Do consumers make too much effort to save on cheap items and too little to save on expensive items? experimental results and implications for business strategy

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DO CONSUMERS MAKE TOO MUCH EFFORT TO SAVE ON CHEAP ITEMS AND TOO LITTLE TO SAVE ON EXPENSIVE ITEMS? EXPERIMENTAL RESULTS AND IMPLICATIONS FOR BUSINESS STRATEGY

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The article presents an experiment that illustrates a behavior that I denote "relative thinking." Subjects in the experiment revealed the minimal price difference for which they were willing to spend 20 minutes and go to a cheaper store. Five different goods and nine different prices were used in a between-subjects design. Subjects showed striking positive correlation between the good's price and their valuation of their time as it was reflected in their decisions. The experiment suggests that subjects think about both the relative and the absolute price differences, even though according to economic theory they should only consider the absolute price difference. Quantifying the effect suggests that consumers' valuation of their time is approximately proportional to the square root of the price of the good they want to purchase. Studying economics courses seems to mitigate relative thinking. Several alternative explanations for the observed behavior are suggested and discussed, but the conclusion is that only the relative thinking explanation can account for the experimental results. Finally, several implications of relative thinking for business strategy are discussed.

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1. Introduction

The theory of rational choice assumes that people have well-defined preferences and they maximize utility by making the best choices given these preferences and their resources. Consequently, a consumer who is willing to drive a certain distance to save $5 on a $10 pen should also drive this distance to save $5 on a $30,000 car. His preference between time and money (how much money he requires as compensation for the lost time associated with driving to another store) should not depend on the good's price.[1] As the experiment reported below shows, however, consumers often do not behave as the theory assumes, and I suggest that they exhibit "partial relative thinking"[2]: they consider not only absolute price differences but also relative price differences (i.e., what part of the good's price they can save).[3] This leads consumers to make more effort to save a certain absolute amount when the good's price is lower, because relative to the good's price the savings seem larger.

The literature includes several examples that are consistent with relative thinking. Thaler (1980), in an article that proposes prospect theory as the basis for a positive theory of consumer choice, discusses various topics, one of which is the conjecture that people exert more effort to save $5 on a $25 radio than to save $5 on a $500 TV. Tversky and Kahneman (1981) discuss

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[1] To see how thinking about relative price differences results in non-optimal decisions, notice that a consumer who spends 20 minutes to save $3 on a $10 good and later refuses to spend 20 minutes to save $50 on a $30,000 good (because the relative savings are high in the first case and low in the second case) could have the same amount of free time and be richer by $47 by making the opposite choices.

[2] I often drop "partial" for the sake of brevity. The difference between full and partial relative thinking is explained later.

[3] In the past some of the literature denoted related results as "mental accounting" rather than "relative thinking." Azar (2008a) explains why the terminology of "relative thinking" seems more appropriate.

framing effects and suggest that people generally evaluate acts in terms of a minimal account, which includes only the direct consequences of the act. To show an example in which people use a more inclusive account rather than a minimal account, they asked people whether they would drive 20 minutes to save $5 on a calculator assuming they intended to buy a calculator and a jacket. When the calculator's price was $15 and the jacket's price was $125, 68 percent of the subjects were willing to drive 20 minutes to save $5, but when the calculator's price was $125 and the jacket's price $15, only 29 percent wanted to drive 20 minutes to save $5. Tversky and Kahneman suggest that this behavior results from a mental account that includes the price of the calculator but not that of the jacket.

Tversky and Kahneman's result was later replicated in several other studies. Mowen and Mowen (1986) show that the effect holds similarly for student subjects and for business manager subjects. Frisch (1993) shows that the effect holds also when only a calculator is being purchased. Ranyard and Abdel-Nabi (1993) vary the price of the second item (the jacket) and obtain similar results. Others, however, obtained somewhat different results. Darke and Freedman (1993), for example, find in one experiment that the percentage off played no role on effort to save money, but in a second experiment with a greater range of percentages that could be saved, they find that the percentage discount has an effect on consumer choice. Additional studies examined other issues related to how evaluation of price differences is affected by the good's price. Azar (2004, 2006, 2007a) reports on experiments that show that people are affected by relative price differences and not only by absolute price differences when choosing between differentiated goods even when only the absolute price differences should matter. Azar (2007b) discusses several issues related to relative thinking, including how we can formalize this behavior. However, other studies do not find evidence for relative thinking in certain contexts.

For example, Azar (2008b) examines mixed compensation schemes, varying the fixed payment and keeping constant the pay-for-performance component. Relative thinking in this case should lead to more effort when the fixed payment is smaller and therefore the pay-for-performance component is relatively larger. However, the results do not show such an effect. Azar (2009) does not detect relative thinking in a field experiment where people could buy a bagel or a bagel with cream cheese. He kept the price of the cream cheese constant and varied the price of the bagel. Relative thinking should then lead to more purchases of the cream cheese when the bagel's price was higher, but the data did not show such behavior.

The findings in the experiment reported in this paper are also related to the literature in psychology and marketing that shows that consumers often respond to percentage discounts. While in economics it is usually assumed that people consider only absolute price differences, authors in the areas of consumer behavior and marketing often claim the opposite: when consumers consider price changes, they care only about percentage differences. Kindra, Laroche, and Muller (1989, p. 80), for example, write "Markups and markdowns, therefore, can be analyzed meaningfully only in terms of their percentage of the original price. Retailers have long recognized that markdowns of less than 20 percent generally go unnoticed" (see also Schiffman & Lazar Kanuk, 1983, p. 137-139; and Hanna & Wozniak, 2001, p. 114-115). Grewal and Marmorstein (1994) propose and test two possible explanations why consumers' willingness to engage in price search does not increase alongside the price dispersion of durable goods. The first potential explanation – consumers underestimate the market price dispersion – was not supported. The second possible explanation, which builds upon Weber's law of psychophysics and Thaler's transaction utility theory, was supported. Grewal and Marmorstein suggest that the psychological utility that consumers derive from saving a certain amount is inversely related to

the good's price. Heath, Chatterjee, and France (1995) are interested in how changes in a good's price are perceived, and explore the effects of percentage-based frames on price perceptions and preferences for multiple price changes (price increases on one product combined with price reductions on another). They find that mental accounting principles generally prevailed in the absence of percentage-based frames, and that mental accounting principles, price perception, and reference dependence are sensitive to the ways in which deviations from reference states are framed.

In the earlier studies that examined how the willingness of people to spend time finding a cheaper price is affected by the good's price, the subjects were faced with the question whether they are willing to spend a certain amount of time to save a given amount, and the answers were therefore yes or no. So for each subject the experimenter knows only whether his time valuation, as reflected by his choice, exceeds the level of savings offered to him, or not. The results are then analyzed in terms of the percentage of subjects who chose to spend time and save money in the different treatments. This method significantly limits our ability to assess the magnitude of the effect of the good's price on the valuation of time. We learn from the previous studies that people behave as if the value of their time is higher when they purchase a more expensive good.[4] But knowing that when the good's price is lower a larger percentage of people are willing to spend a certain time to save a certain amount of money does not tell us by how much valuation of time increases when price increases. When the good's price triples, for example, does the valuation of time also triple, or does it increase but not that much?

[4] This is the reason for the result that when the good's price is lower, more people are willing to spend a certain amount of time to save a certain amount of money.

Moreover, it is not clear what the reason that people exhibit this behavior is. Maybe they have transaction utility (see Thaler, 1985) when they obtain a very good bargain, and they judge how good a bargain is by the percentage savings compared to some reference price. Or maybe they have a disutility from paying an unfair price, and to what extent a price is unfair they determine by examining the percentage difference in prices between the two stores. In that case, when a certain absolute price difference is bigger in percentage in one case, the expensive store will seem more unfair in this case, leading to more willingness to spend time and buy from the cheaper store.

In the experiment reported below, I can reject these alternative explanations for the observed behavior (and other potential explanations) in favor of the relative thinking explanation, thanks to an experimental design that differs from that of previous studies. Moreover, I can examine quantitatively how increasing the good's price affects the subjects' valuation of their time. This allows me, for example, to refute the hypothesis of full relative thinking in favor of partial relative thinking.[5] These advantages over previous experiments in the literature are achieved thanks to three main changes in the experimental design. First, subjects are asked to provide a missing price rather than to answer a yes/no question, allowing me to compute their valuation of their time (as reflected in their answer) rather than to know only whether it exceeds a certain threshold. Second, I use nine different prices in the experiment, as opposed to only two or three

[5] Full relative thinking means thinking only about relative price differences, implying that doubling the good's price doubles the expressed valuation of time. Partial relative thinking means that both relative price differences and absolute price differences have an effect on decisions, implying that doubling the good's price increases, but less than doubles, the expressed valuation of time. A consumer who maximizes utility and has well-defined preferences should exhibit neither full nor partial relative thinking, but rather full absolute thinking, implying that doubling the good's price should have no effect on the expressed valuation of time.

in previous experiments. Third, I use various goods and not only one. These features of the experimental design allow us to reject alternative explanations for this behavior that could not be rejected previously, and consequently the experiment helps us to better understand the reasons for this behavior.

In addition, subjects also recorded some personal information, such as gender, their undergraduate majors, and their year in the undergraduate program. This allows me to test whether relative thinking is weaker for one of the genders, or for students who study economics. The results suggest that while choosing economics by itself is not positively related with more "rational" behavior (i.e. less relative thinking), the more economics courses one took before the experiment, the less relative thinking he expresses. In other words, taking economic courses seems to help students make better decisions in this context (by emphasizing more the absolute price difference and less the relative price difference).

The rest of the article is organized as follows. Section 2 presents the results of the experiment, which suggests that people exhibit relative thinking when trading off time and money; they behave as if the value of their time is increasing with the price of the good they want to purchase. The following section proposes several alternative explanations for the results and explains why relative thinking is the most plausible explanation. Section 4 discusses the limitations of the study and proposes ideas for future research. Section 5 suggests several possible implications of the results for business strategy, and the last section concludes.

2. The Experiment

2.1. Method and Design

As explained in the previous section, traditional economic theory implies that when trading-off time and money, people should compare the absolute monetary gain to the time lost (or vice versa) and relative price differences should not play a role. The relative thinking hypothesis, however, suggests that people also consider relative price differences. As a result, it predicts that people will require higher absolute monetary savings in order to incur the same time (and effort) costs, when the good's price is higher. In order to test whether behavior conforms to the predictions of economic theory or those of the relative thinking hypothesis, the experiment uses questions about different goods and different prices in the various treatments. The time costs (as well as effort and potentially other costs of driving 20 minutes), however, are constant in all treatments. 165 undergraduate students from various disciplines at Northwestern University answered a questionnaire with the following question (or another version of it, as explained below):[6]

Suppose that you want to buy a jacket. You go to a certain store and its price there is $X. You think you might find the jacket for a cheaper price at another store, so you go there. It turns out, however, that the exact same jacket was actually cheaper at the first store; its price in the store you are currently visiting is $100.00 (where 100 > X). What is the maximal value of X (i.e. the maximal price at the first store) for which you will go back and buy the jacket in the first store, if

[6] The data is available from the author upon request.

you know that going back will take you 20 more minutes (driving there, finding the jacket, standing in line etc.)?[7]

The difference between the reference price mentioned in the question (henceforth denoted by P) and the subject's answer is the subject's willingness to accept (henceforth denoted by WTA) for the time and effort associated with driving 20 minutes. The question had nine versions that differed in the good and its price: a pen ($3 or $10), a jacket ($30 or $100), a bike ($300), a computer ($1,000 or $3,000) and a car ($10,000 or $30,000). The experiment was done between subjects, so each subject answered only about one price and one good, where assignment of treatments to subjects was random.

The goal was to use a large range of prices, and this required using various goods in order to make the scenarios as realistic as possible. Moreover, the use of various goods allowed a better understanding of this behavior by ruling out one of the potential alternative explanations for it (see section 3.5). The goods used in the scenarios are goods that students are familiar with and

[7] As opposed to scenarios used in previous studies (e.g., Tversky and Kahneman, 1981), in which the seller tells the subject about a cheaper price elsewhere, in my experiment the subject himself sampled a cheaper price before, but decided not to buy. This change is aimed to verify the robustness of the results in prior studies to different framings and to eliminate certain confounding reasons that may affect the willingness to drive to another store. For example, when the seller tells the subject about a lower price elsewhere, the subject may feel either some pressure to go to the other store, or alternatively feel uncomfortable going to the other store (either because he does not want to appear as someone who would make a lot of effort to save a few dollars, or because he now feels sympathy for the seller who gave him helpful information, possibly against the seller's own interest that the consumer buys at his store). One might also be concerned that people trust information given to them by someone else less than information they obtain themselves.

many of them purchased before.[8] Making the scenarios more similar to situations students encounter is aimed to increase the reliability of their responses.

2.2. Results and Discussion

[Table 1 about here]

Relative thinking predicts that the WTA will be an increasing function of the good's price. The results, summarized in Table 1, support this prediction. The effect of the good's price on the WTA is striking and shows a very strong behavior of relative thinking: in the $30,000-car treatment, for example, the WTA is more than 240 times the WTA in the $3-pen treatment! Recall that the WTA represents the value of time and effort of driving 20 minutes; without relative thinking, the answers should be similar in all treatments. The results suggest that relative thinking leads people to behave as if the value of their time is increasing with the good's price.

Can we say whether people exhibit full or partial relative thinking? Table 1 presents the value of mean WTA/P for each cell and shows that this ratio drops from 0.625 to 0.015 as price increases. Full relative thinking implies that this ratio should remain constant, while partial relative thinking implies that it should decrease in price. The regression of (WTA/P) on Ln (P) shows that we can reject the hypothesis of full relative thinking in favor of partial relative thinking at any conventional level of significance:

$$\mathbf{(WTA/P) = 0.493\ (0.040) - 0.056\ (0.005)\ Ln\ (P)}$$

[8] The car is probably an exception, as many students probably did not buy a car before. However, for the price range of $10,000 - $30,000, this seemed to be the good that students should be the most familiar with. Moreover, the same behavior that is documented in the car treatments is also documented with the other goods in a similar fashion, so the results do not seem to be significantly affected by the fact that many students did not purchase cars before. In addition, the conclusions drawn from the experiment are similar even if the car treatments are ignored.

(165 observations, $R^2 = 0.54$, robust standard errors in parentheses)

Another worthwhile exercise is to estimate by how much, on average, WTA increases as a result of an increase in P, over the range of prices in the experiment. Regressing Ln (WTA+1) on Ln (P) gives the following result:[9]

Ln (WTA+1) = 0.456 (0.130) + 0.444 (0.031) Ln (P)

(165 observations, $R^2 = 0.63$, robust standard errors in parentheses)

The result shows a strong effect of the price on the WTA, as we saw also in Table 1. An increase of one percent in P leads to about 0.44 percent increase in WTA. This result can be stated as follows:

Relative thinking in the experiment led people to behave (on average) as if the value of their time is approximately proportional to the square root of the price of the good they want to purchase.[10]

Finally, is relative thinking different between women and men? Is it weaker for people who study economics? To answer these questions, I used data about the subjects' gender and major field of study. The dummy variable Male is equal to 1 for males and 0 for females. The variable Econ gets the value 0 if the subject is non-economics major, 1 if the subject has economics as one of two or more majors (or if he has not decided yet about his majors but states that economics is likely to be one of them), and 2 if the subject has economics as a single major.

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[9] Taking Ln (WTA+1) rather than Ln (WTA) is necessary because WTA is equal to 0 in three observations.

[10] For example, take two goods with prices P and 2P and WTA of X and Y. We then obtain, using the regression result, that [Ln (Y+1)-Ln (X+1)] = 0.444 (Ln (2P) – Ln (P)) = 0.444*Ln (2) = 0.308. For large values of X and Y, Y/X is close to (Y+1)/(X+1), which equal $e^{0.308} = 1.36$. The rule that says that the WTA is proportional to the square root of the price would predict that Y/X is 1.41, which is relatively close to 1.36.

The main purpose was to test not the effect of Male and Econ on WTA, but their interaction with the good's price (this tells us about the extent of relative thinking). With respect to gender no directional hypothesis was formulated. With respect to Econ there are two different effects that I wanted to test. One hypothesis is that people who behave more rationally (i.e. are not biased by relative differences in this context) tend more to choose economics as a major. A second hypothesis is that taking courses in economics teaches people how to behave more rationally in economic contexts.

To have a better measure of the number of economics courses taken, I created the variable Years, which is the number of years the student has already studied (before the current year) in the undergraduate program (this variable therefore equals 0, 1, 2, or 3). An approximate measure of the number of economics courses taken by the subject is then obtained by multiplying Econ and Years, the product being denoted by Econyears. To control for the possibility that university courses in general teach students to make more rational decisions, I also included Years in the regression without interaction with Econ. All the variables for which the interaction with relative thinking is analyzed (Male, Econ, Years, and Econyears) are included in the regression both independently and when interacting with Ln (P) (so that if these variables are correlated with the value of time but not with relative thinking, this will not be captured by the interaction term). The results of the regression appear in Table 2.

[Table 2 about here]

Since the positive coefficient on Ln (P) is what captures relative thinking, the interaction effects show more relative thinking when they are positive and less relative thinking when they are negative. For example, males exhibit weaker relative thinking than females, because for

females the coefficient on Ln (P) is 0.468, while for males it is 0.431 (0.468-0.037). The difference between the genders, however, is not statistically significant.

The interaction of Econ and Ln (P) is very close to zero. This means that the data do not support the hypothesis that people who make decisions in a more "economic" or "rational" way, choose more to study economics. The positive interaction between Years and Ln (P) shows that taking university courses in general does not alleviate relative thinking.

The interaction of Econyears and Ln (P) is in the predicted direction and is also statistically significant at the 1% level. Studying economics courses seems to mitigate relative thinking, at least in the context of trading off time and money. The concepts of opportunity cost and of the trade-off between leisure and income are sometimes mentioned in economics courses, and this may be the reason for this result. This is an important finding that might indicate that teaching economic principles helps people to make better decisions in their daily life – in this case to overcome the natural tendency to think about relative price differences, and instead to think about absolute price differences. Of course, replications of this result in additional studies are called for before any final conclusions can be made.

3. Alternative Explanations for the Experimental Results

The preceding section shows that people require more compensation for the same effort of driving to a cheaper store when they buy a more expensive good. This is equivalent to being willing to make more effort to save the same amount of money when buying a cheaper good. The explanation offered for this behavior is that people present a bias of relative thinking, according to which they consider relative price differences even when only absolute price differences should matter. Because the same savings are a higher percentage of the good's price when

buying a cheap item, this leads to making more effort to save the same amount of money when buying cheap items.

Are there other potential explanations for the behavior observed in the experiment? In what follows, I present a few alternative explanations for the results. However, as I discuss in more detail below, the innovative design of the experiment (in particular, asking the subjects to provide a missing price rather than to answer a yes/no question, and using a large range of prices and goods rather than one good with two or three prices) allows us to reject these alternative explanations.

3.1. The Curvature of the Prospect-Theory Value Function

One explanation that was previously suggested for the observation that people seem to make more effort to save a constant amount when the relative savings are higher is the curvature of the prospect-theory value function. In prospect theory (Kahneman & Tversky, 1979), the carriers of utility are changes in wealth rather than terminal wealth levels. The value function is defined over changes in wealth, is concave with respect to gains and convex with respect to losses, and is steeper for losses than for gains, representing the idea of loss aversion. Suppose that a consumer is willing to drive 20 minutes to save $5 on a $15 calculator, but not when the calculator's price is $125. The prospect-theory based explanation for these preferences is that since the value function in the domain of losses is convex, the difference in utility between a loss of $10 and of $15 is larger than the difference between a loss of $120 and of $125. Then it is possible that the disutility associated with driving 20 minutes is between these two numbers and the consumer wants to drive 20 minutes to save $5 on $15 but not on $125.

Relative thinking and diminishing sensitivity in the prospect-theory value function both lead to the observation that $5 seems a lot compared to $15, and much less compared to $125. The

prospect-theory based explanation, however, implicitly assumes that people treat the cost of goods they buy as losses. Researchers in the field, however, believe that the cost of a good is not treated as a loss but rather is integrated with the benefit from the good.[11] If the good's cost were treated as a loss, people would be unwilling to purchase many goods whose benefits far exceed their costs, because the price would be treated as a loss, while the benefit from the good would be treated as a gain, and loss aversion implies that losses are considered much more heavily than gains. When a consumer purchases a good, he apparently believes that the good's benefits exceed its price, implying that the transaction yields a net gain. Consequently, the convexity of the value function for losses is irrelevant and cannot explain why people make more effort to save money on cheaper goods.

3.2. Purchase Frequency

Another potential explanation why people are willing to make more effort to save on low-price goods is that they purchase low-price goods more often than high-price goods, so the benefit of finding a low price multiplies itself more times for low-price goods. There are several reasons why purchase frequency is not the explanation for the results. First, the subjects in the experiment face a one-time purchase problem, so purchase frequency is irrelevant, and we still observe WTA for time that increases in the good's price. Second, I believe that people make

[11] Thaler (1985, p. 205), for example, claims "the cost of the good is not treated as a loss." Similarly, Tversky and Kahneman (1991, p.1055), when discussing whether people exhibit loss aversion only with respect to goods or also with respect to money, say about the results of several experiments: "The buyers in these markets do not appear to value the money they give up in a transaction as a loss." In a different article (Tversky and Kahneman, 1981, p. 456) they say "In the account that is set up for the purchase of a car, for example, the cost of the purchase is not treated as a loss nor is the car viewed as a gift."

much more effort to save $5 on scissors or a stapler than on a computer or a car, even though they do not buy scissors and staplers more often than they buy computers and cars.

Finally, purchase frequency cannot explain why people are not making enough effort to save on high-price goods. Suppose that the average value of time of the undergraduate students who participated in the experiment is $10 per hour. Assume for simplicity that driving is not associated with a disutility except for the opportunity cost of time, and that gasoline costs are negligible.[12] A subject who realizes that he buys only one unit should express a WTA of $3.33 for 20 minutes, and subjects that mistakenly think they are buying more than one unit should express a WTA of less than $3.33, but purchase frequency cannot explain WTA of more than $3.33. Notice, however, that in all the treatments except for the $3 pen, the mean WTA is higher than $3.33, up to $455 in the $30,000 car treatment.

3.3. Transaction Utility

Another potential explanation for the results of the experiment is the existence of "transaction utility" (Thaler, 1985). The idea is that when you get a good deal you obtain utility from the transaction itself beyond the monetary savings. I believe that this is an important phenomenon, and that it might be a partial explanation why people make too much effort to save on low-price goods. But transaction utility cannot explain too little effort to save on high-price

[12] These are simplifying assumptions that are made in order to make the discussion clearer and more concise, but any other reasonable assumptions about the subject's time value and additional costs associated with driving to another store are also consistent with the arguments made, even if the threshold discussed changes. If the subject's time value is $20 per hour, for example, then purchase frequency might explain WTA of less than $6.67 for 20 minutes, but it cannot explain a WTA greater than $6.67, recorded in the 7 price treatments of $30 and above. This comment also applies to sections 3.3 and 3.4.

goods. With transaction utility, finding a lower price yields monetary savings plus additional transaction utility. Assuming again a time value of $10 per hour, transaction utility can explain WTA of less than $3.33, but not WTA that is much higher than $3.33, and therefore it cannot explain the results of the experiment.

In addition, even when considering the cases of too much effort to save on low-price goods, transaction utility by itself cannot explain why the WTA increases in the good's price, unless it is accompanied by relative thinking. If my transaction utility is a function of the dollars I save (compared to some benchmark such as the average price in the market or the price I currently face), and I am willing to drive 20 minutes to save $1 on a $2 good because of the transaction utility associated, I should also drive to save $1 on a $10 good. The only way transaction utility can change my driving decision is if the transaction utility is higher when I save $1 on a $2 good than when I save $1 on a $10 good – but this means that transaction utility is determined by the percentage saved, which is again a form of relative thinking.

3.4. Fairness

Another potential explanation for why people are searching too much when buying low-price goods is the reluctance to pay unfair prices (on market implications of the desire for fairness see Kahneman, Knetsch, & Thaler, 1986). Such reluctance can explain why a consumer who encounters an overpriced good decides to search for a lower price even though the expected search costs exceed the expected monetary savings. In a similar fashion to the previous two explanations, however, it is easy to see that fairness cannot explain why people make too little effort to save on high-price goods. In addition, a similar argument to the one mentioned in the discussion of transaction utility applies here: fairness cannot explain even too much effort on low-price goods unless it is accompanied by relative thinking. If I judge the unfairness of a seller

by how many dollars above a benchmark he charges, I will make the same effort to save $1 on a $2 good and on a $10 good; unfairness has to be perceived by the percentage deviation from the benchmark in order to trigger different effort to save $1 when the good's price is different.

3.5. Wealth Perception

We might also be concerned that people who purchase a $30,000 car, for example, are on average wealthier than those who buy a $10,000 car. Consequently, the value of time of those who buy the more expensive good may be higher and lead to a higher WTA. There are several reasons why this is not the reason for the results. First, this could be a concern if the subjects were recruited at the doorsteps of a car dealer (or another store) and were given a question that matches what they planned to purchase. But the subjects in the experiment were all undergraduate students during class, and the assignment of treatments to subjects was random, so on average the wealth of the subjects in each treatment is the same.

One might go one step further and claim that maybe the subjects who got the high-price versions imagined themselves as being wealthier and having a higher value of time compared to the low-price subjects. Even if such an effect had existed, it would have been small and certainly could not explain WTA that changes from $1.88 to $455 as the good's price increases. Moreover, the design of the experiment, which involves several different goods, allows us to refute this alternative explanation in another way. A person who purchases a $10 pen is actually on average wealthier than someone who buys a $30 jacket, because a $10 pen is an expensive pen while a $30 jacket is a cheap jacket. The same idea applies when comparing a $300 bike to a $1,000 computer, and a $3,000 computer to a $10,000 car. Therefore, if wealth perception were the explanation for the results, we should observe WTA which is higher for the $10 pen than for the $30 jacket etc, but the data show the exact opposite pattern.

3.6. Summary

The discussion above shows that the other potential explanations for the behavior documented in the experiment do not seem to fit the pattern of the experimental data. The conclusion is that relative thinking – the tendency of people to consider relative price differences even when these are irrelevant – is the major force behind the experimental results. The next section discusses some potential limitations of the study.

4. Potential Limitations and Future Research Directions

One aspect that seems at first as a limitation of the study is the small number of observations in each treatment. However, we should remember that the goal here is to get an overall estimation of the effect of the good's price on WTA, and not to compare each pair of prices separately. Therefore, what really matters is the total number of observations, and in experimental studies collecting 165 observations is generally reasonable. If the results were not statistically significant it would be helpful to collect additional observations, but here with the t-statistic of 9 for the coefficient of Ln (P) in the regression reported in Table 2 and the t-statistic being above 14 in the regression of Ln(WTA+1) on Ln (P) reported in Section 2, it is hard to believe that increasing the number of observations will change the results in any meaningful manner. In fact, examining the standard deviations of the means in Table 1 shows that the effect of the price on WTA is so strong that even comparisons of two adjacent prices (and obviously comparisons of prices that are not adjacent), despite the small number of observations in each treatment, allow in most cases a rejection of the hypothesis that the mean in the two treatments is the same at the 5% significance level.

Another potential limitation of the study is related to the lack of salient financial incentives to answer correctly. While in psychology conducting experiments without incentives is a common practice,[13] in economics there is more concern that behavior might change significantly with the introduction of incentives. There are two main reasons why I believe the study is important despite this limitation. One reason is that it is unlikely that financial incentives will change the qualitative results. The second reason is that possible experiments with incentives in this context suffer from several problems that this study does not suffer from. Below I provide more details about these two issues.

4.1. Are Financial Incentives Likely to Change the Qualitative Results?

When an experiment requires performing a hard task, there is a reason to believe that with incentives people will put more effort and perform the task better. However, in the experiment reported in this article, the subjects are not asked to perform a hard task but just to answer a simple question about their preferences. In addition, the question does not involve sensitive issues that could result in unwillingness to provide truthful responses, such as sexual behavior or criminal activity. Therefore, there is no apparent reason why subjects might want to report their preferences untruthfully. In this respect, the experiment resembles various surveys conducted by governmental agencies and consumer research firms: these surveys also do not provide incentives for truthful reporting, and yet empirical work in economics often relies on their results.

[13] Hertwig and Ortmann (2003), for example, report that in a sample of 106 empirical studies on Bayesian reasoning published in psychology journals, fewer than three percent provided financial incentives.

In addition, to claim that introducing incentives will change the main qualitative result (the WTA being an increasing function of the price), one has to show that three conditions hold simultaneously. First, it has to be shown that introducing incentives leads to more "accurate" answers or decisions (i.e., that are closer to the subject's true preferences). Second, one has to show that the inaccuracy that results from the lack of incentives is not just noise, but has a systematic direction (that almost everyone overestimates his WTA, for example); if introducing incentives reduces the variance of the responses in each treatment but does not change their mean, then in fact relative thinking will be even stronger with incentives, because the difference in the means (between the various treatments) will be the same but the standard deviations of the means will be lower. Since both the savings and the costs associated with driving to another store are hypothetical, there is no apparent reason why subjects should systematically underestimate (or systematically overestimate) their WTA. Third, even if people do systematically overestimate their WTA for some reason, one still has to show that this overestimation is higher when the good's price is higher, otherwise correcting for the overestimation does not change the result that the WTA is increasing in price.[14] I see no compelling reason to believe that any of these three conditions holds, let alone all of them simultaneously; consequently, the qualitative results do not seem to be only a result of lack of incentives.

It might be true that some people who gave very unreasonable answers (in particular in the car treatments) would be more likely to realize at least partially that their WTA should not be so high if their decision involved real money. But it is far-fetched to conclude from this that the entire bias of relative thinking (or more specifically, of expressing WTA that increases in price),

[14] Similarly, if people underestimate their WTA, one has to show that the underestimation is lower when the good's price is higher.

which is so strong in the experiment, will suddenly vanish altogether with the introduction of incentives. In fact, Camerer and Hogarth (1999) reach a similar conclusion about rationality violations more generally: in a review study that examines the effects of increased incentives on experimental results in 74 different experiments, they conclude that "no replicated study has made rationality violations disappear purely by raising incentives."[15] Finally, the finding that empirical data on price dispersion suggest that firms respond to relative thinking of consumers (Azar, 2005) also supports the claim that relative thinking seems to exist also when financial incentives are present.[16]

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[15] Other leading researchers in this area also believe that incentives do not change behavior in this type of experiments. Tversky and Kahneman (1987, p. 90) argue that "experimental findings provide little support" for the view that "observed failures of rational models are attributable to the cost of thinking and will thus be eliminated by proper incentives." Similarly, Thaler (1994, p.155-157, 190) writes, "To see whether the addition of monetary incentives would improve decision making, numerous researchers, both psychologists and economists, have run parallel experiments with and without incentives… the violations of rationality observed tend to be somewhat *stronger* in the incentive condition…" Later, Thaler adds "Hypothetical questions appear to work well when subjects have access to their intuitions and have no particular incentive to lie," and afterwards he concludes, "… the assertion that systematic mistakes will always disappear if the stakes are large enough should be recognized for what it is – an assertion unsupported by any data."

[16] As an anecdote that suggests that relative thinking exists also when financial incentives are present, I can mention that after this research received some coverage in several newspapers, many students and colleagues came to tell me that indeed they make more effort to save on low-price goods than on high-price goods (for a constant absolute amount of expected savings). One striking example is that people give up hundreds of dollars relatively quickly when they bargain on the price of a car or a house; to avoid a short while of unpleasant negotiations they give up amounts that they have to work for dozens of hours to earn, only because relative to the good's price these amounts do not seem large.

4.2. Possible Experiments with Financial Incentives

Is it possible to conduct the experiment reported in this article with financial incentives? The answer is negative. The question subjects answered is about their preferences (what amount of savings is equivalent for them to the effort of spending 20 minutes going to another store), and therefore the "correct" answer is unknown to the experimenter. Consequently, it is impossible to pay the subjects based on how close their response is to the correct answer.

While it is impossible to replicate this experiment with financial incentive, it is possible to conduct related experiments with financial incentives. One such experiment can be a field experiment, in which customers in a certain store, when they are about to pay for their purchase, will be offered a coupon with a certain constant dollar discount (e.g., $5) that they can use by going to buy the item in another branch of the same store (instead of buying it in the first store).[17] However, such a study involves several limitations that the experiment reported above does not have.

First, it does not allow to elicit a specific WTA, but rather only to infer whether it exceeds the discount offered or not. For example, with a $5 discount, we can infer that the customer's WTA is higher than $5 if he gives up the offer and purchases in the first store, and we can infer that his WTA is lower than $5 if he takes the coupon and goes to the second store. But we do not know when he gives up the offer whether his WTA is $6, $15, or $30, and similarly for the case of the WTA below $5.

Second, this experiment runs into the problem of correlation between the good's price and the customer's wealth. People who are wealthier tend to buy more expensive goods and also tend to have a higher time value. Consequently, even if the experiment shows that the percentage of

[17] In order to have a clean experiment, the coupon should only be offered to customers who purchase a single item.

customers who use the coupon is a decreasing function of the good's price (which is what relative thinking implies), we will not know whether this is because of relative thinking or because of the positive correlation between the good's price and the customer's value of time. In the experiment reported in this paper this problem does not exist because the allocation of treatments to subjects is random and therefore the good's price is independent of the subject's wealth.

Third, the situation that this experiment creates is highly artificial and strange. I never faced a situation in which a seller gave me a coupon to buy in another place instead of selling me himself. It is naïve to expect that such a strange situation will have no effect on the customer and that we will observe the natural behavior of customers according to their true preferences. There are additional problems and limitations of this type of study, but the above seem to be the more important ones.

Another possible study that overcomes some of these limitations is a lab experiment. For example, subjects will have the option to buy a good immediately, or wait a certain time and receive it for a cheaper price. Then they will sell the good to the experimenter for a price known in advance, and finish the experiment. Different subjects will receive different goods and prices. The relative thinking hypothesis predicts that when the good's price is higher, a lower percentage of subjects will choose to wait for the same savings.

The main limitation of such an experiment is the external validity problem: it is not clear to what extent we can infer from the behavior in such an abstract lab experiment about real consumer behavior when searching for a lower price or considering traveling to a remote store. Another limitation is that the results will only give us the percentages of people willing to wait for constant dollar savings, but not a specific WTA for each person (in a similar fashion to the

field experiment discussed above). This limitation might be overcome with a mechanism that elicits the WTA in a way that subjects have an incentive to report the WTA truthfully (maybe with a second-price auction). The problem is that such a mechanism makes the experiment even more abstract and farther away from real-life experiences and therefore reduces the external validity of the experiment even further.

The reason I find the above experiments important enough to discuss them in some detail is twofold. First, despite the limitations mentioned, I still believe these are interesting experiments that are worthwhile to conduct and can shed more light on the topic. The detailed discussion might help readers who find interest in this research agenda to conduct these experiments or similar ones.

Second, this discussion illustrates a point which is important not only for this article, but also more generally. There are many cases in which the same experiment can be conducted with or without incentives. The practice of economists to conduct experiments with incentives is then justified. However, there are also cases in which a certain experiment cannot be conducted with incentives. The point is that in these cases, the experiment that lacks incentives should not be automatically dismissed in favor of designing a related experiment that can be done with incentives, because the benefit of introducing incentives might come at a cost of various limitations that did not exist in the original experiment. One should consider these limitations carefully before dismissing experiments that lack incentives. Ideally, both experiments should be conducted (not necessarily in the same article and by the same person), because each has some advantages, and together they are likely to shed more light on the topic than each experiment alone.

5. Implications of Relative Thinking for Business Strategy

When experiments detect a behavior of bounded rationality, an interesting follow-up question is whether firms can exploit this behavior to increase their profits and whether it affects markets in any way. The results reported in this paper have various possible implications for business strategy, and consequently also for market outcomes.

One implication of the results here for firms is how to price goods in cases when at least some consumers purchase from the firm more than one good at the same shopping trip. Azar (2008c) analyzes pricing of multi-product retailers who take into account relative thinking of consumers. In a model where some consumers buy two different goods while others only buy one good, he finds that the markup on the good with the lower reference price may be negative, corresponding to the practice of loss-leader pricing, but the markup on the other good is always positive. The analysis suggests that when consumers buy several goods together, the firm can benefit from decreasing the prices of the cheaper items (possibly even below cost) and increasing the prices of the expensive items (compared to optimal prices without consideration of relative thinking). A second effect suggests that the existence of consumers who buy many goods reduces prices.

Azar (2005) confronts empirical evidence and theoretical predictions about the correlation between price dispersion and price. Theoretically, search and location differentiation models suggest that price dispersion is a function of search and transportation costs, but is independent of the good's price. Empirical evidence, however, suggests that price dispersion and price are strongly correlated (see for example Pratt, Wise, & Zeckhauser, 1979; Sorensen, 2000; Pan, Ratchford, & Shankar, 2001; Aalto-Setälä, 2003). Azar denotes this discrepancy "the price dispersion puzzle." He then explains why a response of firms to relative thinking of consumers

can solve the puzzle: because the expensive firms can charge a higher premium for more expensive goods given relative thinking of consumers, the absolute price dispersion becomes higher for more expensive goods.

The experimental results also imply that firms have a strategic incentive to raise prices, because doing so increases the subjective transportation costs of consumers and thus benefits the firm (because higher transportation costs increase the market power of each firm and will therefore increase the prices charged by the rivals). Azar (2008a) formalizes this idea in a theoretical model of competition between two firms.

Advertisements of sales might also be affected by relative thinking. When a firm wants to offer a significant absolute discount that is not a large percentage discount (which can happen when the good is expensive), it might be better to present the discount as a rebate or a cash-back than as a change in the good's price. By presenting the discount as a rebate, the firm can stress the absolute discount, and disassociate it (at least partially) from the good's price. It can be helpful because then the big absolute discount is emphasized, and the fact that relative to the good's price the discount is small is less prominent. For example, when a car manufacturer wants to reduce a car's price from $28,000 to $27,000, it should advertise the discount as a $1000 cash-back rather than as a price reduction from $28,000 to $27,000. The reason is that while the absolute savings are $1000 in both cases, the relative amount seems larger with a cash-back: introducing a $1000 cash-back is an infinite increase over the previous cash-back of $0, but changing the price from $28,000 to $27,000 is less than a 4% reduction.

Alternatively, the firm can try to find another dimension in which the discount can be given, to create a larger effect than that of a small percentage discount. For example, instead of lowering the price, a car manufacturer can offer financing with a zero-percent interest rate. While

a reduction in the car's price reduces the monthly payment just as a reduction in the interest rate does, a reduction of the interest rate from 6% to 0% seems very big (it is a 100% reduction in the interest that has to be paid), while an equivalent discount on the car looks smaller in relative terms. Looking at advertisements of car manufacturers, one can see that they indeed employ both the cash-back and the low-interest-rate ideas.

6. Conclusion

Utility maximization by rational consumers implies that consumers should compare the value of their time and effort to the expected monetary gains when choosing whether to spend time to obtain a lower price. Because the value of time does not depend on which good one purchases at the moment, the decision of how much savings justify an effort of driving 20 minutes should not depend on the good's price. Nevertheless, the experiment documents a major effect of the good's price on the minimal amount that people require as a discount in order to drive 20 minutes to a cheaper store.

A few possible explanations for this behavior are discussed, but the experimental data seem to fit well only the explanation of relative thinking. This explanation suggests that people consider not only the absolute savings they can obtain by going to another store, but also the relative savings. Consequently, people behave as if higher relative savings make the effort to go to a cheaper store more worthwhile, even when the absolute savings are constant. This results in more effort to save money on low-price goods than on high-price goods. It is interesting to know how this will affect the optimal firm strategy, market outcomes, optimal regulation policy, etc. A few ideas in this direction were discussed above. I hope that this article will encourage others to think more about this phenomenon and how it affects firm strategy and market outcomes.

What can we learn from the study about neoclassical economics? I think the main lesson is that in the context of price comparisons, people do not behave as neoclassical economics assumes, because they apparently are affected by relative price differences even when a rational consumer should only consider the absolute price differences. As a result, if we want to analyze issues in which this bias is relevant, for example pricing decisions of firms, we should consider incorporating the bias of relative thinking into the model. By building a model that is closer to the manner in which people actually behave, we are likely to obtain predictions that are closer to what happens in real markets. More generally, my view is that neoclassical economics can still be retained as the main paradigm in economics, but in contexts where evidence shows that the assumptions of neoclassical economics are inaccurate in important ways, we should try to examine how incorporating more realistic assumptions changes the predictions of economic models.

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Table 1: Means and Percentiles of WTA

Price (P)	Good	N	Mean WTA	Std. error (mean)	Mean WTA/P	10th perc. WTA	25th perc. WTA	Median WTA	75th perc. WTA	90th perc. WTA
3 [a]	Pen	16	1.88	0.21	0.625	1	1.25	1.5	2.75	3
10	Pen	17	3.75	0.45	0.375	1.5	2	3	5	7
30	Jacket	19	7.74	1.03	0.258	3	5	6	10	15
100	Jacket	19	11.37	1.22	0.114	5	10	10	15	20
300	Bike	19	27.89	7.5	0.093	5	10	20	35	50
1,000	Computer	17	46.76	12.04	0.047	10	15	25	50	100
3,000	Computer	19	62.89	13.13	0.021	20	20	40	100	200
10,000	Car	18	277.83	79.91	0.028	10	50	75	500	1000
30,000	Car	21	454.81	127.76	0.015	50	100	200	500	1000

[a] Four subjects answered "0" or similar answers in the P = 3 treatment, raising the possibility that their WTA is higher than $3. In the absence of a better estimate, the WTA was recorded as $3. Consequently, the mean and the 75th and 90th percentiles for P = 3 are lower bounds for the true values. No zero answers were recorded in the other treatments.

Table 2: Gender and Undergraduate Studies Effects

(Dependent variable = Ln (WTA+1), N=159 [a], R^2=0.68)

Independent variable	**Coefficient**	**Robust standard error**
Constant	0.387	0.213
Ln (P)	0.468[*]	0.052
Econ	0.064	0.181
Econ X Ln (P)	−0.005	0.038
Years	–0.087	0.144
Years X Ln (P)	0.046	0.037
Econyears	0.274	0.172
Econyears X Ln (P)	−0.135[*]	0.046
Male	0.036	0.251
Male X Ln (P)	−0.037	0.058

[*] Statistically significant at the 1% level (two-tailed test).

[a] The number of observations is slightly smaller than in Table 1 because observations for which some personal information was missing had to be dropped from the regression.