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Title

The effect of anomalies in consumption on the fair price

Abstract

In this paper we propose a link between some anomalies in consumption and reference prices. In particular, we argue that two anomalies in consumption, sunk cost effect and flat-rate bias, can be explained by how people update their reference prices. To test this theory we conduct a two-step experiment: first we elicit reference prices using an emotional question, second we measure at individual level the extent of these two anomalies in consumption, creating cluster of subjects with similar behavior. This whole study, if supported, can have massive managerial implications: firms can induce the presence of a) sunk cost or b) preference for pre-payment to increase reference prices, modifying the willingness to pay of subjects.

Keywords

Reference prices, flat-rate bias, sunk costs, willingness to pay

Introduction

Two anomalies in consumption have been explained by mechanisms of mental accounting: sunk-cost effect and preference for pre-payment. These mechanisms involve reference price comparisons. Anchoring to a historical price produces sunk-cost effects. Anchoring to a zero price produces preference for pre-payment. This suggests that these anomalies might depend on how fast reference prices update. This dependence on a single updating rule may create a negative correlation between these two anomalies at individual level. To test this hypothesis, we run an experiment consisting of two parts: first we elicit reference prices using an emotion-based question as in Arkes et al. (2008). Then, we create two groups based on the individual speed of updating reference prices after a new piece of information unfolds. We hypothesize that sunk-cost effects will be more pronounced, and preference for pre-payment less pronounced, among those slow to update their preference price. To test this, we ask to the same participants of the experiment a separate set of 10 questions, each involving a sunk-cost or pre-payment situation.
We start the study with a theoretical framework and our hypotheses. Then we move to the methodological part, with the design of the experiment.

Conceptual framework

Multiple departures from classical models of decision-making, especially in consumer decisions, can be attributed to the psychological effect of comparing outcomes to a reference point. Examples include the effect of reference prices on willingness to pay, the effect of the habitual level of consumption on current consumption, the influence of sunk-costs (past paid prices, or investments to date) on current decisions or the preference for pre-paid solutions.

Classical economic theory portrays consumers as rational agents. Their economic decisions are based on comparing the expected costs and benefits of acquiring any given item. The starting point is that u-p is the net benefit of a purchase, where *u* is the incremental utility of the item and *p* is the price. If payment and consumption are dissociated in time, it may seem that a negative -p is experienced at the moment of payment, and a positive *u* is received at the moment of consumption.

This dissociation in time generates mental accounting effects. Shafir and Thaler (2006) observed that when people buy wines in advance, they think of it as an investment, so that when they later consume the wines, they feel as if the wines were free. This is in line with Prelec and Loewenstein (1998), who showed that consumers like the feeling of free consumption associated with pre-payment and exhibit debt aversion.

Another important anomaly that affects consumers and managers is the sunk-cost effect. Buyers want to consume past purchased items, even if the items have become obsolete (Thaler, 1980). The sunk-cost effect decreases if the item was bought at a discount or given for free; it may also decrease with the mere passage of time, an effect called payment depreciation (Arkes and Blumer 1985, Gourville 1998).

Mental-accounting mechanisms may explain these anomalies. Two formal models of mental accounting stand out: Thaler (1985)’s double comparison model and Prelec and Loewenstein

(1988)'s double-entry model. Yet Baucells and Hwang (2012) argue that none of the existing mechanisms jointly explain these biases. They introduce a formal model capturing the psychological mechanism of Mental Accounting and Reference price Adaptation (MARA).

For a single period, MARA takes the following form

$$V=vp\text{-}p+vu\text{-}p.$$

Consumers keep a reference price in mind and perform two comparisons. First, they compare the reference price with the actual price. The hedonic value of this comparison yields *transaction utility*. Second, they compare the benefits of consumption with the reference price. The hedonic value of this comparison yields *acquisition utility*.

The reference price can be interpreted as the book value of the item. At the moment of purchase, the item enters the mental account as if it were an investment, with an imputed value of p. Thus, the difference, $p\text{-}p$, is the attributed profit at the moment of the purchase. This produces *transaction utility* of $v(p\text{-}p)$, same as Thaler (1985). When the item is consumed, the item is amortized and the imputed value p is subtracted from the benefit u, yielding an attributed profit of $u\text{-}p$.

Sunk-cost effects are produced by obsolescence of items while they are in mental account. Taking these items from the account implies a zero consumption benefit, $u=0$, and produces a mental loss of $v\text{-}p$. To illustrate, suppose you have bought a smart phone for \$100. The price is considered fair, $p=\$100$, and favorable, $u>\$100$. Immediately after the purchase, a new model of the same branch is announced. The new model has the same price and its benefits are much higher. Specifically, $unew=\beta\cdot u$, $\beta>1$. A rational consumer will compare $unew\text{-}p$ with u, and buy the new model if $\beta\geq 2$. Things are different for consumers affected by the sunk cost anomaly. For those, not using the old model produces a mental loss of $v(-p)$. The emotional consumer will buy the new model only if $vunew\text{-}\$100+v(-\$100)>vuold\text{-}\$100$. If $vx=x, x\geq 0$; and $vx=\lambda x$, $x<0$, then this holds if $\beta\geq\lambda+1$. Thus, the higher the loss aversion parameter, λ, the more reluctant the consumer will be to purchase the new model. If λ is greater than one then

consumers will not buy the new model even if they rationally should. However, if the old model of smart phone was received as a gift, or purchased at a discount price, then reference price adaptation implies that p is lower, thus reducing the mental loss of not using the old model.

In a multi-period extension, a standard process of reference price adaptation should explain the mitigation of the sunk-cost effect (payment depreciation). Intuitively, the passage of time lowers the reference price and foregoing consumption, v-p, is not as painful.

Examples of sunk-cost fallacy are everyday present, especially in finance, where people cannot stop investing when they perceive that if they stop what they have invested so far will be lost. However, everything one has invested is lost regardless and, if there is no hope for success in the future from the investment, the rational conclusion would be to leave the project.

Reference price adaptation explains the preference for advance payment: by not paying when using a service, the naïve reference price decreases. Intuitively, pre-paying for durable goods reduces the reference price in subsequent periods and produces the feeling of consuming for free (recall that the observed price is zero in periods of consumption and no payment, and that the reference price adapts to the observed price).

Here is how the mechanism works. Take the following example. Consider a buyer who plans to consume five bottles of wine over 5 separate occasions. Suppose he purchases and pays for the five bottles in advance. Assume the bottles cost $20 each, and that the price is considered fair, that is, $p1=\$20$. Moreover, the bottles are worth the price, in the sense that $u>\$20$. The purchase is considered an investment, with a book value of $100. Hence, no negative transaction utility is experienced at the moment of the purchase.

The first bottle is consumed in period 1, with an observed price per bottle of $20 (the price just paid). As the periods unfold, however, the observed price when the remaining four bottles are consumed is zero. If the reference prices are minimally adaptive, then the reference price adapts to the observed prices, and therefore decreases over time, that is, $pt<\$20$, for $t=2,...,4$. This increases acquisition utility, $vu-pt>vu-\$20$ over time, making the experience enjoyable. In contrast, if the consumer adopts pay-per-use, then the observed price is $20 in every period,

which implies that the reference price is $20 in every period, and the acquisition utility is vu-$20 in every period. Total utility is still positive, but not as large as when investing and then consuming "for free." For the above to be true, of course, discount rates need to be sufficiently small.

Changes in reference prices due to adaptation induce the feeling of consuming pre-paid items for free, heightening the hedonic value of pre-payment. In the case of demand uncertainty, this anomaly takes the form of the so called flat-rate bias. In repeated purchases under demand uncertainty, consumers prefer to pay a high fixed cost in exchange for a low variable cost. This holds even when they would have been better off, on average, under a pay-per-use regime.

Lambrecht and Skiera (2006) analyzed the transactional data of 10,882 customers of an Internet service provider. They found that, over a five-month period, 46 percent of consumers under a tariff with a high fixed-fee (and allowance) would have been better off under an alternative tariff with a lower fixed-fee (and lower allowance). Such a mistake is known as flat-rate bias because the customer picks a too high fixed fee for the amount she consumes. More than half of the consumers with the flat-rate bias paid at least 100% more than they would have on the least costly pay-per-use tariff. Other studies also find a preference for flat-rate tariffs, especially when consumers face demand uncertainty (Della Vigna and Malmendier 2006, Narayanan et al. 2007, Miravete 2003, Goettler and Clay 2011).

Generally, sunk-cost effects are produced by anchoring in historical prices. Our prediction is that individuals who are slow in updating their reference prices, i.e., who give more weight to historical average prices, will be more prone to sunk-cost effects. Conversely, individuals who update their reference prices quickly, i.e. giving more weight to the most recent prices, will exhibit fewer sunk-cost effects.

In the dilemma between pre-purchase vs. pay-per-use, the prediction is the opposite. The intuition is that individuals who update their reference prices quickly should exhibit more preference for pre-payment. By pre-paying for a durable good, their reference price adapts faster to the feeling that the consumption is for free. Therefore, these individuals obtain more hedonic value from avoiding debt and post-payment. Those who update their reference price slowly do

not experience this benefit as much. As a consequence, we hypothesize that the preference for up-front payment and sunk-cost effects are negatively correlated. This hypothesis, if verified, would be very supportive for the literature on reference prices.

Method and findings

After eliciting reference prices using an emotion-based question as in Arkes et al. (2008), we can separate the individuals that update their reference price quickly from those who do so slowly. To create these two groups we will make use of two factors: initial and final prices, attributing individuals to one of these two groups depending on the importance given to initial or final pieces of information in the determination of the reference price.

According to our hypotheses, sunk-cost effects will be more pronounced, and preference for pre-payment less pronounced, among those slow to update their reference price.

We test these hypotheses by asking these individuals a separate set of 10 questions, each involving a sunk-cost or pre-payment situation.

A typical sunk-cost situation is as follows:

> You own a flat, which you bought for 100,000 Euros ten years ago. The real estate market has depreciated by about 20%, so you expect a price of 80,000. You are seeking offers to sell the apartment. You receive an offer of 85,000. You don't have other information regarding the real estate. How likely are you to sell at this price of 85,000?

Then, we will ask to individual to indicate:

a) I would sell for sure, b) Somewhat likely I will sell, c) I'm indifferent, d) Not likely to sell, and e) I would not sell for sure.

Similarly, a pre-payment situation is as follows:

> You plan to consume a particular type of wine that you like over several separate occasions. You can decide between buying the bottles in advance (with a cost of $20 each bottle) or buying one bottle before each occasion (still $20 each). There is no transportation cost or hassle cost in either of the two options. To be specific, consider buying a case of six bottles, or six bottles separately. Which would you prefer?

a) I strongly prefer buying in advance, b) I somewhat prefer buying in advance, c) I'm indifferent, d) I somewhat prefer buying before each occasion, and e) I strongly prefer buying before each occasion

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