reducing the uncertainty range can improve the quality of the pricing-scheme choice by reducing the probability of misleading design.

Next, I estimate the effects of task characteristics on the probability of choosing a particular pricing scheme regardless of this scheme being the first-best (Tables 11 and 12). The estimates suggest that avoiding a misleading design is the most efficient way of improving the quality of pricing-scheme choices.

Result 12. Other things equal, the probabilities of choosing the schemes "Included 30" and "Included 40" are lower (by 6.5 and 7.9 p.p., correspondingly), while the probabilities of choosing the schemes "Included 50" and "Included 60" are higher (by 12.5 and 5 p.p., correspondingly), in the tasks with misleading design.

In addition, the effect of uncertainty on the probability of choosing a particular pricing scheme reveals an interesting pattern.

Result 13. Other things equal, the probability of choosing the scheme "Included 40" is 5.4 p.p. lower, while the probability of choosing the scheme "Included 50" is 7 p.p. higher, in the tasks with a higher uncertainty range. The probabilities of choosing schemes "Included 30" and "Included 60" are not affected.

The result suggests that a higher uncertainty range makes subjects more risk averse but does not shift their choices towards the scheme with no variation in the consumption costs. Instead of switching to the scheme "Included 60", they switch to the scheme "Included 50". This behavior cannot be predicted with a constant risk-aversion utility function.

Finally, I also observe some interesting patterns related to the difference between economics and non-economics students in the data. As expected, the former generally perform better (Table 8), but also spend more effort on the pricing-scheme choice (Table 10).

Result 14. Other things equal, the probability of choosing the first-best pricing scheme is 16.6 p.p. higher for economics students. At the same time, the economics students spend more effort measured by time (by 13.67 seconds) and number of clicks (by 4.85 clicks) on making the choice.

The result can be interpreted as that non-economics students are more likely to make random choices, which obviously requires less effort and leads to a lower chance of choosing the first-best scheme. This interpretation is also supported by the fact that the economics students are more biased towards the scheme "Included 50" and less likely to choose the scheme "Included 60", which is never first best (Tables 11 and 12).

Result 15. Economics students are 11.6 p.p. more likely than other subjects to choose the scheme "Included 50" regardless of that scheme being the first best. They are 9.5 p.p. less likely than other subjects to choose the scheme "Included 60", which is never the first best. There is no difference between economics and non-economics students in the probability of choosing the schemes "Included 30" and "Included 40".

Combined with the previous one, this result suggests that economics students perform better in pricing-scheme choice due to their bias towards the scheme "Included 50" with the number of included units being equal to the expected consumption and due to their ability to overcome this bias when the effort required for finding the first-best scheme is low. The latter is supported by the next result (Table 13).

Result 16. For economics students, the positive effect of the cost of a mistake on the probability of choosing the first-best scheme (11.9 p.p.) is higher than it is for non-economics students.

Based on Results 14−16, subjects with economics education can be characterized as both more efficient and more productive in the pricing-scheme choice tasks.

6 Conclusion

The paper presents an experiment where biases towards pricing schemes and their potential causes can be identified. The considered pricing schemes are such that a number of consumption units is included into a fixed fee, and a unit price has to be paid for additional units. The problem is constrained to the case of inelastic but uncertain demand, such that the uncertainty range is apriori known. This excludes biases related to consumer dynamic inconsistency and overconfidence. Still, there are biases observed in the collected data.

The strongest bias is towards the scheme with the number of included units equal to the expected demand. Two explanations for this bias are suggested. The first is the heuristic “choose the pricing scheme with the lowest costs of expected consumption”, which makes the scheme with the number of included units equal to the expected demand more attractive than it is, and in some cases wrongly identifies it as the first best. Those cases when this heuristic does not correctly identify the first-best scheme are more common when the uncertainty range is higher. However, this heuristic does not fully explain the bias.

The second proposed explanation for the observed bias is the anchoring effect that the expected demand has on consumer decisions. This explanation is especially valid when identifying the first-best scheme is cognitively demanding and consumers prefer to guess. These are the cases when the cost of a mistake, measured by the difference in the expected costs of the first-best and the second-best schemes, is low. This is also what the data analysis suggests.

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Appendix

Stake	Cost of mistake		Relative cost of	Misleading design	
	1st-degree	2nd-degree	mistake 2nd-degree	$\varepsilon_{ti} = 1$	$\varepsilon_{ti} = 2$
50 ECU	5 ECU	10 ECU	20%	Included 30, 40	Included 30, 40
50 ECU	10 ECU	15 ECU	30%	Included 40	Included 30, 40
50 ECU	10 ECU	20 ECU	40%	-	Included 30, 40
100 ECU	0 ECU*	20 ECU	20%	-	-
100 ECU	10 ECU	20 ECU	20%	-	Included 30, 40
50 ECU	15 ECU	20 ECU	40%	-	-
100 ECU	20 ECU	20 ECU	20%	-	Included 30
50 ECU	20 ECU	25 ECU	50%	-	-
100 ECU	20 ECU	30 ECU	30%	-	-
100 ECU	30 ECU	40 ECU	40%	-	-

Table 2: Summary of experimental design. "Stake" corresponds to the maximum expected payoff, "cost of mistake" corresponds to the difference in the expected payoffs: "1st-degree" is between the first-best and the second-best schemes, and "2nd-degree" is between the first-best and the inferior schemes. In each category there is a task with the scheme "Included 30" being the first best, a task with the scheme "Included 40" being the first best, and a task with the scheme "Included 50" being the first best. (*) This type of task was not included in Sessions 1-2.

Individual characteristic	Session 1	Session 2	Session 3	Session 4	Session 5	**Total**
Gender:						
- male	10	8	16	8	11	**18**
- female	2	4	0	6	6	**53**
Field of study:						
- economics	3	4	8	9	13	**37**
- math	3	7	2	3	2	**17**
- other	6	0	6	2	1	**15**
Year of addmission:						
- before 2006	3	-	6	7	2	**18**
- 2006-2007	3	-	4	4	9	**20**
- after 2007	6	-	5	1	6	**18**
Year of birth:						
- before 1986	4	3	8	7	2	**24**
- 1986-1987	4	3	3	3	6	**19**
- after 1987	4	1	4	3	8	**20**
Mobile operator:						
- Vodafone	5	-	9	6	7	**27**
- Telefonica O2	3	-	5	4	7	**19**
- T-mobile	3	-	2	3	3	**11**
Number of subjects:	12	12	16	14	17	**71**
Avg. earnings (CZK):	537	509	551	542	554	**541**
Avg. time (min)	27	58	45	47	45	**45**

Table 3: Distribution of individual characteristics across experimental sessions. If observations do not sum up to the total number of subjects, there are missing observations.

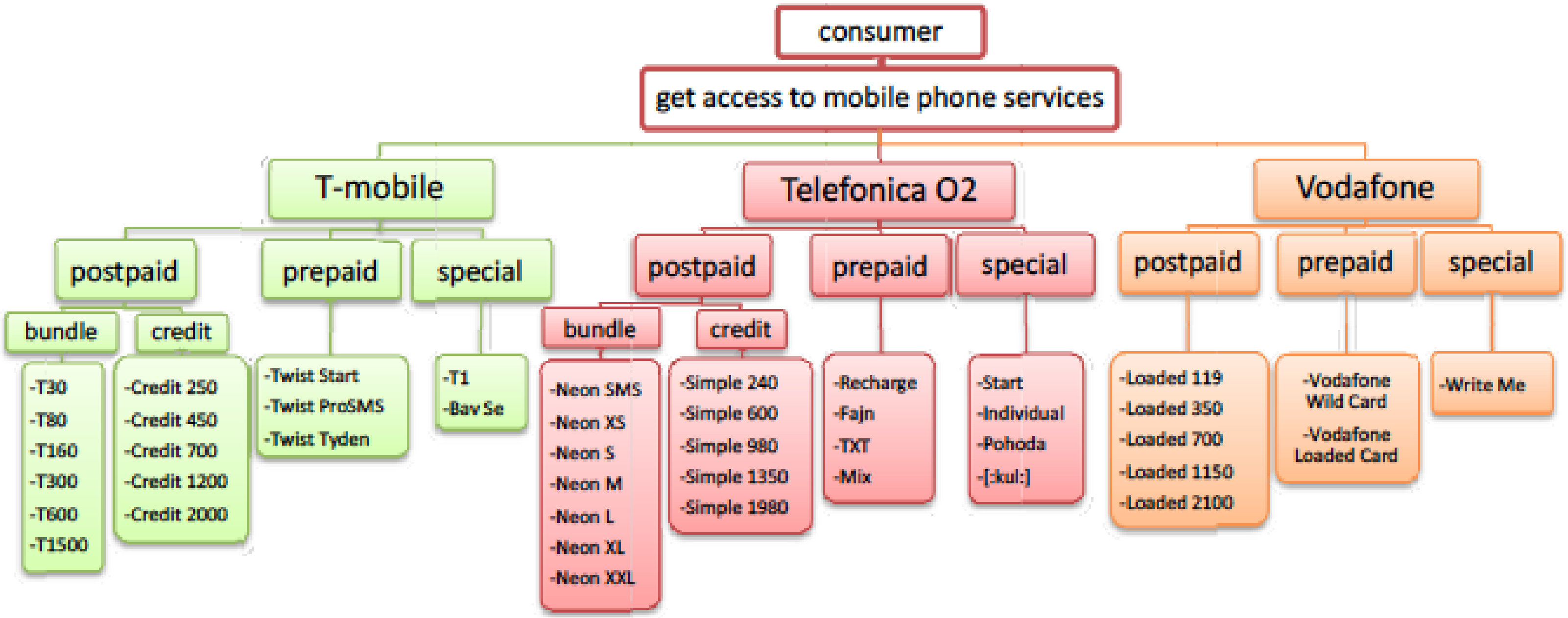


Figure 1: Choice of mobile phone plans in the Czech Republic in April 2008.

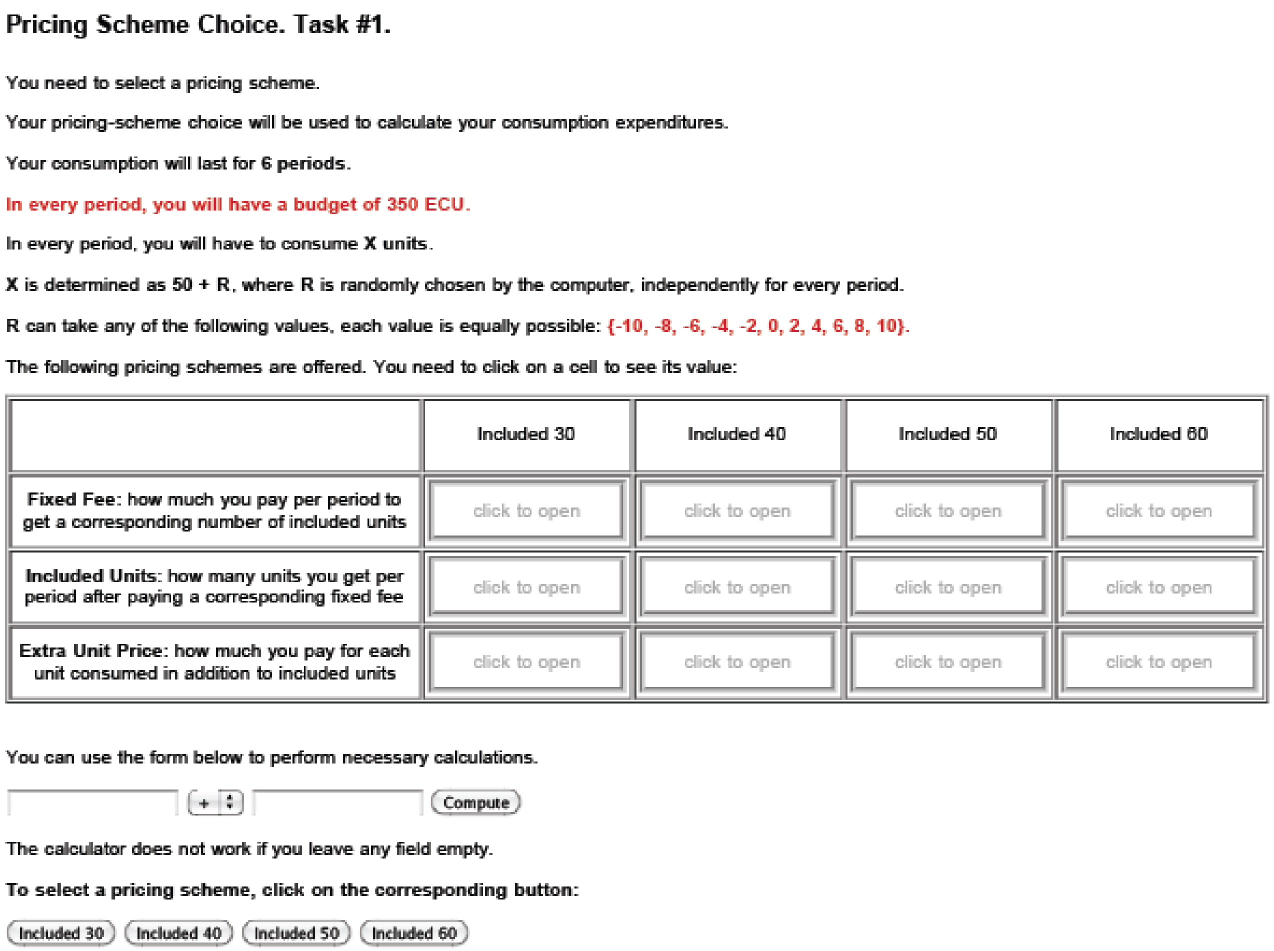
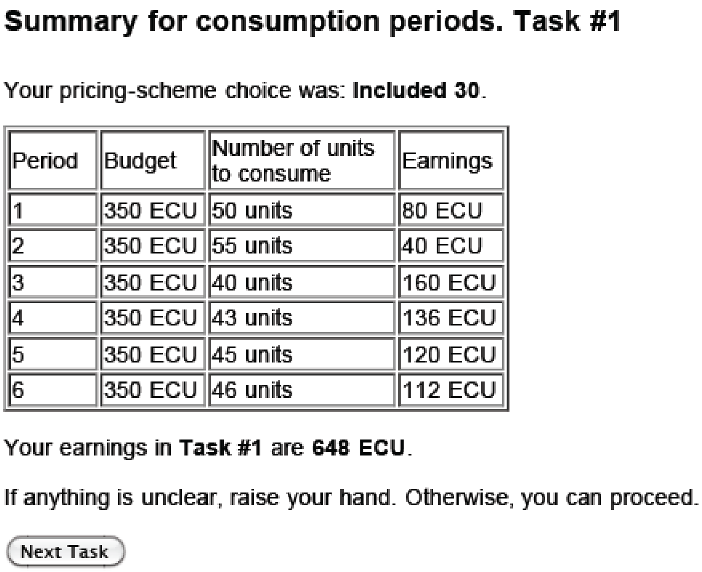


Figure 2: Screen-shot of a pricing-scheme choice task. The text in red is task and treatment specific.



Summary for consumption periods. Task #1

Your pricing-scheme choice was: **Included 30**.

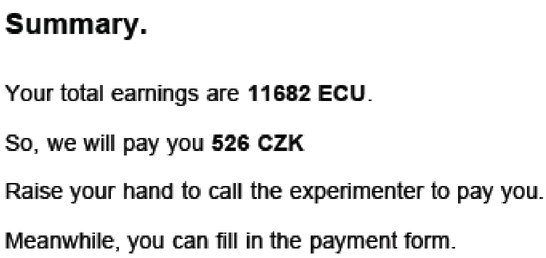
Period	Budget	Number of units to consume	Earnings
1	350 ECU	50 units	80 ECU
2	350 ECU	55 units	40 ECU
3	350 ECU	40 units	160 ECU
4	350 ECU	43 units	136 ECU
5	350 ECU	45 units	120 ECU
6	350 ECU	46 units	112 ECU

Your earnings in **Task #1** are **648 ECU**.

If anything is unclear, raise your hand. Otherwise, you can proceed.

Next Task

Figure 3: Screen-shot of a feedback provided after every pricing-scheme choice.



Summary.

Your total earnings are **11682 ECU**.

So, we will pay you **526 CZK**

Raise your hand to call the experimenter to pay you.

Meanwhile, you can fill in the payment form.

Figure 4: Screen-shot of the summary page of the experiment.

# task	Expected earnings	1st-best scheme	Budget	% correct
7.	100-100-80 ECU	Included 50, 60	420 ECU	83
27.	100-100-80 ECU	Included 40, 60	400 ECU	83
17.	100-100-80 ECU	Included 30, 60	410 ECU	77
29.	50-35-30 ECU	Included 50	420 ECU	76
4.	100-80-70 ECU	Included 50	360 ECU	75
6.	100-70-60 ECU	Included 50	420 ECU	75
1.	100-90-80 ECU	Included 50	350 ECU	74
10.	100-70-60 ECU	Included 40	360 ECU	73
30.	100-80-80 ECU	Included 40	350 ECU	73
20.	100-80-80 ECU	Included 50	380 ECU	70
18.	50-30-25 ECU	Included 50	400 ECU	70
19.	50-40-30 ECU	Included 50	360 ECU	68
28.	50-40-35 ECU	Included 50	380 ECU	65
22.	100-80-70 ECU	Included 40	420 ECU	61
14.	50-35-30 ECU	Included 40	380 ECU	58
2.	50-45-40 ECU	Included 50	350 ECU	54
13.	50-30-25 ECU	Included 40	420 ECU	54
3.	100-90-80 ECU	Included 40	380 ECU	49
24.	50-40-30 ECU	Included 40	350 ECU	49
15.	50-30-25 ECU	Included 30	350 ECU	49
26.	50-35-30 ECU	Included 30	360 ECU	49
5.	100-80-70 ECU	Included 30	350 ECU	46
12.	100-80-80 ECU	Included 30	360 ECU	46
8.	50-40-35 ECU	Included 40	360 ECU	44
11.	100-70-60 ECU	Included 30	380 ECU	44
25.	100-90-80 ECU	Included 30	420 ECU	44
16.	50-40-30 ECU	Included 30	380 ECU	41
23.	50-45-40 ECU	Included 40	400 ECU	39
21.	50-40-35 ECU	Included 30	400 ECU	37
9.	50-45-40 ECU	Included 30	420 ECU	17

Table 4: Ranking of tasks based on the proportion of first-best choices ("% correct").

Group identifier	Group 1	Group 2	t-stat.
First-best scheme:	*Included 50*	*Included 30, 40*	
share of first-best choices (st. dev.)	.697 (.46)	.485 (.5)	-8.97***
# observations	637	1278	
Expected payoff from first-best:	*50 ECU*	*100 ECU*	
share of first-best choices (st. dev.)	.513 (.5)	.609 (.488)	-4.2***
# observations	1064	851	
Difference between first- and second-best:	*below 15 ECU*	*15 ECU and more*	
share of first-best choices (st. dev.)	.484 (.5)	.613 (.487)	-5.72***
# observations	850	1065	
Range of uncertainty:	$\varepsilon_{ti} = 1$	$\varepsilon_{ti} = 2$	
share of first-best choices (st. dev.)	.59 (.492)	.52 (.5)	3.03***
# observations	956	959	
Misleading design:	No	Yes	
share of first-best choices (st. dev.)	.638 (.48)	.415 (.49)	9.7***
# observations	1205	710	

Table 5: Two-group mean-comparison t-tests with unequal variances. Subjects are divided into two groups based on the specified group identifier.

	Pricing-scheme choice				
	Included 30	Included 40	Included 50	Included 60	**Total**
Included 30 is first-best	**265**	67	229	78	**639**
	.401 (.49)	.105 (.307)	.343 (.475)	.151 (.356)	
Included 40 is first-best	51	**355**	174	59	**639**
	.083 (.276)	.535 (.499)	.257 (.017)	.125 (.331)	
Included 50 is first-best	61	84	**444**	48	**637**
	.096 (.295)	.127 (.333)	.674 (.469)	.102 (.303)	
Total	377	506	847	185	**1915**

marginal homogeneity test for:	chi-square
Included 30 - Included 50	130.32***
Included 30 x Included 40	2.17
Included 30 x Included 50	97.32***
Included 40 x Included 50	31.4***

Table 6: Pricing-scheme choices grouped by the first-best scheme and the actually chosen scheme.

	Included 30	Included 60	Included 40	Included 60	Included 50	Included 60
mean	.213	.553	.213	.574	.362	.468
st. dev.	(.414)	(.503)	(.441)	(.5)	(.487)	(.504)
# obs.	47	47	47	47	47	47
t-stat.	2.86***		2.54***		.8	

Table 7: Tests for the bias towards "Included 60". Only data from the tasks where both "Included 60" and one of the remaining schemes are first-best are used.

	First-best choice by subject i in task t	
	(a) linear probability	(b) probit
Dummy for subject i being male	.13**	.142**
	(.061)	(.065)
Dummy for subject i having economics major	.154**	.166**
	(.066)	(.069)
Dummy for subject i having mathematics major	.119	.123
	(.088)	(.089)
Dummy for the difference between first-best	.071***	.079***
and second-best schemes in task t being $>$ 15 ECU	(.023)	(.026)
Dummy for the highest expected payoff in task t	.054**	.043**
being 100 ECU (it is 50 ECU otherwise)	(.018)	(.02)
Dummy for $\varepsilon_{ti} = 2$ in task t for subject i	-.042	-.047
($\varepsilon_{ti} = 1$ otherwise)	(.04)	(.044)
Dummy for the first-best scheme being "Included 40"	.13***	.135***
	(.038)	(.039)
Dummy for the first-best scheme being "Included 50"	.23***	.24***
	(.044)	(.044)
Dummy for tasks with misleading design	-.135***	-.135***
	(.037)	(.039)
Constant	.221***	-
	(.076)	-
# observations	1861	1861

Table 8: Probability of making a correct pricing-scheme choice. Standard errors clustered by subject are in parentheses.

	First-best choice by subject i in task t	
	(a) linear probability	(b) probit
Dummy for subject i being male	.158**	.167**
	(.072)	(.075)
Dummy for subject i having economics major	.192***	.2***
	(.072)	(.072)
Dummy for subject i having mathematics major	.124	.119
	(.099)	(.092)
Dummy for the difference between first-best	.055*	.062**
and second-best schemes in task t being > 15 ECU	(.029)	(.032)
Dummy for the highest expected payoff in task t	.049**	.051**
being 100 ECU (it is 50 ECU otherwise)	(.022)	(.023)
Dummy for $\varepsilon_{ti} = 2$ in task t for subject i	-.046	-.051
($\varepsilon_{ti} = 1$ otherwise)	(.045)	(.046)
Dummy for the first-best scheme being "Included 40"	.145***	.142***
	(.045)	(.042)
Dummy for the first-best scheme being "Included 50"	.237***	.239***
	(.047)	(.045)
Constant	.181***	-
	(.084)	-
# observations	1419	1419

Table 9: Probability of making correct pricing-scheme choice controlling for the tasks with non-misleading design only. Standard errors clustered by subject are in parentheses.

	Effort by subject i in task t		
	(a) time (sec)	(b) clicks	(c) calculator
Dummy for subject i being male	10.07	7.29***	-.25*
	(7.03)	(2.11)	(.14)
Dummy for subject i having economic major	13.67**	4.85*	-.002
	(6.41)	(2.7)	(.091)
Dummy for subject i having mathematics major	17.35*	-.015	-.018
	(9.25)	(2.73)	(.099)
Dummy for the difference between first-best	-28.08***	-1.22*	-.121***
and second-best schemes in task t being > 15 ECU	(3.62)	(.668)	(.042)
Dummy for the highest expected payoff in task t	21.93***	.8	.07**
being 100 ECU (it is 50 ECU otherwise)	(3.07)	(.5)	(.034)
Dummy for $\varepsilon_{ti} = 2$ in task t for subject i	17.88***	-.62	.01
($\varepsilon_{ti} = 1$ otherwise)	(3.72)	(1.25)	(.04)
Dummy for the first-best scheme being "Included 40"	.49	.71	-.037
	(1.66)	(.44)	(.027)
Dummy for the first-best scheme being "Included 50"	8.73***	.58	.064**
	(2.77)	(.55)	(.027)
Dummy for tasks with misleading design	-9.57***	-.04	-.026
	(3.22)	(1.09)	(.042)
Constant	40.99***	7.6***	.4***
	(6.99)	(2.64)	(.146)
# observations	1861	1861	1861

Table 10: Effort invested in the pricing-scheme choice. Standard errors clustered by subject are in parentheses.

	Linear probability model for:			
	(a) Included 30	(b) Included 40	(c) Included 50	(d) Included 60
Dummy for subject i being male	-.055	.009	.077	-.031
	(.049)	(.03)	(.05)	(.031)
Dummy for subject i having economics major	-.058	.037	.116**	-.095***
	(.05)	(.03)	(.05)	(.035)
Dummy for subject i having mathematics major	-.045	.059	.044	-.057
	(.057)	(.043)	(.06)	(.046)
Dummy for the difference between first-best	.006	.012	-.019	-.0001
and second-best schemes in task t being > 15 ECU	(.017)	(.017)	(.024)	(.011)
Dummy for the highest expected payoff in task t	-.002	-.002	-.007	.011
being 100 ECU (it is 50 ECU otherwise)	(.016)	(.017)	(.021)	(.012)
Dummy for $\varepsilon_{ti} = 2$ in task t for subject i	-.001	-.045*	.061**	-.015
($\varepsilon_{ti} = 1$ otherwise)	(.023)	(.024)	(.028)	(.016)
Dummy for the first-best scheme being "Included R"	R=40: -.338***	R=30: -.445***	R=30: -.377***	R=30: .026*
	(.044)	(.041)	(.048)	(.015)
Dummy for the first-best scheme being "Included S"	S=50: -.349***	S=50: -.447***	S=40: -.457***	S=40: -.002
	(.048)	(.043)	(.047)	(.015)
Dummy for tasks with possibly misleading design	-.081**	-.081***	.114***	.048**
	(.032)	(.027)	(.036)	(.02)
Constant	.527***	.555***	.551***	.163***
	(.07)	(.046)	(.08)	(.045)
# observations	1861	1861	1861	1861

Table 11: Linear probability model for the choice of a particular pricing scheme. Standard errors clustered by subject are in parentheses.

	Linear probability model for:			
	(a) Included 30	(b) Included 40	(c) Included 50	(d) Included 60
Dummy for subject i being male	-.069	-.0004	.089	-.031
	(.053)	(.034)	(.056)	(.031)
Dummy for subject i having economics major	-.069	.037	.133**	-.087***
	(.049)	(.035)	(.058)	(.029)
Dummy for subject i having mathematics major	-.048	.065	.052	-.04
	(.048)	(.054)	(.07)	(.029)
Dummy for the difference between first-best	.009	.009	-.021	-.0004
and second-best schemes in task t being $>$ 15 ECU	(.016)	(.022)	(.028)	(.011)
Dummy for the highest expected payoff in task t	-.002	-.009	-.009	.01
being 100 ECU (it is 50 ECU otherwise)	(.017)	(.021)	(.024)	(.012)
Dummy for $\varepsilon_{ti} = 2$ in task t for subject i	-.004	-.054*	.07**	-.015
($\varepsilon_{ti} = 1$ otherwise)	(.025)	(.028)	(.033)	(.016)
Dummy for the first-best scheme being "Included R"	R=40: -.246***	R=30: -.34***	R=30: -.37***	R=30: .025*
	(.027)	(.026)	(.043)	(.016)
Dummy for the first-best scheme being "Included S"	S=50: -.243***	S=50: -.331***	S=40: -.439***	S=40: -.0001
	(.029)	(.027)	(.042)	(.016)
Dummy for tasks with possibly misleading design	-.065**	-.079***	.125***	.05***
	(.025)	(.028)	(.04)	(.022)
Observed probability	.198	.263	.447	.092
Predicted probability (at mean values of regressors)	.161	.225	.442	.084
# observations	1861	1861	1861	1861

Table 12: Probit model for the choice of a particular pricing scheme. Standard errors clustered by subject are in parentheses.

	First-best choice by subject i in task t		
	economics	non-economics	chi-square
Dummy for subject i being male	.162**	.08	.40
	(.078)	(.106)	
Dummy for the difference between first-best and second-best schemes in task t being > 15 ECU	.119***	.013	5.35**
	(.037)	(.032)	
Dummy for the highest expected payoff in task t being 100 ECU (it is 50 ECU otherwise)	.042	.04	.00
	(.027)	(.025)	
Dummy for $\varepsilon_{ti} = 2$ in task t for subject i ($\varepsilon_{ti} = 1$ otherwise)	-.035	.0001	.19
	(.04)	(.071)	
Dummy for the first-best scheme being "Included 40"	.165***	.09*	.99
	(.054)	(.053)	
Dummy for the first-best scheme being "Included 50"	.302***	.151**	3.06*
	(.063)	(.06)	
Dummy for tasks with misleading design	-.151***	-.108**	.35
	(.055)	(.05)	
Constant	.29***	.369***	.32
	(.086)	(.109)	
# observations	999	862	

Table 13: Differences between economics and non-economics students in the pricing-scheme choice. Standard errors clustered by subject are in parentheses.

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