Mental Budgeting vs. Relative Thinking

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A growing literature uses economic behaviors in field settings to test predictions generated by various psychological models. In some cases, psychological theories make conflicting predictions for the same consumer context. In this paper, we attempt to reconcile two conflicting predictions about upgrading behavior, one made by category budgeting (e.g., Heath and Soll, 1996, Thaler, 1985)—which suggests people will upgrade less as prices go up—and one made by relative thinking (e.g., Kahneman and Tversky, 1981)—which suggests people will upgrade more as prices go up.[1]

In a recent paper, Hastings and Shapiro (2013) convincingly demonstrate a violation of fungibility in gasoline upgrade decisions. They show that consumers are less likely to upgrade to premium gas when the overall price of gas goes up and the price difference between regular and premium gas remains fixed. Hastings and Shapiro provide evidence that the standard model as well as simple behavioral models utilizing loss aversion and salience have difficulty accounting for the upgrade decisions made in the data. Their findings instead provide strong evidence of category budgeting (Heath and Soll, 1996). The intuition for this model is that as gas prices go up, a consumer's mental budget for gas feels tight and he/she may decide to forgo the upgrade option.

Using a different psychology literature, however, one might have come to the exact opposite prediction than the result found by Hastings and Shapiro. Specifically, Kahneman and Tversky (1981) show that people respond in a non-rational manner to relative price differences.[2] In their hypothetical scenario, people report being more likely to drive across town to save $5 on a $15 calculator than on a $120 calculator.[3] In the gasoline context, when the price of gas goes up, Kahneman and Tversky's model of relative thinking suggests that the price of premium gas now looks relatively cheap, so consumers will be more likely to upgrade since the difference in price between premium and regular now seems small.

Given the strong findings in Hastings and Shapiro (2013), one might argue that in situations where mental budgeting and relative thinking make disparate predictions, the mental-budgeting prediction will always dominate. In this paper, we attempt to shed light on this argument and, using primarily survey data, find evidence that this is not necessarily the case. Additionally, we provide suggestive evidence of relative thinking in the field using a dataset of car-rental insurance purchases.

I. Replicating Relative Thinking

We begin by attempting a replication of Kahneman and Tversky's finding of relative thinking using a large sample and a slightly different hypothetical scenario. In a between-person design, Amazon Mechanical Turk (MTurk) participants ($N = 516$) were told that

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[1] There are other examples in the literature of situations where psychological theories provide conflicting predictions and researchers have tried to understand when one effect will dominate the other. For example, the gambler's fallacy and the hot-hand fallacy predict opposite effects in many contexts (Rabin and Vayanos, 2010). Similarly, order effects can result in contrast or assimilation (e.g., Bless and Schwarz, 2010).

[2] Recent work has further explored relative thinking both theoretically (e.g. Bushong, Rabin, and Schwartzstein, 2016) and empirically (e.g. Azar, 2007; Azar, 2011).

[3] Participants are asked about buying both a jacket and a calculator. They are told that the calculator is on sale for $5 at a store across town. The price of the calculator and jacket are counterbalanced, such that people are always spending the same total amount of money (i.e., $135 if they do not drive across town versus $130 if they do).

they were going to the drug store to pick up a prescription drug and that they could walk to a nearby store that was 3-5 minutes away to get a lower price. They were randomly assigned to one of six different price pairs ($1 and $6, $11 and $16, $21 and $26, $31 and $36, $51 and $56, $91 and $96, $151 and $156). Participants responded on a 4-point scale ranging from "1-Definitely would walk to the other store" to "4-Definitely would not walk to the other store". The results presented in Figure 1 show that as prices get higher (and therefore the price difference seems relatively small), participants are much less likely to accept the higher price and more likely to walk to save money. These results are statistically significant and consistent with the original finding of Kahneman and Tversky.

II. Relative thinking vs. Mental Budgeting in the Lab

Our second study moves from the original relative-thinking scenario above, which focuses on the opportunity cost of walking to a different store, to a scenario about upgrade decisions. We also switch from large price differences and ranges ($1-$156) to ones that are more similar to the gasoline prices studied in Hastings and Shapiro (2013).

We asked MTurk participants ($N = 1600$ per product) how likely they would be to upgrade to a higher-quality product for various products at different prices. The first 3 products were a pen, an 8-oz bottle of glass cleaner, and a box of 100 paper clips. For each product there was the "regular" version and then a "premium" version: the premium pen had quick-dry ink, and the premium glass cleaner and paper clips are both name brands. Participants faced one of four price pairs for the regular or premium version of the product ($0.39 vs $0.59, $1.39 vs $1.59, $3.39 vs $3.59, $6.39 vs $6.59) and were asked how likely they would be to upgrade on a scale from "1-definitely would not upgrade" to "4-definitely would upgrade" given the regular and premium prices that they were shown.

This framework allows us to see if the prediction of mental budgeting (participants are less willing to upgrade as prices increase) dominates the prediction of relative thinking (participants are more willing to upgrade as prices increase). The first 3 panels of Figure 2 provide the results from our experiment. In all three cases, we find statistically significant evidence of percentage thinking. For example, for each product the highest pair of prices resulted in a significantly higher willingness to upgrade than the lowest pair of prices (pens: $T = 6.26$, $p < 0.001$; glass cleaner: $T = 5.69$, $p < 0.001$; paper clips: $T = 7.43$, $p < 0.001$).

One potential explanation for why relative thinking dominates mental budgeting in these three scenarios is that the items chosen are not regularly-purchased items and therefore may not have strong mental budgets associated with them. We therefore ask participants to give their tendency of upgrading on two items that are purchased more regularly and are thus more likely to have mental budgets: a candy bar and a one-gallon bottle of milk. The premium version of the candy bar was king-sized and the premium version of the milk was organic. Panels D and E of Figure 2 show the results for these two products. Once again, we find evidence that participants are more likely to upgrade as prices increase, which is consistent with relative thinking (candy: $T = 5.92$, $p < 0.001$; milk: $T = 4.00$, $p < 0.001$).

The difference so far between our findings consistent with relative thinking and those of Hastings and Shapiro consistent with mental budgeting could perhaps be due to the fact that Hastings and Shapiro are using field data as opposed to hypothetical choices on MTurk. Perhaps MTurk participants are not able to conjure up true mental budgets when answering hypothetical upgrade questions. An obvious way to test what is causing the different results that we find is to do a hypothetical scenario using exactly the product that Hastings and Shapiro studied: gasoline purchases. We ask participants to give their probability of upgrading to premium gas when facing one of our four price pairs. The results are shown in Panel F of Figure 2. Unlike the other products, we do not find relative thinking, but if anything we find some evidence of mental budgeting: participants given the lowest price pair were marginally significantly more likely to upgrade than those given

the highest price pair ($T = 1.80$, $p = 0.036$). While the evidence for mental budgeting is merely suggestive, we are definitely able to reject evidence of relative thinking, which we found for all of the other products studied. This suggests that gas is different in some way from both random household items (pen, glass cleaner, and paper clips) and regularly purchased food items (candy bars and milk).

Why are we, and Hastings and Shapiro, finding mental budgeting for gasoline but not for other goods? We can only speculate why gasoline is different from these other products. Perhaps gasoline is an item for which consumers have a particularly well-defined mental budget. Perhaps buying premium gas is thought of as a luxury to consumers and when prices go up consumers can't stomach the idea of being so frivolous.

The survey results presented in this section suggest that in many situations where one can upgrade from one product to another, the prediction from a model of relative thinking may dominate the prediction from a model of mental budgeting. It is possible that the best field evidence to date on this question (Hastings and Shapiro, 2013) may have looked at one of the few products where a mental-budgeting prediction happens to dominate.

III. Data for Relative Thinking in the Field

In our final study we use administrative data on rental-car insurance purchases to test for relative thinking and mental budgeting. We obtained data from an online travel company that sells add-on insurance for $10 per rental day. Our data include observations for 98,275 rentals made by 80,870 unique customers. The data span from May 1st, 2016 to May 31st, 2017, and insurance is purchased in 17.86% percent of the rentals. The data include a person identifier, information on prices, insurance purchase, date and duration of the rental, a variety of location variables (e.g. pickup and dropoff locations), and rental-car categories (e.g. mid-size and compact).

We are interested in whether people are more likely to purchase the add-on insurance when the base daily rental price is high. Relative thinking predicts that people will be more likely to purchase the add-on insurance when the price of a car rental goes up, while mental budgeting predicts the opposite. However, one obvious concern with this simple identification strategy is that the variation in the car rental price might be endogenous:

Firstly, the rental price will likely be higher for nicer cars and purchasing insurance at a fixed rate may be more valuable when driving a nicer car. One way to overcome this concern is to control for car categories and therefore only use the variation in rental prices within each type of car. Secondly, individuals that are renting cars during high-price periods of year (e.g. Thanksgiving) may be different types of people from those who are renting during low-price periods. For example, the high-price renters may be wealthier and more likely to purchase the add-on insurance. We can try to overcome this type of endogeneity by including person fixed effects and therefore identify off the time series variation of rental prices within person. Furthermore, We can also include additional control variables—such as time of year and geographic controls—to avoid spurious correlation and soak up variation in insurance purchases to improve statistical power[4].

Table 1 provides the results from a regression of the insurance purchase indicator on the per-day price of the rental. Column 1 reports the results without any controls and each column includes an increasingly rich set of control variables. Panel A provides estimates without person fixed effects and Panel B includes person fixed effects in all specifications. Column 1 of Panel A suggests that a one dollar increase in price is associated with a 0.11

[4]It is important to note that our identification strategy is far from perfect. One can come up with other stories that might lead to the effects that we find. For example, even when looking within person, perhaps people sometimes rent cars for business and at other times for pleasure. They are perhaps more price sensitive when renting for pleasure and therefore travel during cheaper periods of time and are less likely to purchase insurance. We are unable to rule out these types of stories.

percentage point increase in the likelihood of purchasing insurance—a finding consistent with relative thinking. The point estimate is robust to the inclusion of controls for type of car, seasonal effects, locations, and length of rental. Panel B reports the estimates when controlling for individual fixed effects. The results when including person fixed effects are significantly smaller than the results in Panel A and also less robust to the inclusion of various controls.

While we are hesitant to draw strong conclusions from this exercise, the results above at least provide suggestive evidence of relative thinking, and they certainly do not provide evidence of mental budgeting.

IV. Conclusions

In this paper, we examined a theoretical tension in the literature on mental accounting, namely the conflicting predictions from mental budgeting and relative thinking in upgrade scenarios. We find evidence of relative thinking in hypothetical upgrade scenarios across a variety of products and also find suggestive evidence of mental budgeting in the lab for hypothetical gasoline upgrade scenarios. Our evidence suggests that gasoline is somewhat of an outlier in that we find evidence for mental budgeting instead of relative thinking. Finally, we provide suggestive evidence of relative thinking in the decision to purchase insurance in the rental car market.

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FIGURE 1. LIKELIHOOD OF WALKING FOR A CHEAPER DRUG

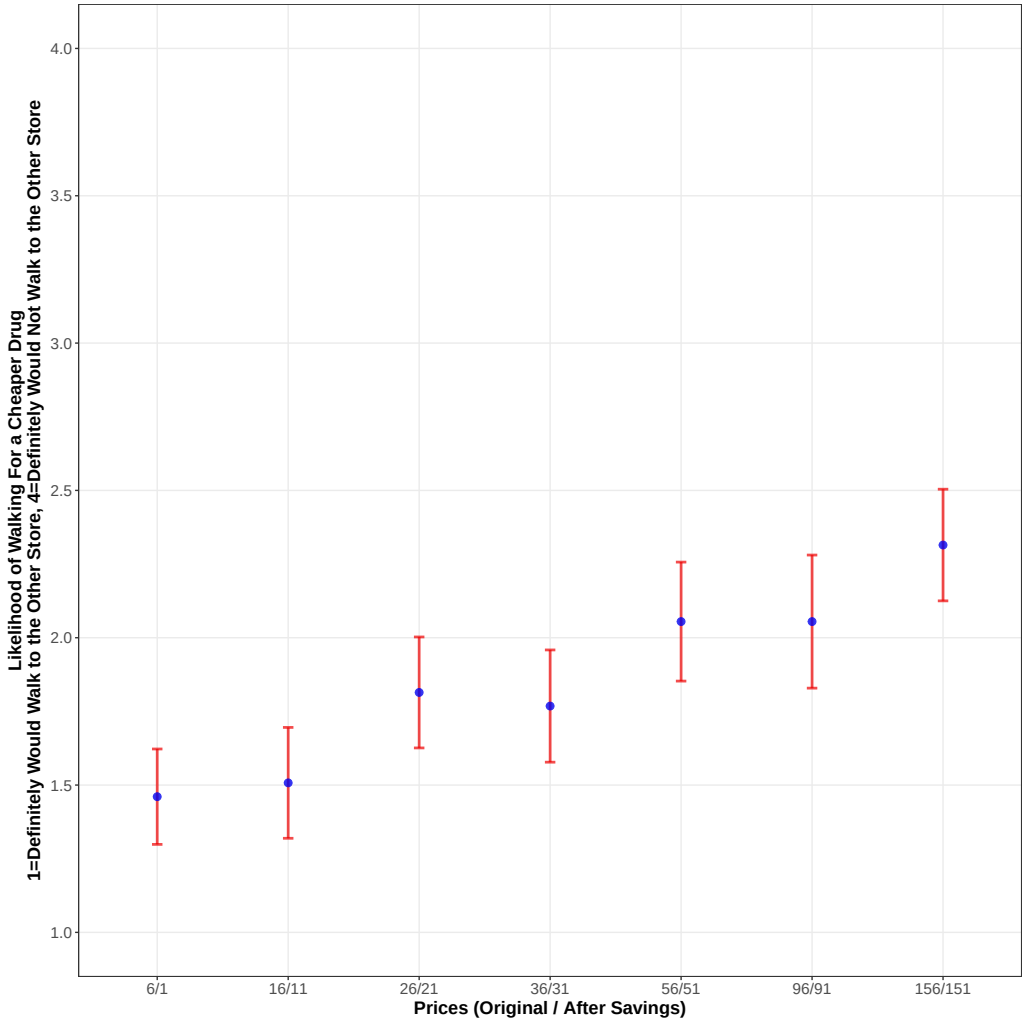

Figure 2. Likelihood of Upgrading for a Variety of Products

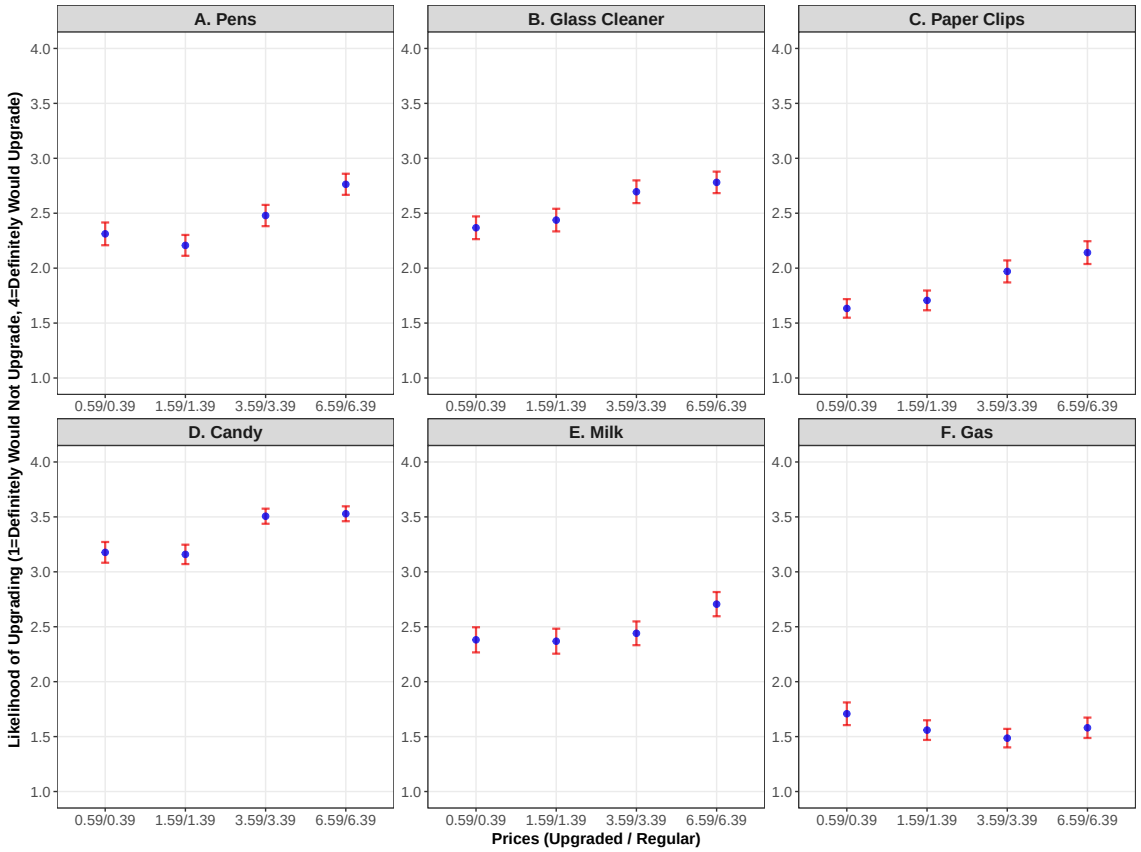

Table 1—Car Rental Insurance Regressions

	Dependent Variable: Insurance Purchase Indicator					
Panel A: No Person Fixed Effect	(1)	(2)	(3)	(4)	(5)	(6)
Daily Rental Price	0.112***	0.102***	0.106***	0.105***	0.112***	0.100***
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Observations	98,275	98,275	98,275	98,194	98,194	98,194
R^2	0.005	0.007	0.007	0.017	0.018	0.020
Panel B: With Person Fixed Effect	(7)	(8)	(9)	(10)	(11)	(12)
Daily Rental Price	0.024***	0.017**	0.016*	0.014	0.013	0.006
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Observations	27,178	27,178	27,178	27,063	27,063	27,063
R^2	0.758	0.758	0.758	0.766	0.766	0.766
Category Dummies		X	X	X	X	X
Month Dummies			X	X	X	X
Pickup Location Dummies				X	X	X
Dropoff Different from Pickup					X	X
Rental Duration Dummies						X

Note: Coefficients and standard errors are scaled up by 100. *p<0.1; **p<0.05; ***p<0.01