Testing for the Real Option in Consumer Behavior

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ABSTRACT

Consumers become indecisive when facing too many choices. The usual explanation is the lack of attribute alignability (comparable features) among the offers. In this paper, we provide an alternative explanation from recent advances in economic theory. A decision often involves uncertain outcome, can be delayed and is irreversible. When these conditions are met, there will be a real option in the cost-benefit analysis. For example, the option to keep alive a consumer's purchasing decision can have a significant value. It allows the consumer to take advantage of any future potential advantageous deals while avoiding the bad choices. This renders the consumer more hesitant. When a consumer decides to exercise his buy decision, he demands a compensation for the loss of this option. Hence, the benefits of a purchase must be over and above its costs by a wide margin (the option value). In this paper, we collected data from a roving questionnaire survey at a university in Cyprus. We targeted students with hypothetical purchase decisions on consumer electronic goods. The data confirmed the existence of this real option. This has led to new insights into advertising and marketing. We conclude by offering policy recommendations in future research directions.

Key words: attribute alignability**,** real option, uncertainty, consumer behavior

JEL classifications: D81, M31

1. Introduction

Consumers love variety. More choices increase the likelihood that a consumer will find one that suits his needs (Beckman and Rigby, 2003). However, recent studies have shown that when faced with a bewildering array of product offering varieties, customers simply refrain from making a purchase at all (Rust, Thompson, and Hamilton, 2006; Kahn and Wansink, 2004; Kahn and Morales, 2001). Traditionally, companies believed that assortment proliferation or more available product lines would better satisfy customers' diverse preferences. For example, richer variety ensures that customers will find something that satisfies their specific tastes and preferences. This will increase satisfaction and decrease brand switching behavior and churn (Kahn and Lehmann, 1991; Broniarczyk, Hoyer, and McAlister, 1998; Hoch, Bradlow, and Wansink, 1999; Chernev, 2003; Kim and Drolet, 2003). Alternatively, consumers like to seek variety. They prefer products and services that have multiple varieties or assortment sizes (Huffman and Kahn, 1998; Chernev and McAllister, 2005).

Unfortunately, a large number of assortment sizes can present the problem of "overchoice" (Gourville and Soman, 2005). For instance, service options increase the customer's time and cost for searching for, acquiring, and processing product information (Payne, Bettmann, and Johnson (1993). They also make a customer less likely to carry through a planned purchase (Dhar 1997; Tversky and Shafir, 1992). Various experiments have demonstrated this phenomenon (Iyengar and Lepper, 2000; Boatwright and Nunes, 2001; Chernev, 2003; Iyengar, Jiang, and

Huberman, 2004).

A popular explanation for this uses the concept of product attribute alignability (AA). Several product varieties have an AA if they can be arranged on a linear vector. For example, memory size of a smartphone is an AA (e.g., 16 or 32 Gigabyte). The apps on a smartphone are, however, non-AAs (e.g., sat-nav, e-reader, camera, video recorder, etc). Herrmann *et al* (2009) use an experiment to demonstrate that increase in product varieties that are AA is conducive to purchase. On the contrary, increase in those that are non-AA is not. They then show how changing product varieties from non-AA to pseudo-AA can increase sales.

In this paper, we provide an alternative explanation. We use a recent advancement in economics to explain why consumers are reluctant to buy when confronted with increasing choices – the real option theory. The idea stems from the traditional cost benefit analysis (Silberberg and Suen, 2001). Suppose the benefits – discounted future cashflows from a project, are greater than the investment cost. Then the investment project is worth undertaking.

$$\text{benefits} \geq \text{costs} \qquad (1)$$

Similarly, a consumer carries through on a purchase when the perceived benefits of the product are greater than its price. In the 1990s, two economists, Dixit and

Pindyck (1994) made a significant discovery. Suppose the benefits and/or costs of a project are uncertain – can go up or down in the future. The project can be delayed (does not require immediate investment) and is irreversible (cannot be unwound should the project go wrong). Then the benefits must outweigh the costs by a wide margin to accommodate the value of a real option. This option refers to a project investor's ability to capture potential advantageous benefits and/or costs (option in the money). On the other hand, the investor can retain this option (does not need to exercise it) should the benefits/costs be disadvantageous (option out of money). The ability to do this has a significant value. However, this investment option vanishes once it is exercised. Therefore, potential investors demand a compensation. Future benefits must outweigh both the costs and the value of this real option for the project to be profitable.

$$\text{benefits} \geq \text{costs} + \text{option} \qquad (2)$$

Note that the more uncertain are the benefits/costs, the more valuable is this option.

By analogy, suppose a consumer is confronted with potentially increasing product varieties. Suppose different varieties confer different benefits to the consumer. That means he is facing increasingly more uncertain benefits. He may also be facing potentially uncertain costs (e.g., future promotional offers). Therefore he develops a purchase option which can be very valuable should he

be able to capture these advantageous benefits/costs. Note that this option only has value if the purchase is not urgent (can be delayed – hence option) and is irreversible (not refundable). If the purchase is reversible (refundable), there is no need to retain the purchase option to capture a potentially better deal. This is because even if you got a raw deal (e.g., bought a bad product or pay too much), you could always demand your money back and try again later until you get a better deal.

The concept of real option works well in theory. However, it has not been extensively tested empirically in economics, much less marketing. This paper hopes to address this with the following layout: section 2 describes the real option theory in more detail; section 3 details the survey that we carried out to test the theory in a consumer behavior setting; section 4 summaries the survey results and section 5 carries out the statistical analysis. We conclude with some new insights in marketing research provided by this economic approach in section 6.

2. The Real Option in a Consumer Behavior Setting

Suppose a product or service will generate a benefit or enjoyment R in each period after the purchase. Then the total net present value (NPV) of the purchase is:

$$NPV = R/r - C = B \qquad (3)$$

where r is the discount rate, C is the purchase cost and B is the net benefit of the potential purchase. When NPV is positive, the consumer will go ahead with the purchase. Suppose now the purchase can be delayed but is non-refundable. Furthermore, there is a future promotional offer in which the consumer may get a hefty discount if he is lucky. Therefore, B is now uncertain. Assuming B evolves stochastically over time with a steady rate of change of α. Net benefit may increase steadily over time due to more proficient use of the product. However, B is also subject to an instantaneous standard deviation σ (promotional discount). To simplify our analysis, we assume B is continuous over time even though B can rise 15% abruptly if the consumer is lucky enough to get a discount. Then,

$$dB = \alpha B\, dt + \sigma B\, dz \qquad (4)$$

t is time. dt represents an infinitesimal period of time in differential calculus. dz follows a standard Wiener stochastic process. Equation (4) is a geometric Brownian motion (Harrison, 1985) in B. It enters into the consumer's purchase calculus in the following way. When the net benefit $B \geq B^*$, a certain threshold to be determined later, the consumer carries through with the purchase. Otherwise he stays put (retains his purchase option). If he chooses the latter, he gives up the enjoyment stream R for the moment. However, he retains the option to buy should he hit the promotional jackpot. But this is uncertain (σ). On the other hand, if he buys now and realizes later there is a promotional sale, then he would

miss out on the potential saving. The ability to retain his purchase option has an intrinsic value that should enter his NPV in equation (3). As with financial options, the larger the volatility σ in net benefit B, the higher the value of this option. Then it will be less likely for this consumer to buy now. Algebraically, we can represent the value of this purchase option by a function F of B, i.e., F(B). Its behavior follows the differential equation:

$$\frac{1}{2}\sigma^2 B^2 F_{BB} + \alpha B F_B - r F = 0 \qquad (5)$$

r is the no-arbitrage equilibrium discount rate (Harrison and Kreps, 1979). Equation (5) can be derived as follows. A small random change in B, dB, over dt results in a small expected NPV change of E[F(B + dB)]. This can be discounted back to t using the discount rate r, i.e., $F = e^{-r}$ dt E[F(B + dB)]. Note that $e^{-\rho}$ dt is approximately 1 - r dt. F(B + dB) can be expanded by Ito's lemma (Dixit *et al*, 1999). On re-arranging, we have (5). (5) can be solved by the method of undetermined coefficients:

$$F(B) = AB^{\beta} \qquad (6)$$

A is a positive undetermined coefficient. β is the root of the characteristic function:

$$\frac{1}{2}\sigma^2 \beta (\beta - 1) + \alpha \beta - r = 0 \qquad (7)$$

β has a bigger-than-1 root and a negative root. The latter is discarded since the value of the purchase option F(B) should increase with the net benefit B. Now, the consumer's NPV before the purchase consists entirely of the value of the purchase option, AB^{β}. Suppose the net benefit of purchase B hits the threshold B*. That is, when the consumer's NPV hits NPV*, he carries through with the purchase (exercises option). We have

$$AB^{\beta} = B \qquad (8)$$

This is the *value-matching condition* (Dixit and Pindyck, 1994). The *smooth-pasting condition* dictates that the derivatives with respective to B on both sides of equation (8) must be equalized:

$$A\beta B^{\beta-1} = 1$$

This gives, on re-arranging,

$$AB^{\beta} = B/\beta \qquad (9)$$

Note that B* must now be big enough to cover the value of the purchase option B*/β so that the threshold NPV* becomes positive and triggers the purchase:

$$NPV^* = B^* - B^*/\beta \qquad \text{(using (9))}$$

$$= B^* (\beta - 1)/\beta \qquad (10)$$

The factor $(\beta - 1)/\beta < 1$ is called the *option value multiple*. As a result, the original net benefit B must be raised to

$$B^* = B\,\beta / (\beta - 1) \qquad (11)$$

before the consumer will carry through with the purchase. Suppose the consumer would consider buying when the net benefit was B in the absence of this option. With the option, B will have to be raised to B* to induce his purchase. One way of raising net benefit B is by paying less purchase cost C. For example, a promotional discount can achieve this.

Moreover, the characteristic equation (7) indicates that the β solution is decreasing in σ^2. Thus, equation (11) implies that the threshold B* is decreasing in σ^2 (steeper discount). For example, a high σ^2 means steeper discount (higher net benefit) could be available. The consumer will do well by holding his purchase option or requiring a higher threshold B*. Suppose the enjoyment R is fixed, a higher net benefit B can be achieved by demanding a steeper discount on cost C (a lower willingness-to-pay WTP). With the option, the consumer could stay put should he not hit the promotional jackpot, or buys the product *vice versa*. In other words, he suffers no loss if he does not exercise his purchase option

(option out of money). On the other hand, he stands to gain big if he does exercise his option (option deep in the money).

3. The Survey

To investigate the effect of a real option on the WTP, we carried out a survey at a university in Cyprus during the week of May 3 to May 7, 2010. It was a non-exam week. The location was the Faculty of Business and Economics (FBE). 7 interviewers (students) were recruited (labeled a, b, c, d, e, f, g). Interviewers a,c,d,g were male, while b,e,f were female. There were two survey venues: the small cafeteria inside the FBE building and the large Café inside the Central Lectures Hall (CLH). There were a total of 5 class days. On each day, one interviewer is placed each at FBE and CLH from 0800 to 0830 (morning coffee break before classes start) and from 1200 to 1230 (during lunch break). Therefore, there were a total of 20 survey sessions (2 sessions per day X 2 venues X 5 days). The assignment of interviewers at each location and time slot was random. An interviewer might conduct more than one survey session since there are more sessions (20) than interviewers (7). The allocation of interviewers can be seen in Table 1 – the survey dataset.

In each session, around 10 subjects (students going to classes) were randomly approached by the interviewer. The interviewer first described the set-up (written on a piece of paper).Then the interviewer asked the subject to choose from a total of 8 envelopes. Each envelope contained a different scenario and the

subject's WTP to pay was then solicited. All material was translated to Turkish on the spot by the interviewers. If the subject was an international student, the original English wording is used.

The following set-up was first described to every subject:

Very shortly, a new iphone 4 without any mobile carrier contract (i.e., no SIM card) will go on sale for the recommended retail prices (RRPs) of $599 (16Gb) and $699 (32Gb) in the US. How much would you be willing to pay in Turkish Lira TL? Before you consider the answer, there is a phone shop in town. They are planning to do a promotion in the near future. You pick up a queuing number and wait for customer service (like in a bank). Depending on your number, you may get a discount of 10%, 20% or no discount on a new iphone 4. The discount allocation is random and at the manager's discretion. There is no mention when the promotional offer will start or finish. But it will definitely not start today. Therefore, if you don't want to miss out on a new iphone 4 while stocks last, you should not wait for the promotion to start. Furthermore, there is no purchase obligation if you don't hit the promotion jackpot. The promotion outcome is revealed to you before you make the purchase commitment. If you renege or walk away from your purchase, you cannot come back and try your luck again on the same day. However, service cannot be refused to you after 1 day. But there is no guarantee stocks still last.

The 8 scenarios that the subjects could choose from were:

1: stocks are aplenty, refund is possible but there is no promotion

Rationale: there is no possibility to pay any less, and there is nothing to gain by waiting. Hence, buy at RRP now and enjoy.

2: stocks are aplenty, refund is possible and there is promotion

Rationale: there is possibility to pay less. But even if you pay full RRP, you can demand a refund and try again later to see if you can hit the promotion jackpot. Therefore, to buy now doesn't constitute a commitment because you can always refund it. Hence, you should be happy to pay RRP now and enjoy. Note that there is a weak option here if there are transactions costs.

3: stocks are aplenty, refund is impossible but there is no promotion

Rationale: there is no possibility to pay any less. There is nothing to gain by waiting. Hence, buy at RRP now and enjoy.

4: stocks are aplenty, refund is impossible and there is promotion

Rationale: there is possibility to pay less. Even if you don’t hit the promotion jackport, you have the right to refuse purchase. However, to buy now constitutes a commitment since you cannot refund it. Therefore you will demand a premium for a loss of this option to buy cheap later. That means you are willing to pay less for the iphone now. Alternatively, you are happy to wait for a promotion hit and enjoy later. The option is here. But it exists only when stocks are unlimited and

you cannot take it back for a refund. It pays to wait for a promotion jackpot.

5:stocks are limited, refund is possible but there is no promotion

Rationale: there is no possibility to pay any less. Since you may miss out on your favorite toy later, it is better to buy at RRP now and enjoy.

6:stocks are limited, refund is possible and there is promotion

Rationale: there is possibility to pay less. If you don't hit the promotion jackpot, you can still buy now. You can make up any excuse for a refund and try again later. But you may miss out on your favorite toy because there may be no stock. To avoid the possibility of missing out, it is better to pay full RRP now and enjoy.

7:stocks are limited, refund is impossible but there is no promotion

Rationale: there is no possibility to pay any less. You may miss out on your favorite toy later. Hence, buy at full RRP now and enjoy.

8: stocks are limited, refund is impossible and there is promotion

Rationale: there is possibility to pay less. However, if you don't hit the promotion jackpot, you cannot make up any excuse for a refund and try again later. Besides, you may miss out on your favorite toy. There may be no stock. To avoid the possibility of missing out, it is better to pay full RRP now and enjoy.

Note that the rationales behind all scenarios were clearly explained to the

subjects regarding the effects on purchase prices. However, interviewers stopped short of making price recommendations. The exchange rate was approximately 1 USD = 1.5 TL in May 2010. Uncooperative subjects who joked, offered ridiculous prices (too high, too low), who didn't understand or misunderstood the question, compared with android/blackberry, couldn't afford to pay, etc were rejected. Whether a subject was rejected was left to interviewers' own judgment. Interviewers did not reveal other subjects' prices during the survey but they did aid in the subjects' calculation, e.g., exchange rate from $ to TL or vice versa.

Quite a few subjects reported the following problem. If there is no purchase obligation after the promotion offer outcome is revealed, then it is equivalent to on-the-spot refund or immediate refund. This is the same as reversibility. However, reversibility is only good if you can come back on another day to try your luck again on the promotion jackpot. This is not always possible because stocks may be limited.

4. Survey Results

We summarize our findings by using the ANOVA (analysis of variance) technique. It is popular for studying if there are statistically significant differences between various groupings (e.g., venue, time, interviewer, etc). The results are displayed in the Table 2 (for a 16Gbyte memory phone) and Table 3 (for a 32Gbyte memory phone). All WTPs are expressed in Turkish Lira (TL).

We begin with Table 2. Except for the scenarios (scenario 4 contains the real option while the others don't), all other variables including sex of subject, survey day/time/venue, and interviewer, do not exhibit statistically significant differences ($p > 0.05$). In technical terms, for example, WTPs from female and male subjects appear to be drawn from the same probability distribution with identical means (860.08 TL vs 852.50 TL) and standard deviations (SDs). Ditto for survey day/time/venue and interviewer. On the other hand, WTPs solicited under various scenarios appear to have been drawn from different distributions with non-identical means and SDs ($F = 43.71$, $p = 0.00$). Specifically, scenario 4 (with the real option) appears to have solicited a much lower WTP (approx. 731 TL) than the other scenarios (approx. 890 TL). In other words, subjects appear to have demanded a compensation of approx. 159 TL for the loss of the purchase option when paying for a new iphone 4. Presumably the option enabled the subjects to potentially purchase the phone at a much lower discounted price if they hit the promotional jackpot. We will calculate much more precisely the value of this real option in the next section.

Table 3 shows the ANOVA results for a 32 Gb iphone. These are qualitatively similar to those of Table 2. For example, WTPs solicited on different survey days are not statistically different with almost identical means (1028.95 TL for day 1 vs 1017.37 TL for day 2 vs 1042.63 TL for day 3 vs 1028.68 TL for day 4 vs 1018.10 TL for day 5). Similarly for survey time/venue, sex of subject and interviewer ($p >$

0.05). The only variable that solicited statistically different WTPs is scenario type ($F = 17.28$, $p = 0.00$). Once again, the odd man out is scenario 4 (real option) with WTP approx. 893 TL vs average approx. 1050 TL for the other scenarios. Therefore, the compensation for the loss of purchase option for a 32 Gb phone is approx. 157 TL. This is the approx. saving between a 10% and a 20% discount that the option can potentially generate. This also applies to a 16 Gb phone in Table 2.

Interestingly, the WTPs from Table 3 are by and large 150 TL more than those of Table 2. This is the difference in RRP for a 16 Gbyte and 32 Gbyte phone in the US.

5. Regression Analysis

Having established the difference between WTPs in various scenarios, we now proceed to establish the presence of the real option and calculate its value. To achieve this, we employ regression analysis. It is popular for testing for the existence of a special effect and calculating its magnitude. The results are shown in Table 4.

Our regression is based on the following equation:

$$WTP = \beta_0 + \sum \beta_i Q_i + e \qquad (12)$$

Where Q_i's are the 7 dummy variables for scenarios 2 to 8. Scenario 1 is subsumed into the intercept β_0. β_i's are the corresponding coefficients and e is the residual. Equation (12) is estimated twice - once each for the 16Gb and 32 Gb phones. The β_i's calculate the effect of each scenario on WTP as compared to senario 1. The regression results are reported in Table 4. Note that we have also estimated 2 models. Model 1 is as equation (12) suggested. In model 2, Q_i only contains the dummy for scenario 4 (where the option is) while all the other scenarios are subsumed into the intercept. This allows us to calculate the effect of the real option on WTP as compared to the average of all other scenarios (no option). Therefore, β_4 in model 2 is the estimated value of the real option.

We start with the F-statistics for the 4 estimated regression equations. They are all significant with p-values approaching zero. This implies the models are well-fitted by data. The R-square's are also all relatively high for a cross-sectional study such as ours. Model 1 tells us that scenario 4 gives an expected significant difference (negative) in effect on WTP as compared to scenario 1. The surprise is that scenario 2 also shows up as having a significantly different effect than scenario 1, at the 5% level. This is the case for both 16Gb and 32Gb phones.

Scenario 2 is the closest to having a real option. In theory it shouldn't. The scenario allows the consumer to delay purchase (unlimited stock) and offers uncertain price (through the promotional discount) but the purchase is refundable (reversible). There is no valuable option here. Even if the consumer does not hit

the promotion jackpot, he can always demand a refund and try again later to see if he qualifies for the discount. Moreover, he can do this *ad infinitum*. Therefore he is happy to pay the full RRP now. He can start enjoying the iphone right away, knowing full well that the discount will be there for the taking. However, some subjects believed the certainty of discount can be translated to a lower WTP for the phone now. This resulted in a decrease of approx. 33 TL for the 16 Gb model and 48 TL for the 32 Gb model, when compared to scenario 1 subjects.

Scenario 4 is where the real option exists, in both theory and survey. Here the purchase can be delayed and there is a possibility of discount, but the purchase is non-refundable. Therefore the subjects were not willing to pay the full RRP for the phone now. They knew they could never try again later to qualify for the promotional discount. To buy now meant to kill the option to buy cheaper later. As a result, subjects demanded a compensation for the loss of this option. This resulted in a decrease in WTP of approx. 164 TL for the 16 Gb phone and 169 TL for the 32 Gb phone, compared to scenario 1 subjects (Model 1, Table 4). Compared to all other subjects combined, scenario 4 subjects (with the option) demanded a drop in WTP (value of the real option) of approx. 159 TL for the 16 Gb phone and 155 TL for the 32 Gb phone (Model 2, Table 4). Specifically, Model 2 says that on average, all subjects (*sans* scenario 4) are willing to pay 890 TL for the 16 GB phone and 1048 TL for the 32 Gb phone. On the contrary, scenario 4 subjects (holders of the real option) are only willing to pay 731 TL (890 TL – 159 TL) and 893 TL (1048 TL – 155 TL) respectively.

Interestingly, the value of the option equates to approx. halfway between the savings for a 10% discount and a 20% discount (the 2 possibilities under the promotional offer). This is the case for both the 16 Gb and 32 Gb phones. In other words, by purchasing now, subjects are shrewd enough to demand a reduction of at least 10% in price for the loss of the future discount possibility. On the other hand, they are also realistic enough to not demand the maximum discount possibility (20%). It may be a while (may be never) before he sees the 20% discount offer. In the meantime, he cannot enjoy the iphone while he waits.

6. Conclusions and Research Implications

Recent marketing research suggests that when there are too many choices facing consumers, they tend to walk away. Some researchers explain this behavior by arguing that the choices are not attribute alignable. In other words, consumers become confused and cannot decide when choosing between apple and orange. In this study we argue that consumers cannot decide because they do not want to. Consumers want to keep their purchase option open, to take advantage of better prices, or better products, or both, in future.

This is the *real option* from recent economic theory. It exists when a decision will bring about uncertain outcome, can be delayed and is irreversible. In this study, we design a survey in which subjects are asked to name a price for the new i-phone 4 model. However, subjects face a randomly selected hypothetical

situation in which promotional discount may be offered, stocks may be unlimited and a purchase may be non-refundable. When all three conditions are in the positive, a real option arises that will potentially give the consumer a hefty saving. A consumer simply waits and observes when the discount is offered, then takes advantage of it. He will never miss out because stocks are aplenty. But once the purchase option is exercised, he cannot renege because it is non-refundable. Therefore, when he does decide to buy, he demands a compensation for killing his potentially lucrative option (to buy at a discount later). In other words, he is willing to pay less. When the purchase is refundable, he is in theory willing to pay the full price (without discount). This is because he can always demand his money back and take advantage of the discount when he sees it. In the meantime, he gets to enjoy his favorite toy. Note that refundability is meaningless when stocks are limited. The refund cannot guarantee that you can buy back at cheaper price if there are no stocks left.

In our survey design, the promotion outcome (discount) does not oblige the consumer to purchase. In other words, he can renege on his purchase if his ticket number turns out not to qualify him for a discount. If he could not do so, he would not be able to simply observe and take advantage of the discounted price. Then the option would be meaningless to him.

Finally, when stocks are limited, the consumer is in imminent danger of missing out on his favorite toy if you doesn't buy now. Then the future promotion

campaign (chance to buy cheap) is irrelevant to him. There is no option.

As can be seen now, the 3 conditions of uncertainty, delay and irreversibility must be met concurrently for the consumer to enjoy the option. When he does decide to buy, he kills the option and demands a compensation. Out of the 8 possible scenarios involving the on and off of the 3 conditions, only 1 scenario turns on all 3 conditions and gives rise to the option (scenario 4 in our survey). This survey design has significant implications for our statistical analysis. We cannot simply construct 3 dummies for the 3 conditions and test them together in an F-test for the presence of an option value.

In summary, our survey data on WTP are well behaved without any significant differences among survey times, survey days, survey venues, interviewers or subject sexes for both 16 Gbyte and 32 Gbyte models. On the contrary, the 8 scenarios clearly differentiated in the WTPs solicited among the subjects. The non-option scenarios (1, 2, 3, 5, 6, 7, 8) resulted in WTPs that approximated the RRP. The option scenario (4) led to discounted WTPs roughly in the order of the promotional discount, as the theory predicted.

There are concerns that our survey does not show much variations in the WTPs. It could be because the new i-phone 4 models were not out yet during the survey period. Therefore subjects could not judge the actual worthiness of the new features or apps. They stuck to the RRP for guidance on WTP. Furthermore,

interviewers had the discretion to throw out WTPs that were judged too high or too low. Since interviewers also had little idea about the worthiness of the new i-phone 4, their judgment of overvaluation or undervaluation might be on the conservative side.

Suppose our empirical findings can be carried over to the realistic consumption world. What are their implications for a marketing campaign? A purchase option to the consumer is obviously detrimental to sales. Therefore efforts must be exerted to eliminate this option. We start by eliminating the conditions in which this option will arise. Firstly, remove the ability for a consumer to delay purchase. We implicitly assume that the product is much needed or wanted, notwithstanding competition. We will leave this to the product development department. For example, “whilst stocks last” is a good tactic. Secondly, make the purchase reversible. A refund is the obvious strategy. Provide warranty or recourse. Thirdly, and most importantly, remove the uncertainty, in price or otherwise. For example, offer a uniform across-the-board RRP. New books are a good example, although individual retailers might still give discounts. Dedicated retail outlets like branded phone shops guarantee that price will be uniform. The idea is to remove the consumer’s incentive to wait for a better offer, in price or product variety.

Of course the strategies we offer here are in addition to the myriad of strategies that a seller can or already adopts. The difference is that our strategies are

based on economic reasoning, while others are based on psychological or management perspectives, etc.

The usual caution on any survey analysis also applies here. Can a subject's verbal indication in a hypothetical situation be carried over to a realistic consumer setting? In an actual retail environment, it would be difficult to achieve the control conditions. That is, consumers only have to disentangle the 3 conditions for a real option while all other variables are held constant. To achieve unbiasedness, a large scale survey would have to be conducted. It must also collect information on control variables such as age, income, educational background, store locations, advertising campaigns, and attributes of the product in question and its competitors. It would be interesting to analyze the real option and attribute alignability in the same survey setting, as two competing hypotheses.

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Table 1 – Survey Dataset

WTP	scenario	16 or 32Gb	sex	day	Time	venue	interviewer
850	2	16	m	1	0800-0830	CLH	a
1050	3	32	f	1	0800-0830	CLH	a
900	4	32	f	1	0800-0830	CLH	a
890	8	16	m	1	0800-0830	CLH	a
1000	1	32	f	1	0800-0830	CLH	a
800	4	32	f	1	0800-0830	CLH	a
900	5	16	f	1	0800-0830	CLH	a
850	6	16	m	1	0800-0830	CLH	a
1000	2	32	m	1	0800-0830	CLH	a
1040	3	32	f	1	0800-0830	CLH	a
1050	2	32	f	1	0800-0830	FBE	b
900	3	16	f	1	0800-0830	FBE	b
750	4	16	f	1	0800-0830	FBE	b
1100	2	32	m	1	0800-0830	FBE	b
960	3	16	f	1	0800-0830	FBE	b
700	4	16	m	1	0800-0830	FBE	b
850	5	16	f	1	0800-0830	FBE	b
1050	6	32	f	1	0800-0830	FBE	b
900	7	16	f	1	0800-0830	FBE	b
1050	8	32	m	1	0800-0830	FBE	b
900	2	16	f	1	0800-0830	FBE	b
880	8	16	m	1	1200-1230	CLH	a
1100	5	32	m	1	1200-1230	CLH	a
1010	6	32	m	1	1200-1230	CLH	a
700	4	16	f	1	1200-1230	CLH	a
900	3	16	m	1	1200-1230	CLH	a
800	4	16	f	1	1200-1230	CLH	a
1050	5	32	f	1	1200-1230	CLH	a
1000	6	32	f	1	1200-1230	CLH	a
1100	7	32	m	1	1200-1230	CLH	a
800	2	16	m	1	1200-1230	CLH	a
1100	2	32	m	1	1200-1230	FBE	c
1100	3	32	m	1	1200-1230	FBE	c
850	4	16	f	1	1200-1230	FBE	c
850	1	16	f	1	1200-1230	FBE	c
890	6	16	f	1	1200-1230	FBE	c
1000	8	32	m	1	1200-1230	FBE	c
1050	7	32	f	1	1200-1230	FBE	c
900	5	16	m	1	1200-1230	FBE	c
600	4	16	m	1	1200-1230	FBE	c

910	3	16	f	1	1200-1230	FBE	c
890	3	16	f	2	0800-0830	CLH	d
600	4	16	f	2	0800-0830	CLH	d
890	5	16	m	2	0800-0830	CLH	d
1000	2	32	m	2	0800-0830	CLH	d
1100	6	32	m	2	0800-0830	CLH	d
950	8	32	m	2	0800-0830	CLH	d
900	7	16	f	2	0800-0830	CLH	d
800	1	16	m	2	0800-0830	CLH	d
1000	2	32	f	2	0800-0830	CLH	d
700	4	16	f	2	0800-0830	FBE	e
1100	5	32	f	2	0800-0830	FBE	e
850	6	16	m	2	0800-0830	FBE	e
950	2	32	m	2	0800-0830	FBE	e
900	3	16	m	2	0800-0830	FBE	e
800	4	16	f	2	0800-0830	FBE	e
1100	1	32	m	2	0800-0830	FBE	e
990	8	32	f	2	0800-0830	FBE	e
900	1	16	f	2	0800-0830	FBE	e
1100	3	32	m	2	0800-0830	FBE	e
900	4	32	f	2	1200-1230	CLH	f
850	4	32	m	2	1200-1230	CLH	f
1040	5	32	f	2	1200-1230	CLH	f
890	6	16	m	2	1200-1230	CLH	f
1000	2	32	f	2	1200-1230	CLH	f
950	1	16	m	2	1200-1230	CLH	f
800	2	16	m	2	1200-1230	CLH	f
850	8	16	m	2	1200-1230	CLH	f
1100	7	32	f	2	1200-1230	CLH	f
900	8	16	f	2	1200-1230	CLH	f
650	4	16	f	2	1200-1230	FBE	g
750	4	16	f	2	1200-1230	FBE	g
1080	5	32	m	2	1200-1230	FBE	g
1070	6	32	f	2	1200-1230	FBE	g
900	2	16	f	2	1200-1230	FBE	g
920	3	16	m	2	1200-1230	FBE	g
900	1	16	f	2	1200-1230	FBE	g
900	8	16	m	2	1200-1230	FBE	g
1050	7	32	f	2	1200-1230	FBE	g
950	2	32	m	2	1200-1230	FBE	g
1000	1	32	m	2	1200-1230	FBE	g
850	2	16	m	3	0800-0830	CLH	g
880	2	16	m	3	0800-0830	CLH	g

780	4	16	f	3	0800-0830	CLH	g
890	1	16	m	3	0800-0830	CLH	g
990	6	32	f	3	0800-0830	CLH	g
1000	7	32	f	3	0800-0830	CLH	g
690	4	16	m	3	0800-0830	CLH	g
890	5	16	f	3	0800-0830	CLH	g
1050	8	32	f	3	0800-0830	CLH	g
1050	5	32	f	3	0800-0830	CLH	g
900	2	16	m	3	0800-0830	FBE	c
720	4	16	f	3	0800-0830	FBE	c
1050	3	32	m	3	0800-0830	FBE	c
1030	5	32	f	3	0800-0830	FBE	c
880	6	16	m	3	0800-0830	FBE	c
900	7	16	f	3	0800-0830	FBE	c
950	8	32	m	3	0800-0830	FBE	c
900	1	16	f	3	0800-0830	FBE	c
870	2	16	f	3	0800-0830	FBE	c
1100	3	32	f	3	0800-0830	FBE	c
900	5	16	m	3	0800-0830	FBE	c
1000	3	32	m	3	0800-0830	FBE	c
900	3	16	f	3	1200-1230	CLH	d
750	4	16	m	3	1200-1230	CLH	d
880	3	16	f	3	1200-1230	CLH	d
1100	2	32	f	3	1200-1230	CLH	d
1050	1	32	m	3	1200-1230	CLH	d
1060	5	32	f	3	1200-1230	CLH	d
810	4	16	m	3	1200-1230	CLH	d
1100	7	32	f	3	1200-1230	CLH	d
1030	8	32	f	3	1200-1230	CLH	d
900	4	32	m	3	1200-1230	CLH	d
900	1	16	f	3	1200-1230	FBE	b
900	2	16	m	3	1200-1230	FBE	b
800	4	16	f	3	1200-1230	FBE	b
900	5	16	m	3	1200-1230	FBE	b
865	6	16	f	3	1200-1230	FBE	b
1050	7	32	m	3	1200-1230	FBE	b
1100	8	32	m	3	1200-1230	FBE	b
865	5	16	m	3	1200-1230	FBE	b
1100	1	32	f	3	1200-1230	FBE	b
1100	2	32	f	3	1200-1230	FBE	b
850	2	16	f	4	0800-0830	CLH	f
900	3	16	f	4	0800-0830	CLH	f
900	2	16	f	4	0800-0830	CLH	f

1000	4	32	m	4	0800-0830	CLH	f
800	4	16	m	4	0800-0830	CLH	f
1055	5	32	f	4	0800-0830	CLH	f
900	6	16	f	4	0800-0830	CLH	f
1050	1	32	m	4	0800-0830	CLH	f
1060	7	32	m	4	0800-0830	CLH	f
910	8	16	m	4	0800-0830	CLH	f
800	2	16	f	4	0800-0830	FBE	c
900	1	16	m	4	0800-0830	FBE	c
1000	2	32	f	4	0800-0830	FBE	c
950	4	32	m	4	0800-0830	FBE	c
910	6	16	f	4	0800-0830	FBE	c
910	7	16	f	4	0800-0830	FBE	c
1050	8	32	m	4	0800-0830	FBE	c
1100	6	32	m	4	0800-0830	FBE	c
1020	7	32	m	4	0800-0830	FBE	c
900	8	16	f	4	0800-0830	FBE	c
900	4	32	f	4	0800-0830	FBE	c
1100	3	32	f	4	1200-1230	CLH	b
920	5	16	m	4	1200-1230	CLH	b
1100	1	32	m	4	1200-1230	CLH	b
900	6	16	m	4	1200-1230	CLH	b
910	7	16	f	4	1200-1230	CLH	b
890	8	16	m	4	1200-1230	CLH	b
1100	8	32	f	4	1200-1230	CLH	b
920	1	16	f	4	1200-1230	CLH	b
700	4	16	f	4	1200-1230	CLH	b
1010	5	32	m	4	1200-1230	CLH	b
900	3	16	f	4	1200-1230	FBE	a
800	2	16	m	4	1200-1230	FBE	a
890	3	16	f	4	1200-1230	FBE	a
1040	5	32	f	4	1200-1230	FBE	a
1050	6	32	m	4	1200-1230	FBE	a
900	7	16	m	4	1200-1230	FBE	a
900	4	32	f	4	1200-1230	FBE	a
1000	5	32	f	4	1200-1230	FBE	a
900	1	16	f	4	1200-1230	FBE	a
1060	7	32	m	4	1200-1230	FBE	a
910	8	16	f	4	1200-1230	FBE	a
950	3	16	f	5	0800-0830	CLH	d
800	4	16	m	5	0800-0830	CLH	d
900	2	32	m	5	0800-0830	CLH	d
1100	3	32	m	5	0800-0830	CLH	d

900	1	16	f	5	0800-0830	CLH	d
1100	6	32	f	5	0800-0830	CLH	d
900	7	16	f	5	0800-0830	CLH	d
900	8	16	f	5	0800-0830	CLH	d
700	4	16	m	5	0800-0830	CLH	d
1070	5	32	m	5	0800-0830	CLH	d
900	3	16	f	5	0800-0830	FBE	g
950	4	32	m	5	0800-0830	FBE	g
900	5	16	f	5	0800-0830	FBE	g
660	4	16	m	5	0800-0830	FBE	g
910	6	16	f	5	0800-0830	FBE	g
1050	7	32	f	5	0800-0830	FBE	g
1100	8	32	f	5	0800-0830	FBE	g
900	7	16	m	5	0800-0830	FBE	g
1050	5	32	f	5	0800-0830	FBE	g
905	1	16	m	5	0800-0830	FBE	g
950	2	32	m	5	0800-0830	FBE	g
900	2	16	f	5	1200-1230	CLH	f
1100	3	32	m	5	1200-1230	CLH	f
1000	4	32	f	5	1200-1230	CLH	f
900	3	16	m	5	1200-1230	CLH	f
800	4	32	m	5	1200-1230	CLH	f
910	1	16	m	5	1200-1230	CLH	f
900	6	16	f	5	1200-1230	CLH	f
1080	7	32	f	5	1200-1230	CLH	f
1020	8	32	f	5	1200-1230	CLH	f
1060	5	32	m	5	1200-1230	CLH	f
700	4	16	f	5	1200-1230	FBE	e
900	5	16	m	5	1200-1230	FBE	e
900	7	16	f	5	1200-1230	FBE	e
1100	7	32	m	5	1200-1230	FBE	e
760	4	32	f	5	1200-1230	FBE	e
890	2	16	m	5	1200-1230	FBE	E
1100	1	32	m	5	1200-1230	FBE	E
990	2	32	f	5	1200-1230	FBE	E
910	3	16	f	5	1200-1230	FBE	E
1050	2	32	m	5	1200-1230	FBE	E
1050	8	32	f	5	1200-1230	FBE	E

Table 2 – ANOVA of survey findings for a 16 Gbyte memory iphone 4

1. Scenario	1	2	3	4	5	6	7	8	F-statistic	p-value
Average WTP	894.64	861.88	906.88	730.87	892.27	885.91	902.22	893.00	43.71	0.00
2. Sex of subject	female	male								
Average WTP	860.08	852.50							0.26	0.61
3. Survey day	1	2	3	4	5					
Average WTP	842.27	840.00	853.04	879.13	868.33				1.07	0.37
4. Survey time	0800-0830	1200-1230								
Average WTP	855.00	858.68							0.06	0.80
5. Survey venue	CLH	FBE								
Average WTP	855.29	858.05							0.04	0.85
6. Interviewer	a	b	c	D	e	f	g			
Average WTP	858.00	864.74	860.56	838.00	845.00	884.00	843.06		0.63	0.71

Table 3 – ANOVA of survey findings for a 32 Gbyte memory iphone 4

1. Scenario	1	2	3	4	5	6	7	8	F-statistic	p-value
Average WTP	1062.50	1015.00	1074.00	893.08	1053.00	1052.22	1063.08	1033.85	17.28	0.00
2. Sex of subject	female	Male								
Average WTP	1025.41	1028.54							0.04	0.84
3. Survey day	1	2	3	4	5					
Average WTP	1028.95	1017.37	1042.63	1028.68	1018.10				0.37	0.83
4. Survey time	0800-0830	1200-1230								
Average WTP	1021.38	1032.20							0.52	0.47
5. Survey venue	CLH	FBE								
Average WTP	1021.35	1032.45							0.55	0.46
6. Interviewer	a	B	c	D	e	F	g			
Average WTP	1006.25	1075.83	1026.67	1032.86	1026.36	1007.67	1024.29		1.30	0.26

Table 4 – Regression analysis of the real option value

Dependent variable = WTP

	Model 1				Model 2			
	16 Gbyte		32 Gbyte		16 Gbyte		32 Gbyte	
regressor	coeff	st err	coeff	st err	coeff	st err	coeff	st err
intercept	894.64**	10.59	1062.50**	17.64	890.06**	4.37	1047.68**	5.64
Q 2	-32.77*	14.50	-47.50*	21.60				
Q 3	12.23	14.50	11.50	23.66				
Q 4	-163.77**	13.43	-169.42**	22.42	-159.19**	9.55	-154.60**	15.39
Q 5	-2.37	15.96	-9.50	21.84				
Q 6	-8.73	15.96	-10.28	24.24				
Q 7	7.58	16.93	0.58	22.42				
Q 8	-1.64	16.40	-28.65	22.42				
R-square	0.75		0.58		0.72		0.51	
F-statistic	43.71		17.28		277.73		100.86	
p-value	0.00		0.00		0.00		0.00	
observations	110		97		110		97	

* - statistically significant at 5% level; ** - at 1% level

coeff – coefficient; st err – standard error; Q - scenario

Intercept = Q 1

Model 1 = all scenarios represented in regression

Model 2 = only Q 4 is regressed, all other scenarios are represented by intercept

Coefficient for Q 4 in model 2 = estimated value of the real option

Intercept for model 2 = estimated WTP without the real option