Relative Thinking Theory

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Abstract

The article presents a theory that I denote "Relative Thinking Theory," which claims that people consider relative differences and not only absolute differences when making various economics decisions, even in those cases where the rational model dictates that people should consider only absolute differences. The article reviews experimental evidence for this behavior, summarizing briefly several experiments I conducted, as well as some earlier related literature. It then discusses how we can think about relative thinking and formalize this behavior. Later, the article addresses several related questions: why do people exhibit relative thinking, whether it is beneficial to do so, and whether experience and education can change relative thinking. Finally, the article explains why firms seem to respond to relative thinking of consumers, and raises additional implications of relative thinking for economics and management.

1. Introduction

The model of rational choice in economics assumes that people maximize their utility subject to their budget constraint. The utility function they maximize, in turn, is assumed to come from well-defined preferences. If we take two goods that are identical except for one difference, and ask a consumer to tell us how much more valuable to him is the preferred good between the two, the answer should not depend on the good's price.[2]

For example, suppose that the difference between the goods is the location in which they can be purchased (but the good itself is identical). The good can be purchased either at a store 5 minutes away, or at another store 35 minutes away. Suppose that the good is a baby crib that costs $300 at the remote store, and the consumer tells us that he would purchase it at the closer store as long as its price there does not exceed $340. That means that the consumer's preferences are such that he prefers anything higher than $40 (the difference between $340 and $300) to saving an hour (30 minutes in each direction), but he prefers to save an hour to anything lower than $40. In other words, the value of his time when driving to shop, is valued (by himself) at $40 per hour.

According to the model of rational choice, if the same consumer is then asked about a stroller that costs $20 in the remote store, he should be willing to purchase the same crib for up to $60 in the closer store. The extra cost of going to the remote store (compared to the cost of going to the closer one) is exactly the same regardless of the good to be purchased. Therefore, the minimal price difference for which the consumer chooses to go to the remote store must be the same

[2] Under two conditions that are discussed in more detail later on.

regardless of the good's price. In other words, the consumer should only consider the absolute price difference between the goods, and not the relative price difference.[3]

In various experiments I conducted, however, I show that in practice consumers violate this principle in a significant and systematic way. In the context of differences in store location, consumers make choices that reflect valuation of time that increases when the good's price increases. This leads consumers to make too much effort to save money when they purchase low-price goods, and too little effort to save when they purchase high-price goods.

In the context of product differentiation, the extra amount consumers are willing to pay for a preferred characteristic of a good is higher when the good's price is higher, even though the characteristic has the same value regardless of the good's price. For example, a flight that requires the passenger to wake up at 7 am to catch it is preferred to one that requires to wake up at 4 am. It is clear that the value of sleeping 3 more hours does not depend on the flight's price. Nevertheless, experimental evidence shows that consumers are willing to add more money to get the preferred flight when the flight's price is higher.

I call this behavior "relative thinking." Sometimes I also make the distinction between partial relative thinking (considering both absolute and relative differences) and full relative thinking (considering only relative differences). When I use just "relative thinking," I mean partial relative thinking. The experiments mentioned below suggest that relative thinking exists in various economic contexts and therefore should be of great interest to researchers in economics

[3] To see how deviating from this principle results in non-optimal decisions, notice that a consumer who spends an hour to save $10 on a $20 good and later refuses to spend an hour to save $30 on a $300 good (because the relative savings are high in the first case and low in the second) could have the same amount of free time and be richer by $20 if he made the opposite choices.

and management and to managers. This conclusion is reinforced by the empirical evidence on price dispersion, which suggests that firms respond to relative thinking.

The rest of the article is organized as follows: Section 2 presents some experimental evidence about relative thinking. Section 3 discusses how we can think about relative thinking and formalize this behavior. Sections 4, 5 and 6 discuss, respectively, why do people exhibit relative thinking, whether it is beneficial to do so, and whether experience and education can change relative thinking of people. Section 7 explains why firms seem to respond to relative thinking of consumers, and the last section discusses additional implications of relative thinking for economics and management.

2. Experimental Evidence for Relative Thinking

Several examples consistent with relative thinking have existed for over 20 years. 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 on a $500 TV. Tversky and Kahneman (1981) discuss 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 when they are about 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, 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 interpret this result as

coming from a mental account that includes the price of the calculator but not that of the jacket, together with the curvature of the prospect theory value function.

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 managers 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, and Darke and Freedman (1993) find that both the percentage discount and the absolute discount have an effect on consumer choice. Moon, Keasey and Duxbury (1999) find that the effect of relative savings is not detected when the level of absolute saving to be gained increases.

In all those studies, 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 these studies that people behave as if the value of their time is higher when they purchase a more expensive good. 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 doubles, for example, is the valuation of time doubles, or less than doubles?

Moreover, it is not clear what is the reason that people exhibit this behavior. 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.

Azar (2004a), however, presents an experiment that allows to reject these alternative explanations for the observed behavior, and other potential explanations, thanks to an experimental design that differs from that of the previous studies. Moreover, he can examine quantitatively how increasing the good's price affects the subjects' valuation of their time. This allows him, for example, to refute the hypothesis of full relative thinking in favor of partial relative thinking. Two main changes in the experimental design allow for these advances over previous experiments in the literature: first, subjects are asked to provide a missing price rather than to answer a yes/no question, allowing to compute their valuation of their time (as reflected in their answer) rather than to know only whether it exceeds a certain threshold. Second, Azar uses nine different prices in the experiment, as opposed to only two or three in previous experiments, allowing him to reject alternative explanations for this behavior that could not be rejected previously.

Specifically, Azar asked subjects to assume they are about to purchase a certain good, telling them what the price of the good is at a store they currently visit, and asking them for the maximal price for which they prefer to purchase the same good at another store (where purchasing from

the other store requires spending 20 more minutes going there etc.). The difference between the good's price at the current store and the subject's answer reflects the monetary compensation the subject requires for spending 20 minutes going to a different store. The experiment is between-subjects, but the assignment of treatment (the good and its price) to subjects is random, and therefore if people behave rationally (exhibiting no relative thinking), the value of 20 minutes should be similar across treatments. In the experiment, however, the value of 20 minutes turns out to increase from $1.88 (for those who were told they are about to purchase a $3 pen) to $454.81 (in the $30,000 car treatment)!

While the literature discussed above focused on the trade-off between time and money, Azar (2004b) shows that the same idea applies also in other domains. He presents subjects with two goods that are identical except for one characteristic: a flight that requires waking up at 4 am versus one that requires to wake up at 7 am, a hotel room with a view to the Swiss Alps versus one with a view to the parking lot, and a website that ships a desired book in 2 days versus one that takes a week. His experiment (conducted between subjects) shows that in all those cases, the price of the good affects how much people are willing to add to get the preferred good, even though the value of 3 hours of additional sleeping in the morning (or of the Alps view or the earlier book delivery) should not depend on the good's price. Thus, Azar provides evidence that relative thinking is a general phenomenon that applies in many circumstances and not only when people have to make trade-offs between time and money.

Moreover, the experiment uses, in addition to a sample of undergraduate students, a unique sample: participants in the 2003 North American Summer Meetings of the Econometric Society. These learned economists turn out to display relative thinking not less than undergraduate students. In addition, Azar shows once again that full relative thinking can be rejected in favor of

partial relative thinking. He multiplies the good's price by 3 between the two treatments of the various questions in the experiment, and shows that the willingness to add for the preferred good increases, but less than triples.

Azar also provides evidence for relative thinking in yet another context, and in this case also with real financial incentives to behave rationally.[4] In another experiment, subjects were asked to solve as many algebra questions as they wanted (up to a total of 50 questions) and were paid six cents for each correct answer. The treatments were the show-up fee; subjects were randomly assigned to one of three treatments, with show-up fees of $1, $3 and $10. Consequently, the six cents per correct answer were a different percentage of the total payoff in the various treatments, and this indeed had an effect on the subjects' effort to solve the algebra questions.

3. A Theory of Relative Thinking

In this section, I want to discuss how relative thinking can be formalized in a simple model. The general structure of decision contexts in which relative thinking can be observed most easily is the following: there are two goods that are identical except for one attribute.[5] The consumer prefers one of the two goods. The differentiation between the goods can be either vertical (one good is clearly better than the other one – such as a room with a view versus a room without a

[4] In the previous experiments, financial incentives could not be provided because the subjects were asked about their preferences, and those are unknown to the experimenter. Consequently, the experimenter cannot reward the subjects based on how much their answers deviate from the correct ones.

[5] For example, the different attribute may be the location of the stores in which the good is sold, or the flight departure time of otherwise identical flights.

view), or horizontal (consumers can differ regarding which of the two goods they prefer – for example when the difference between the goods is the good's color or the store's location).[6]

We can then define the willingness to add (WTAD)[7] as follows: denote the price of the less-preferred good by P_L (L for "low-preference"). If the preferred good also costs P_L or only slightly more, the consumer prefers it to the less-preferred good. If the preferred good is much more expensive than the less-preferred good, the consumer prefers the less-preferred good. Therefore, there is a certain threshold price for the preferred good for which the consumer is exactly indifferent between the two goods. If the price is above the threshold he prefers the cheaper good, and if the price is below the threshold, he prefers the preferred (and more expensive) good. Denote this threshold by P_H (H for "high-preference"). Now the willingness to add is simply the difference between P_H and P_L:

$$WTAD = P_H - P_L.$$

Now suppose that we take two similar goods, and the difference between them is exactly the same difference as in the original pair of goods. For example, suppose that the original pair was two flights with departure times of 6 am and 9 am, where the consumer prefers (if prices are identical) the later flight, and where the earlier flight costs \$150. Assume that the consumer told us that at a price of \$180 for the later flight, he is exactly indifferent between the two. We can then compute that his WTAD is \$30 = \$180 − \$150.

The second pair of goods in this example could be two flights that leave at 6 am and 9 am, but where the earlier flight costs \$300. Obviously, a rational consumer with well-defined preferences who is willing to add \$30 to wake up 3 hours later in the first case, should be willing

[6] In experiments it is easier to handle the case of vertical product differentiation, because then the experimenter knows which good is more valuable to the consumer, and this simplifies the experiment.

[7] I use WTAD rather than WTA because WTA is often used for "willingness to accept."

to add the same amount in the second case, implying that P_H should now be \$330, and the WTAD should remain \$30.

This principle is true as long as two conditions are satisfied: (1) the difference between the goods is not related to their price level, and (2) the difference in P_L between the two pairs is small enough that it does not create significant wealth effects. Let me elaborate on these two conditions to make them clear:

(1) The difference between the goods is not related to their price level. If this condition does not hold, then it might be reasonable for the consumer to have a higher WTAD for the more expensive pair of goods. A few examples will make this clear. Suppose that identical goods are sold in two stores, but one store requires paying in cash, while the other store allows the customer to pay 3 months from today. The customer therefore prefers the second store. Here, however, it makes sense that the WTAD will be higher for more expensive goods, because the time value of money (3 months of free credit) is higher for more expensive goods.

Another example is when one store gives a satisfaction-guaranteed, no-questions-asked return policy that allows to return merchandise for 3 months after purchase, while the other store allows to return items only if they are unopened, and only for 2 weeks after purchase. The value of the better return policy is that it reduces the customer's risk of getting stuck with a good that turns out to be undesired. The value of the risk reduction is higher the more expensive is the good, and therefore the WTAD to buy from the better-return-policy store should be higher for more expensive goods. A similar example is when two sellers provide different warranty coverage for the same item. The value of the warranty is higher for more expensive goods, and therefore the WTAD will increase in price.

There are, however, many cases where the difference between the goods is not related to their price level. One example is the two flights with different departure times – the extra value of a more convenient departure time should not depend on the flight's price. Similarly, when stores differ in their location, the extra value of the closer store stems from saving time going to the more remote store, and this value is the same regardless of the price of the good that the consumer is going to purchase.

(2) The difference in P_L between the two pairs is small enough that it does not create significant wealth effects

If one pair of goods we consider is so much more expensive than the other pair, that the difference is significant compared to the consumer wealth, a wealth effect might change the analysis. If the consumer considers the cheaper pair of goods, he has much more wealth left than when he considers the more expensive pair. In this case (and absent relative thinking), the WTAD for the preferred good in the more expensive pair will be lower than the WTAD in the cheaper pair, because the consumer has smaller wealth left after purchase in the former case.[8] Notice that this goes in the opposite direction to relative thinking (that causes the WTAD to be higher in the more expensive pair). Consequently, if we observe a behavior of relative thinking, it cannot come from wealth effects; on the contrary − if wealth effects are present, then the results underestimate the true extent of the relative thinking.

As an example for the idea of wealth effects, suppose that the consumer wants to purchase a house, and the difference between the goods in each pair is whether to invest in new windows or not. One pair of goods is a house in the city center, which costs $500,000 (one good is the house

[8] This is based on the assumption that the difference in each pair between the preferred and less-preferred good (more convenience, better quality, nicer view, etc.) is a normal good (i.e. not an inferior good).

with its old windows, and the other good in the pair is the house with new windows). The other pair of goods is a house in the suburbs, with or without new windows, for a price of $150,000 (the price for the house without new windows). Now we can ask the consumer in each case how much he is willing to add to replace the windows. Assuming that the $350,000 difference in the house's price is significant compared to his wealth, the cheaper house leaves him much more wealth, and assuming that new windows are a normal good, the wealth effect means that absent relative thinking (and ignoring issues related to investment in the house in order to sell it later for a higher price), the consumer should be willing to add more for the windows if he buys the cheaper house. For the vast majority of goods, however, the difference in prices between the two goods are so small compared to the consumer's wealth, that wealth effects are irrelevant.

To summarize, under the two conditions discussed above, a rational consumer with well-defined preferences should have the same WTAD regardless of P_L for a constant difference between two goods. This is the case of a consumer that does not exhibit relative thinking. A consumer who exhibits relative thinking, will express a WTAD that increases with P_L. We can write this formally as follows:

$$WTAD = w(P_L),$$

where w is a function that increases in P_L for relative-thinking consumers, and is constant in P_L for rational consumers with well-defined preferences. Of course, WTAD depends on additional factors other than P_L and the type of the consumer, such as the context of the decision problem. A simple and useful function to use for w is the following function:

$$w(P_L) = dP_L^{\alpha\beta},$$

where d is a number that depends on the difference in utility between the two goods and is not a function of P_L, and α and β are parameters between 0 and 1. α is a parameter that captures

the extent of relative thinking of a certain consumer, and β captures the extent of relative thinking inherent in a certain decision context. A completely rational consumer has $\alpha = 0$, and therefore for him WTAD = d, i.e. his WTAD does not depend on P_L. The extreme version of relative-thinking is captured by $\alpha = 1$; for this consumer, in contexts that are the most prone to relative thinking (with $\beta = 1$), we will have WTAD = dP_L, i.e. WTAD is proportional to P_L, what we called before "full relative thinking." In most cases in which relative thinking is relevant, however, α and β are both strictly between 0 and 1, and the result is partial relative thinking: increasing P_L by x% raises WTAD by less than x%.

Azar (2004a) formulates the "Golden Rule of Relative Thinking" as follows: "Relative thinking leads people to behave as if the value of their time is proportional to the square root of the price of the good they want to purchase." This implies that $\alpha\beta = 0.5$ on average in the context of shopping for a good that can be purchased for a lower price at a more remote store.

What determines the value of α? In general, some people have more tendency to relative thinking than others, and therefore α varies across people. A reasonable conjecture seems to be that people who make their choices in a more systematic way, and in a way that is closer to what the rational model prescribes (i.e. they think carefully about their preferences and maximize utility given their budget constraint), will exhibit less relative thinking than people who make decisions less systematically and more intuitively and spontaneously. In addition, experience and education may reduce the value of α; experience and education are discussed in more detail in Section 6.

Azar (2004a) analyzes how relative thinking was affected by various individual characteristics, and he finds that students who studied more courses in economics exhibit less relative thinking. Both Azar (2004a) and Azar (2004b) find some evidence suggesting that males

exhibit relative thinking a little less than females. Surprisingly, Azar (2004b) finds that participants in the 2003 North American Summer Meetings of the Econometric Society exhibit relative thinking slightly more than students, although the difference is not statistically significant.

What affects the value of β? It is hard to formulate rules, but additional experimental research might help us understand in which contexts relative thinking is more common. One interesting result that Azar (2004b) finds, is that formulation of the decision problem in a way that the subject thinks about his willingness to accept (WTA) encourages relative thinking more than formulating it in a way that the subject thinks about his willingness to pay (WTP). The WTA formulation is one in which the subject is told the price of the preferred good, and is asked for the price of the less-preferred good that will make him indifferent between the two. The subject then has to consider a loss in the good's quality compared to the reference good (the good whose price is provided), and therefore this resembles the concept of WTA (how much money you require in order to give up something you have – in this case the good quality). In the WTP formulation the subject is provided the price of the less-preferred good and he has to provide the price of the preferred good that will make him indifferent between the two. The subject considers a gain in the good's quality compared to the reference good, and this resembles WTP (how much you are willingness to pay for something you do not have).

The concept of WTAD and the discussion above applies to relative thinking in the context of product differentiation (which can come either from the goods being different, or from the sellers being different – in their location, return policy, etc.). The main idea, however, namely that people consider relative differences and not only absolute differences, applies to other contexts as well. In search models, for example, consumers without relative thinking have search costs

that are independent of the good's price; consumers with full relative thinking behave as if their search costs are proportional to the good's price; and consumers who exhibit partial relative thinking behave as if their search costs are increasing in the good's price, but less than proportionally (i.e. when the good's price is multiplied by z, they behave as if their search costs increased by z^{α}, where $0 < \alpha < 1$). The same principle probably applies to the perception of people regarding wages, interest rates, tax rates and so on. If people for some reason are "programmed" to consider relative differences in addition to absolute differences, there is no apparent reason why this should be limited to prices only. Additional research along these lines is called for.

4. Why Do People Think about Relative Differences?

4.1. Weber's Law

An intriguing question is why people think about relative differences when the rational thing to do is to think only about absolute differences. An idea where this tendency might come from is Weber's Law, which states that our ability to distinguish between two stimuli depends on their relative difference, rather than their absolute difference. That is, for each type of stimulus we have a constant k and we can tell that two stimuli x_1 and x_2 (assume without loss of generality that $x_2 > x_1$) are different in their magnitudes, if and only if $x_2 > kx_1$, where $k > 1$. This law was found to be true for various senses and stimuli and for almost all levels of stimulus except for very high or very low ones (Miller, 1962). For example, suppose that when we evaluate weight using our hands the minimum weight that we can distinguish from 10 grams is 12 grams. Then

when we have instead 100 grams, we cannot distinguish it from 102 grams; the minimal distinguishable weight will be about 120 grams.

This explanation for relative thinking resembles the justification that Kahneman and Tversky (1979) gave for why people look on changes in their wealth rather than the terminal wealth levels. They explain that our perceptual apparatus is attuned to the evaluation of changes or differences rather than to the evaluation of absolute magnitudes, and that stimuli are perceived in relation to a reference point (e.g. if we dip our hand in water of 15 degrees Celsius and then move it to 30 degrees, the latter feels hot; if we dip our hand in 45 degrees and then in 30 degrees, the latter feels cold). Accordingly, prospect theory is based on a value function that represents the idea that one's utility depends on gains and losses compared to his reference point rather than on his terminal wealth level. Similarly, Tversky and Kahneman (1991, p.1057) explain loss aversion in choice as coming from the asymmetry between pain and pleasure: "… pain is more urgent than pleasure. The asymmetry of pain and pleasure is the ultimate justification of loss aversion in choice."

The explanations for relative thinking and the existence of reference point and of loss aversion share the feature that they make an inference from how we perceive the physical world to how we perceive economic problems, an inference that is not necessarily true. My senses might be limited by Weber's Law, but I can still understand that $100 is different from $100.01 even though the relative difference is very small. I can also check my bank account and be happy that I have in it a million dollars even if I lost today $1000. And while pain is more urgent than pleasure in the physical world, this does not imply necessarily that I suffer more from $20 loss than from a forgone gain of $20.

Although Weber's Law does not necessarily imply that we should exhibit relative thinking in economic contexts, it is suggestive why we do so (a similar argument can be made regarding the reference point and loss aversion). Since our perception system and various instincts we adopted over millions of years of evolution act according to relative differences rather than absolute differences (as Weber's Law suggests), it is quite natural that we also exhibit relative thinking in economic contexts.

One example where the relationship between Weber's Law and relative thinking about prices seems natural is when memory is involved. We do not remember the exact price of everything we buy, but we have a vague memory of how much it costs, and the inaccuracy (in dollars) in which we remember the price is increasing in the good's price. If we ask people to provide a 95-percent confidence interval about the price of something they purchased a week ago, the range will generally be increasing in the good's price. Consequently, we will identify a difference in the price in the future only if it is above a certain threshold, which is an increasing function of the good's price (though not necessarily a fixed percentage of the good's price). Consequently, with goods that we buy on a regular basis (such as food), we might decide to purchase a larger quantity than the usual one if we observe a lower price (either at another store we go to, or because of a price change in our regular store), but to observe a lower price the difference has to be higher than a threshold that is increasing in the good's price. This can explain why "Retailers have long recognized that markdowns of less than 20 percent generally go unnoticed" (Kindra, Laroche and Muller, 1989, p.80).

4.2. Evolution

Can relative thinking be the result of an evolutionary process, i.e. does it enhance the fitness of humans? Since evolution of species is a process that occurs over millions of years, we should look not whether this tendency is beneficial today, but rather whether it was beneficial tens and hundreds of thousands of years ago. It may be the case that thinking about relative differences was more useful than thinking about absolute differences in the evolution of human beings. While I know too little about human evolution to make any specific claims regarding whether and how relative thinking might have been useful in the past, I think that exploring this issue is a worthwhile endeavor for future research by biologists, psychologists, sociologists and anthropologists as well as economists.

5. Is Relative Thinking Beneficial Today?

In today's environment, is it helpful to think in relative terms (for example to think about percentages)? If the agent is unboundedly rational and mental processes (thinking, memorizing, etc.) are costless, the answer is no. Thinking about absolute levels allows us to implicitly think also about ratios and percentages when this is relevant; but thinking automatically about percentages regardless of the context leads to non-optimal decisions, for example making too little effort to save money on high-price goods, and too much effort to save on low-price goods. If I think about absolute levels and I know that I have to drive 20 minutes to save $30 on a $1,500 computer, for instance, I can compute that this means that I save 2 percent on the computer, and I can use this figure if it is relevant in the problem I face. But if I only think about percentages and therefore I am only aware that I save 2 percent, but not the absolute magnitude of the saving, I lose valuable information and might not optimize as well.

The conclusion that relative thinking is not beneficial, however, might change if we introduce various sorts of bounded rationality, such as deliberation costs, limited ability to analyze problems, and limited memory capacity. Consider the case of deliberation costs, for example, and assume that every additional variable in the decision problem makes it more time consuming (and therefore costly) to solve the problem. To have a concrete example in mind, suppose that I go to the grocery store once a week, and for every good that I buy I have to decide whether to buy a small package that suffices for one week or a bigger one that suffices for three weeks. If it were not time consuming, I should have examined for every good, among other things, the difference in prices between the two sizes, the interest rate I earn in the bank, the rate with which the freshness of the product declines and how it affects my utility from it, whether there are increasing returns to scale in purchasing (I may spend less time with the cashier if I buy the large packages, for example), and if I am a hyperbolic discounter, also how tempted I will be to consume more if I buy the large box.[9] With deliberation costs, however, I might be better off coming up with a rule of thumb (e.g. to buy the larger box if it saves me at least 10 percent compared to buying three smaller boxes) rather than solving each decision problem separately.[10]

6. Experience and Education

Another interesting question is whether this tendency to think about relative differences disappears with experience. The experiments reported above suggest that the answer is no, since adults make the trade offs they were asked to do in the experiment (between money and time or

[9] I suspect that if I buy my annual consumption of chocolate at the beginning of the year, I will finish it much before the year is over, for example…

[10] Baumeister (2003, p. 13), for example, argues that "making decisions consumes one of the self's important inner resources. This is probably one reason people are creatures of habit: Habit, routine, and automatic processes avoid having to expend resources by making choices."

various dimensions of quality) everyday for years, and still they exhibited relative thinking. It is possible, however, that experience mitigates relative thinking to some extent. Examining the effect of experience is an interesting topic for future research. I suspect, however, that even if experience mitigates relative thinking, it is very context-sensitive: for example, someone who makes often the trade-off between convenience of flights and their price may realize that he should be unwilling to pay more to wake up three hours later when the flight ticket is more expensive, but still exhibit relative thinking in other contexts.

Is it possible to educate people about relative thinking, and if so, will it change their behavior? The answer to both questions seems positive. We can explain people that this tendency exists, and give them a few examples in which it is not optimal (such as when searching too much for low-price goods or too little for high-price goods). Once the consumer is aware of relative thinking, he can overcome his tendency to quit looking or negotiating for a better price too soon when purchasing something expensive, and to spend to much effort to save when buying something cheap. Obviously, when relative thinking is a useful and parsimonious rule of thumb, the consumer can retain this rule even when he is aware of relative thinking.

7. Do Firms Respond to Relative Thinking?

When experiments detect a behavior that departs from that of a selfish and unboundedly rational agent, economists usually want to know whether this behavior affects markets in any way. Do we observe any response of firms to relative thinking? A full treatment of this question is beyond the scope of this article, but I will describe briefly why it seems that they do. The first step in answering this question is to recognize how firms should react to relative thinking.

Price competition with homogenous products leads to the Bertrand paradox where prices equal marginal cost, and in that case consumers and their biases have no effect on the equilibrium. In many markets, however, despite seemingly homogeneous goods, prices are above marginal cost and not all firms charge the same price. These observations are often explained by either seller heterogeneity (models such as the linear city) or by search models that assume that searching for the lowest price is costly.

Seller heterogeneity (for example because of different geographical location of the sellers), leads to product differentiation and potentially (if asymmetries exist) to price differences. How much the sellers differ from each other is captured by the concept of transportation costs. If the sellers differ in their geographical location, for example, the transportation costs reflect the time and effort required to go to each seller, and the more remote the sellers are from each other, the higher those transportation costs would be. Since price differences are the result of product differentiation, the higher is the product differentiation (i.e. higher transportation costs), the more price dispersion we would expect to see.

If consumers exhibit relative thinking, they behave as if their transportation costs are higher when they purchase a more expensive good (e.g. they require higher compensation to drive 20 minutes to a cheaper store when the good's price is higher). If firms know this and respond to it, price dispersion will be higher for more expensive goods. If, on the other hand, consumers do not exhibit relative thinking or firms do not respond to it, transportation costs are independent of the good's price (because the cost of going to a remote store does not depend on the good's price), and therefore absolute price dispersion (i.e. price dispersion that is not divided by the good's price, e.g. the standard deviation of prices) should also be independent of the good's price.

In search models, a similar result holds. Price dispersion is the result of costly search, and therefore higher search costs generally lead to more price dispersion. If consumers exhibit no relative thinking, their search costs are independent of the good's price, and therefore price dispersion should be independent of the good's price. If consumers exhibit relative thinking and firms respond to it, then consumers behave as if their search costs are higher when they purchase more expensive goods, and this leads firms to choose prices such that absolute price dispersion is higher for more expensive goods.

To summarize, both seller heterogeneity models and search models lead to the conclusion that if firms respond to relative thinking of consumers, then price dispersion should be an increasing function of the good's price, but otherwise price dispersion should not be affected by the good's price. What do we know about the relationship between price dispersion and the good's price? Studies of price dispersion in various markets find a very strong positive relationship between price dispersion and the good's price (or the good's cost, which is obviously positively related to the good's price). Examples include Pratt, Wise and Zeckhauser (1979); Pan, Ratchford, and Shankar (2001); Sorensen (2000); and Aalto-Setälä (2003). The strong positive relationship between price and price dispersion supports the idea that firms respond to relative thinking of consumers.

Another example for response of firms to relative thinking can be seen in advertisements of sales by car manufacturers. Because cars' prices cannot be reduced by a significant percentage, when a car manufacturer wants to reduce the price of a car from $25,000 to $24,000, it usually chooses to advertise the sale as a $1,000 cash-back (an increase of infinite percentage, from $0 to $1,000 cash-back) rather than as a reduction of the price from $25,000 to $24,000 (only 4 percent reduction). Similar reason probably leads to the common practice to advertise low

interest rates (e.g. “0.0% APR”) rather than a reduction in the car’s price. Obviously, a reduction in the car’s price reduces the monthly payment just as a reduction in the interest rate does. A reduction from 6% interest to 0%, however, looks much more significant (it is a 100% reduction in the interest rate) than the equivalent reduction in the car’s price.

8. Implications of Relative Thinking for Other Areas in Economics and Management

The article suggests that people exhibit relative thinking in various economic contexts and that firms respond to this behavior. While the current article focuses on the implications of relative thinking in product markets, relative thinking is more general and has implications in many other areas in economics and management (as well as in other disciplines). One example is labor markets. Relative thinking affects the optimal choice of incentive schemes. For example, increasing the fixed payment to a worker reduces the perceived magnitude of the pay-for-performance component, because it becomes a smaller percentage of total compensation, and this might reduce the worker’s effort. In addition, the optimal wage increase when workers are promoted (or if the firm increases the wage annually) may be different if workers respond to the percentage increase rather than to the dollar increase.

Relative thinking also has various policy implications. Suppose that the government has to increase taxes to cover a budget deficit and that increasing the highest rate of income tax from 40 to 41 percent yields the same revenue as increasing sales tax from 10 to 11 percent. Assume that the two alternatives have a similar effect on social welfare and that the government wants to take the step that will be perceived as a smaller tax increase. Since the difference between 40 and 41 is smaller in relative terms than the difference between 10 and 11, this suggests that the increase in income tax may look less significant and cause less resistance. Similarly, a government in an

inflationary country that wants to increase the interest rate in order to encourage savings and alleviate the inflationary pressures might have more effect on household behavior by advertising that the CPI-linked interest rate is raised from 3 to 4 percent, than by advertising an increase in the nominal interest rate from 23 to 24 percent.

How firms should compare their price or quality to market benchmarks is also influenced by relative thinking. For example, consider a mutual fund manager who has to compare his previous performance to the market benchmark in a brochure for potential investors. If the manager achieved a return of 16 percent when the market index increased by 19 percent, he should use the numbers 19 and 16 percent. But if he achieved 19 percent when the index increased by 16 percent, he should advertise that he outperformed the index by 3 percentage points, because 3 compared to 0 (which is the natural reference point) seems a bigger difference than the difference between 19 and 16.

Relative thinking has also many implications in product markets in addition to those mentioned in the previous sections. A firm that sells many goods, such as a grocery store or a department store, might gain by reducing the prices of low-price goods and increasing the prices of high-price goods (compared to their optimal levels without relative thinking). If consumers decide in which store to buy according to the average relative difference in prices rather than according to the difference in the total cost of what they buy, this strategy can attract more customers and increase profits.

How firms should frame their prices is also affected by relative thinking. One example was mentioned before: a cash-back of $1,000 on a $25,000 car has greater impact than a reduction of the price from $25,000 to $24,000. For another example, if a car dealer wants the client to

upgrade from an AM/FM radio to a CD player, it is better to present it as an increase in the car's cost from $25,000 to $25,300 than to frame it as a separate $300 purchase.

Relative thinking, which implies that the willingness to pay for a more convenient location or more desired product characteristics is increasing in the good's price, also affects optimal location choice, both geographically and in the product space. For example, if by being located 20 minutes away from the city center a firm can reduce the price of the goods it sells by $5 per item, this might be worthwhile for a firm that sells $70 VCRs, but not for a firm that sells $2,000 notebook computers, because of the different effect of the $5 savings on the willingness to drive to the remote store in the two cases.

These are only a few examples for the importance of relative thinking in economic contexts, and how firms can exploit this behavior. Relative thinking is a wide-spread phenomenon that was virtually ignored by economists so far. I hope that this article will encourage economists to think more about this phenomenon and how it affects markets.

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