When is a 9-ending Price Perceived Lower Than a 0-ending Price? The Moderating Role of Price Consciousness

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ABSTRACT
Prior research suggests that 9-ending prices may lead one to underestimate the magnitude of such prices for consumers. In particular, 9-ending prices would be perceived substantially lower than 0-ending prices, which are actually just a little higher (e.g., $199 vs. $200). Research indicates, however, that the underestimation effect of 9-ending prices is context-dependent. This study examines the effect of the left-most digit, distances between the target price and the reference price, price length, and, especially, price consciousness on the perceptual underestimation of a 9-ending price through three experiments. Results show that a 9-ending price is perceived lower than a 0-ending price (1) when the left-most digit changes, (2) when the target price is close to the comparison standard price, and (3) when the price is a three-digit or a five-digit number. The perceptual underestimation of the 9-ending price diminishes, however, in high price-conscious consumers.

Keywords: 9-ending prices, 0-ending prices, price perception, price consciousness
1. INTRODUCTION

The issue of price endings receives much attention in pricing research. If price endings come from a cost formula, the right-most digits will show an even distribution of all ten possible digits. However, many studies on retail pricing show that 0, 5, and 9 are over-used as ending digits [Kreul, 1982; Schindler and Kirby, 1997; Stiving and Winer, 1997; Schindler, 2006]. For example, Stiving and Winer [1997] concluded from past price ending surveys that more than 74% of prices end in the digits 0, 5, and 9. Price endings are determined strategically rather than by chance. Schindler [1991] suggested that retailers can manipulate price endings to communicate information about a product or a retail store. For example, the prices $19.99 and $20.00 are not the same, but they are not very different, either. Retail managers may use $19.99 to communicate some meaning. The over-representation of the digits 5 and 0 in price endings may be derived from the decimal number system, as 0-ending numbers are multiples of 10 and 5-ending numbers are mid-points between multiples of ten. Digits 5 and 10 have higher cognitive accessibility, which accounts for their over-representation in pricing practice [Schindler and Kirby, 1997]. However, why do price setters prefer 9-ending prices, which are just below round prices?

One commonly proposed advantage of using 9-ending prices could be referred to as the underestimation effect, or lower price illusion. This type of pricing leads consumers to perceive a lower price level. Consumers tend to ignore or pay less attention to the ending digits of a price to minimize mental effort [Bizer and Schindler, 2005; Brenner and Brenner, 1982; Lambert, 1975; Thomas and Morwitz, 2005]. Therefore, 9-ending prices would be perceived substantially lower than 0-ending prices, which are actually just a little higher (e.g., $199 vs. $200, or $259 vs. $260). However, empirical studies of 9-ending pricing streams have produced inclusive findings [e.g., Lambert, 1975; Schindler and Kibarian, 1993; Stiving and Winer, 1997].
The underestimation effect of 9-ending prices is context-dependent. For example, Anderson and Simester [2003] concluded that the underestimation effect of 9-ending prices is stronger for new items but is weaker when retailers use “sale” cues. Thomas and Morwitz [2005] also documented that a change in the left-most digit is the crucial factor for underestimating 9-ending prices, in terms of left-digit effect, and they further pointed out that the left-digit effect depends on the distance between the target price and the reference price.

Those studies focus on objective factors rather than subjective factors, consumer difference variables. Is a price’s perceived magnitude similar across consumers? Do consumer difference variables moderate the underestimating effect? Only a few researchers have examined the subjective factors of this issue. Among them are Bizer and Schindler [2005], who proved the moderating role of “processing motivation” on the underestimating effect.

There is extensive research on the effect of price consciousness, one of the consumer difference variables, on price perceptions [e.g., Alford and Biswas, 2002; Kukar-Kinney, Walters, and MacKenzie, 2007; Lichtenstein, Bloch, and Black, 1988; Lichtenstein, Ridgway, and Netemeyer, 1993; O'Neill, David R Lambert, 2001].

The current study focuses on the moderating role of price consciousness in the underestimation effect of 9-ending prices. In this research, we begin with the left-most digit effect and distance effect, as proposed by Thomas and Morwitz [2005], and the price length effect on perceptual underestimation for 9-ending prices. The moderating effect of price consciousness is examined in further detail under the three foregoing circumstances, respectively, in three experiments. Previous price-ending studies also present the prices ending in cents. Those studies prove the existence of perceptual underestimation for 9-ending prices in some circumstances. However, in countries with a relatively low value for each currency unit, retail prices most often end in dollars. Do 9-ending prices that end in dollars exert the same effect as those that end in cents? This study surveys prices that end in dollars to test the hypotheses.
2. CONCEPTUAL BACKGROUND AND HYPOTHESES

This section includes a discussion of how consumers process numerical information, and then explains the underestimation effect, the left-most digit effect, the distance effect, the price length effect, and price consciousness.

2.1. Processing Numerical Information

Various models have been used to explain how consumers process numerical information, or compare two numbers. Hinrichs, Yurko and Hu [1981] discuss two well-defined models: a lexicographic model and a holistic model. According to the lexicographic model, numbers are processed digit by digit. According to the holistic model, numbers are encoded to points on the mental number line (i.e., analogous magnitude).

People are exposed to a continuous flow of price information in everyday life. Because they are subject to the limitation of human information-processing abilities, consumers tend to process price information in an imprecise way and memorize the more valuable messages instead [Brenner and Brenner, 1982]. Therefore, this study speculates that people form their price perceptions based on a holistic model most of the time. The encoding process determines the precision of their price perceptions. Schindler and Kirby [1997] noted that two strategies are available for rounding a non-0-ending number: rounding and truncation. Because people read a multi-digit number from left to right, they must read every digit and then judge whether they should round up or down according to the rounding rule. Clearly, this strategy requires significant mental effort. Compared with rounding up or down, truncation requires the least amount of mental effort. In this strategy, consumers do not need to read all the digits in a number. No rounding rule is applied, and no digits changed except for substituting zeros for digits to the right. Schindler and Kirby [1997] pointed out that consumers commonly use the truncation strategy.
2.2. **Underestimation Effect**

Using the truncation strategy, consumers will perceive a 9-ending price to be much lower than a 0-ending price, which is actually only one unit higher. This is the underestimation effect proposed by Schindler and Kirby [1997]. Moreover, the less that consumers process the left digits, the more they will underestimate a 9-ending price. For instance, when a price is $299, truncating the right-most digit 9 would lead the consumer to regard the price as $290. Truncating all digits right of the left-most digit would make the consumer regard the price as $200. In the former case, the price underestimation is 3%, but in the latter case, the price underestimation is 30%. This underestimation mechanism leads consumers to perceive a 9-ending price as being much lower than a 0-ending price even though it is only one unit higher [Schindler and Kibarian, 1996].

2.3. **Left-Most Digit Effect**

Hinrichs et al. [1981] suggested that left-to-right reading causes people to perceive the magnitude of a multi-digit number based mainly on the left-most digit. Thomas and Morwitz [2005] proposed that perceptual underestimation of a 9-ending price is derived from changes in the left-most digit. Dehaene, Dupoux, and Mehler [1990] pointed out that a multi-digit number is encoded into a mental analog magnitude. The conversion from numerical to mental magnitudes happens automatically and very rapidly. Because of left-to-right reading, the encoding process begins as soon as the perceiver sees the left-most digit, and may be finished before all the digits are examined. Therefore, the left-most digit exerts a critical effect on the perceived magnitude of a multi-digit number [Thomas and Morwitz, 2005]. For a 9-ending price versus a 0-ending price that is only one unit higher, if their left-most digits are the same, the underestimation effect of the 9-ending price is limited (e.g., $259 vs. $260). However, if the left-most digit of the 0-ending price increases because of the increase of one unit – that is, the left-most digit of the 9-ending price is lower than that of the 0-ending price – the the 9-ending price has an eminent perceptual underestimation. In other words, the
left-most digit plays a moderating role in perceptual underestimation of a 9-ending price.

**H1**: The left-most digit moderates perceptual underestimation of a 9-ending price. In particular, if the left-most digit of a 9-ending price is lower than that of a 0-ending price, then the perceived magnitude of the 9-ending price is smaller than that of the 0-ending price (e.g., $199 vs. $200). But, if not, the perceived magnitude of the 9-ending price is not smaller than that of the 0-ending price (e.g., $259 vs. $260).

### 2.4. Distance Effect

How people judge a number depends on reference frames. For instance, is 50 judged to be large or small? Compared with 10, the number 50 is large. In contrast, 50 is small when compared with 90. Moyer and Landauer [1967] proved that the time to determine which of two given digits is larger decreases as the difference between the two digits increase. They found a logarithmic relationship between reaction times and numerical differences between comparison stimuli. In other words, the closer the two digits are, the more response time is required. This phenomenon is called the distance effect. It means that comparing two objects becomes easier as the distance between them increases [Dehaene, Bossini and Giraux, 1993]. The distance effect is relevant to comparisons between multi-digit numbers and other domains.

Dehaene et al. [1990] noted that, when people make a magnitude judgment of a number, they encode the target number into an analogical magnitude on a number line. They then compare the analog magnitude with a reference frame. Space for encoding on the number line is limited if the difference between numbers is small, and it will be difficult to make a magnitude judgment correctly. Likewise, when people evaluate a price, they need a reference price as a comparison standard. If the target price is close to the reference price, difficulty in assessing the target price leads to perceptual underestimation of a 9-ending...
price. Alternatively, if the target price is far from the reference price, the perceived difference between a 9-ending price and a 0-ending price that is one unit higher is not so evident [Thomas and Morwitz, 2005].

**H2**: The distance between the target price and the comparison standard moderates the perceptual underestimation of a 9-ending price. In particular, if the distance between the target price and comparison standard is small rather than large (e.g., $100 vs. $200), it is more likely to create perceptual underestimation of a 9-ending price.

### 2.5. Price Length Effect

With regard to the perceptual underestimation of 9-ending prices, researchers have not thoroughly investigated the price length effect. Are the perceived magnitudes of 9-ending prices and 0-ending prices that are one unit higher influenced by price length? Hornik, Cherian and Zakay [1994] reported that consumers tend to use rounders to determine, perceive, and estimate numbers for the duration and frequency of consumption activities. Further, the larger the value is, the more digits are rounded. Because people must process a lot of numerical information, limited energy and time forces them to capture only part of the information that is present. If someone processes only two digits of a multi-digit number, they will encode $199 as $190, with an underestimation of 4.5%. The price $19,999 will be encoded as $19,000, with an underestimation of 5.0%. Moreover, consumer perceptions of numbers are compressed as the numbers increase [Hinrichs et al., 1981]. Therefore, it is more difficult to make a large-small comparison for two large numbers than for two small numbers. Consumers are also more likely to perceive that a 9-ending price is smaller than a 0-ending price, which is only one unit higher. Thus,

**H3**: The length of a price moderates the perceptual underestimation of a 9-ending price. In particular, if the price length is large rather than small (e.g., $29,999 vs. $299), it is more likely to create perceptual underestimation of a 9-ending price.
2.6. **Price Consciousness**

Although the literature frequently discusses the underestimation mechanism, it seldom mentions the influence of individual difference variables. Consumers are very heterogeneous in their attention and reaction to price cues. Each individual gives a distinct meaning to the same objective price while converting it to a perceived price [Lichtenstein et al., 1988; Gedenk and Sattler, 1999; Alford and Biswas, 2002]. The encoding process is very important in interpreting price information.

This study focuses on whether a consumer will underestimate a 9-ending price on receiving a price cue. The extent to which a consumer underestimates a 9-ending price may be determined by how much he or she is concerned with purchase outlay. Lichtenstein et al. [1993] referred to price consciousness as the degree to which the consumer focuses exclusively on paying a low price for a product. Because of their focus on prices, highly price-conscious people will be cognitively very involved with prices [Kukar-Kinney et al., 2007].

Therefore, in the stage of processing price information, a highly price-conscious consumer who is very concerned about paying a specific amount of money is more likely to encode the numbers of a price digit by digit, based on the lexicographic model, and is less likely to misconceive a 9-ending price. For instance, when seeing $299, this type of customer will regard it as a price near $300 rather than about $200 or two hundred and some dollars, and thus be less likely to induce the perceptual underestimation effect. Therefore, the underestimation effect of a 9-ending price will be weakened when the perceiver is more price conscious. In particular, whenever the underestimation effect of a 9-ending price is caused by the left-most digit change (e.g., $199 vs. $200), the distance between the target price and comparison standard being small, or the price length being large, the effect will be mitigated when the perceiver is highly price conscious. Thus,
**H4:** *Price consciousness moderates the perceptual underestimation of a 9-ending price. In particular, for a more price-conscious consumer, it is less likely to underestimate the magnitude of a 9-ending price.*

3. **EXPERIMENTS**

Three studies were conducted to evaluate the moderating effects hypothesized. The left-most digit effect [H1], the distance effect [H2], and the price length effect [H3] were tested, respectively, in Experiment 1, Experiment 2, and Experiment 3, whereas the price consciousness effect [H4] was examined in all of the three experiments.

Consumer perceptions of prices are not absolute. Price evaluation usually refers to comparing two objective prices. One price is the target price, which we want to evaluate in the current study, and the other price is the reference price. The reference price either might already exist or might come from the current situation. Therefore, the experiment design in this study offered comparison standards with the same price in all treatments besides the targets as the reference price.

3.1. **Experiment 1**

This section describes the method used for Experiment 1, presents the results, and concludes with a discussion of the experiment.

3.1.1. **Method**

*Design.* To test H1 and H4, we designed Experiment 1 to determine the impact of the left-most digit and price consciousness on perceptual underestimation of a 9-ending price. The H1 test was an attempt to replicate Thomas and Morwitz’s [2005] findings, but using prices ending in dollars rather than cents. This experiment was a 2 (price ending: 9 versus 0) × 2 (the left-most digit of the target price: same versus different) mixed factorial design. The first factor was manipulated *between* subjects, and the second factor was manipulated *within* subjects. The experiment contained two manipulated conditions (Table 1).
Participants. We recruited 68 part-time graduate students at a national university in northern Taiwan to participate in this experiment. Their ages ranged from 25 to 54 years.

Stimuli. Spaghetti dishes were used as the stimuli for this experiment. Spaghetti is popular in northern Taiwan; hence, most people are familiar with the dish. Spaghetti is often priced differently, and thus allows price manipulation and an examination of whether experimental results generalize across products with such prices. We surveyed menus of spaghetti items in regular restaurants and interviewed potential participants to determine the price range for the products and the content of the product pictures.

Procedure. Each participant received a pamphlet containing instructions, four-color pictures of spaghetti with prices, price evaluation scales, and a price consciousness scale. The pictures of the spaghetti were similar. The first two dishes were spaghetti with clam and pesto sauce, and spaghetti with seafood and cream sauce from Tuscany (a fictitious restaurant). These two dishes served as comparison standards, with their prices held constant at $300 across all conditions. The next two dishes, which served as the target, were from Mulasa (another fictitious restaurant). As shown in Table 1 above, their prices were
manipulated to be either 9-ending ($199 and $259) or 0-ending ($200 and $260). Half of the participants were given the questionnaire with 9-ending target prices, and half were given the questionnaire with 0-ending target prices. Participants were randomly assigned to each group.

**Price Consciousness.** This experiment measured price consciousness with a reduced version of the scales proposed by Lichtenstein et al. [1993]. The scale consisted of three items on a seven-point Likert scale ranging from 1 (“strongly disagree”) to 7 (“strongly agree”). Cronbach’s α is 0.86. A median split on price consciousness scores was used to divide the participants into high (n=35) and low (n=33) subgroups.

**Dependent Variable.** The dependent variable in this experiment was the price magnitude perception for each dish. Participants responded to the statement, “I feel the price of ×× spaghetti is high,” on seven-point Likert scales ranging from 1 (“strongly disagree”) to 7 (“strongly agree”), as per Thomas and Morwitz [2005]. Every item was printed right next to its picture to avoid confusing the participants.

### 3.1.2. Results

Since Tuscany’s spaghetti dishes were used as the comparison standards, we used two ANOVAs to determine whether magnitude perceptions for the comparison standards were the same across the two conditions. As expected, magnitude perceptions for both of the comparison standards were not affected by left-most digit manipulation ($F_{1,66}=0.14$, $p>0.05$; $F_{1,66}=0.57$, $p>0.05$). Therefore, if the magnitude perception for the target was distinct in various price-ending conditions, it was caused by the manipulation.

Subsequently, we analyzed the price magnitude perception data using a $2 \times 2 \times 2$ mixed factorial ANOVA. Price ending and price consciousness were two between-subject factors, and the left-most digit was the within-subject factor. The interaction of the left-most digit by price ending interaction was significant ($F_{1,64}=9.09$, $p<0.01$). Under different left-most digit conditions ($199$ vs. $200$),
the price magnitude perception was significantly smaller for the 9-ending price condition ($M_9=3.56$) than for the 0-ending price condition ($M_0=4.32$; $t = -2.59$, $p < 0.05$). However, under the same left-most digit conditions ($259$ vs. $260$), the price magnitude perception of the 9-ending price condition ($M_9=4.74$) was not different from the 0-ending price condition ($M_0=4.65$; $t = 0.27$, $p > 0.05$). Consistent with H1, the perceived magnitude of a 9-ending price was smaller than that of a 0-ending price ($199$ vs. $200$) when the left-most digit of the 9-ending price was lower than that of the 0-ending price (Figure 1a).

![Figure 1a. Price Magnitude Perception for Each Price Ending x Left-Most Digit Condition](image)

Next, the three-way interaction of left-most digit by price ending by price consciousness was significant ($F_{1,64} = 4.16$, $p < 0.05$). This result showed that price consciousness played a moderating role in Experiment 1. We conducted two follow-up two-way ANOVA tests to reveal more details. We conducted the two ANOVAs with price ending and price consciousness as the two between-subject factors for two “left-most digit” conditions, respectively.

When the left-most digit was different ($199$ vs. $200$), there was a significant price ending by price consciousness interaction ($F_{1,64} = 7.60$, $p < 0.01$).
However, when the left-most digit did not change, the interaction effect was not significant ($F_{1,64} =0.19$, $p > 0.05$). Therefore, the price consciousness effect was examined further only in the different left-most digit conditions.

Figure 1b below depicts the mean of the price magnitude perception across the four conditions. When the perceivers were low price-conscious, price magnitude perception was significantly smaller in the 9-ending price condition ($M_9=2.73$) than in the 0-ending price condition ($M_0=4.33$; $t=-4.74$, $p<0.001$). However, when the perceivers were high price-conscious, price magnitude perception in the 9-ending price condition ($M_9=4.21$) was not consistently different from those in the 0-ending price condition ($M_0=4.31$; $t=-0.24$, $p > 0.05$). Therefore, consistent with H4, we found that, for a more price-conscious consumer, the left-most digit was less likely to create perceptual underestimation of the 9-ending price.

![Figure 1b. Price Magnitude Perception for Each Price Ending x Price-Consciousness Condition](image)

### 3.1.3. Discussion

The results of Experiment 1 indicate that the left-most digit has a moderating effect on perceptual underestimation for 9-ending prices. This result was consistent with Thomas and Morwitz’s [2005] finding that lowering a price by 1 to a 9-ending underestimates magnitude perceptions when the left-most digit
decreases 1. This finding also shows that 9-ending prices that ended in dollars exerted the same effects as those ending in cents. It further proved that the left digit in a price cue was more important than the right digit [Brenner and Brenner, 1982], and that, when the numbers are processed left to right, the left digit exerted a stronger effect than the right digit in price evaluation [Stiving and Winer, 1997; Thomas and Morwitz, 2005].

The result of Experiment 1 also provided support for the moderating influence of price consciousness. For high price-conscious consumers, the left-most digit did not lead to lower perceived 9-ending prices. However, for low price-conscious consumers, the left-most digit created perceptual underestimation for 9-ending prices.

3.2. Experiment 2

This section discusses the method used for Experiment 2, presents the results, and concludes with a discussion of the findings.

3.2.1. Method

Design. Experiment 2 measured the distance effect on the perceptual underestimation of 9-ending prices. Because of the support of H1, which predicts that a decrease in the left-most digit creates underestimation of the price magnitude perception, we conducted Experiment 2 for the price setting that the left-most digits of the targets in 9-ending and 0-ending conditions were manipulated to be different ($199 vs. $200).

Like Experiment 1, Experiment 2 was modified from Thomas and Morwitz’s [2005] design. In the current study, however, we compared prices ending in dollars rather than cents. In practice, when a price setter uses reference pricing, the reference price (which may be the regular price, the competitor’s price, or the last price paid) is always higher than the target price. Therefore, the current study considered only two higher comparison standard price conditions in
Experiment 2, whereas Thomas and Morwitz [2005] considered both higher and lower comparison standard price conditions. This experiment used a $2 \times 2$ (price ending of the target: 9 versus 0) × (the distance between the target and comparison standard: $\$100$ versus $\$200$) between-subjects design. Each subject sees one of the distance conditions in either 9- or 0-ending (Table 2).

### Table 2

**Design of Experiment 2**

<table>
<thead>
<tr>
<th>Distance</th>
<th>$$100$</th>
<th>$$200$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price-ending condition</strong></td>
<td>9-ending</td>
<td>0-ending</td>
</tr>
<tr>
<td>MegaTech (standard)</td>
<td>$$500$</td>
<td>$$500$</td>
</tr>
<tr>
<td>SuperTech (target)</td>
<td>$$399$</td>
<td>$$400$</td>
</tr>
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</table>

**Subjects.** A total of 169 part-time students from a university in southern Taiwan were chosen to participate in Experiment 2. Their ages ranged from 18 to 42 years.

**Products.** DVD-Rs served as the stimuli for this experiment. Students frequently use DVD-Rs, and most of them have experience buying the product. These products often have different prices within and across brands, allowing price manipulation. For this experiment, the researchers surveyed DVD-R prices in stores and interviewed potential participants to ascertain the price range for the products and the content of the product pictures.

**Procedure.** Each participant received a pamphlet containing instructions, two black-and-white pictures of DVD-Rs of different fictitious brands with prices, product descriptions, the price consciousness scale, and the price evaluation scale. The price consciousness scale and the dependent measure of the price magnitude perception were the same as those used in Experiment 1. Cronbach’s α of the price consciousness scale was 0.84. The product pictures were similar and their descriptions were the same across different brands. Participants were told that
both of the DVD-Rs were famous brands, but they were presented under pseudonymous brands (MegaTech or SuperTech) to avoid possible brand effects. Participants evaluated the products as national brands rather than private-label brands. The first DVD-R (MegaTech) served as the comparison standard, and its price was set at $500 or $600. The second DVD-R (SuperTech) served as the target, and its price was set at $399 or $400. As shown earlier in Table 2, the design comprised four cells. Participants were randomly assigned to the various conditions.

3.2.2. Results

Since MegaTech DVD-R prices served as the comparison standard, Experiment 2 used two ANOVAs to determine whether the magnitude perceptions for eTech DVD-R prices were indifferent across different price-ending conditions. As expected, the magnitude perceptions were not affected by price-ending manipulation (the distance =100: $F_{1,85}=0.42$, $p>0.05$; the distance =200: $F_{1,55}=0.01$, $p>0.05$).

A 2×2 ANOVA, with price ending and the distance as two between-subject factors, was conducted to test H2. The results supported H2. This hypothesis states that it is more (less) likely to exert the underestimation effect of the 9-ending price as the distance is small (large). The ANOVA results showed a main effect of price ending ($M_9=3.85$, $M_0=4.44$; $F_{1,165}=14.88$, $p<0.001$), qualified by a significant interaction between price ending and the distance ($F_{1,165}=3.95$, $p<0.05$) (see Figure 2a). Under small distance conditions (the distance=100), the price magnitude perception was significantly smaller for the 9-ending price condition ($M_9=3.59$) than for the 0-ending price condition ($M_0=4.47$; $t=-4.72$, $p<0.001$). However, under large distance conditions (the distance=200), the price magnitude perceptions for the 9-ending price condition ($M_9=4.13$) were not consistently different from the 0-ending price condition ($M_0=4.40$; $t=-1.18$, $p>0.05$).
A further analysis within the small distance conditions was conducted to examine the price consciousness effect. The participants for the conditions were divided into high (n=41) and low (n=40) subgroups, using the same procedure followed in Experiment 1. As expected, the $2 \times 2$ ANOVA yielded a significant interaction between price ending and price consciousness ($F_{1,77}=4.52$, $p<0.05$). Figure 2b depicts the mean of the price magnitude perception across the four conditions.
Again, when the perceivers were low price-conscious, price magnitude perception was significantly smaller in the 9-ending price condition ($M_9=3.40$) than in the 0-ending price condition ($M_0=4.65$; $t=-4.50$, $p<0.001$). However, when the perceivers were high price-conscious, price magnitude perception in the 9-ending price condition ($M_9=3.86$) was not different from those in the 0-ending price condition ($M_0=4.30$; $t =-1.68$, $p>0.05$). Therefore, consistent with H4, it was found that small distance was less likely to create perceptual underestimation of the 9-ending price for a more price-conscious consumer rather than for a less price-conscious consumer.

### 3.2.3. Discussion

The results of Experiment 2 indicated that the distance between two prices being compared moderates the perceptual underestimation of the 9-ending price. This result is consistent with Thomas and Morwitz’s [2005] finding that lowering a price by 1 to a 9-ending is more likely to produce underestimated magnitude perceptions when the two prices being compared get closer. However, such effect will be moderated by price consciousness; that is, for people who are low price-conscious, the small distance may create the perceptual underestimation of the 9-ending price, but for people who are high price-conscious, this effect does not occur.

### 3.3. Experiment 3

This section describes the method used for Experiment 3, presents the results of the experiment, and discusses the findings.

#### 3.3.1. Method

**Design.** In Experiment 3, we tested whether the length of a price affects the perceptual underestimation of a 9-ending price. As before, we performed the experiment using prices ending in dollars rather than cents. Experiment 3 used a $2 \times 2$ (the length of a
price: three-digit price versus five-digit price) mixed factorial design. The price ending of the target was manipulated between subjects, whereas the length of a price was manipulated within subjects. This experiment involved two manipulated conditions: 9-ending and 0-ending prices (Table 3).

Table 3

<table>
<thead>
<tr>
<th>Design of Experiment 3</th>
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<tbody>
<tr>
<td><strong>Price-ending condition</strong></td>
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<tr>
<td><strong>DVD-R</strong></td>
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<tr>
<td>eTech (comparison standard)</td>
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<tr>
<td>SuperTech (the target)</td>
</tr>
<tr>
<td><strong>Notebook</strong></td>
</tr>
<tr>
<td>eTech (comparison standard)</td>
</tr>
<tr>
<td>SuperTech (the target)</td>
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</table>

Subjects. We selected 178 undergraduate students from a national university in southern Taiwan to participate in Experiment 3. Their ages ranged from 18 to 24 years.

Products. Because there were two price levels (a three-digit price versus a five-digit price), we tested the hypothesis for two different products: DVD-Rs and Notebooks. Students frequently use DVD-Rs and Notebooks, and are familiar with the products. Both products come in a wide range of prices within and across brands, and are therefore suitable for price manipulation. We surveyed the prices of DVD-Rs and Notebooks in stores and interviewed potential participants to determine price ranges for the products and the content and layout of the product pictures.

Procedure. Each participant received a pamphlet containing instructions, four black-and-white pictures of DVD-Rs or Notebooks from two brands with prices and descriptions, the price consciousness scale, and the price evaluation
scale. The price consciousness scale and the dependent measure of the price magnitude perception were the same as those used in Experiment 1. Cronbach’s \( \alpha \) of the price consciousness scale was 0.81. The pictures were similar, and the descriptions were the same across brands. Participants viewed two fictitious brands (eTech and SuperTech), which were pseudonyms for famous brands. The first two products were DVD-Rs, and the other products were Notebooks. In each category, the first item was an eTech product that served as the comparison standard. The second item was a SuperTech product that served as the target. The target DVD-R’s price was $299 versus $300, and the target Notebook’s price was $29,999 versus $30,000. The comparison standards were held constant at $400 for DVD-Rs and $40,000 for Notebooks across all conditions. Participants were randomly assigned to the various conditions shown previously in Table 3.

### 3.3.2. Results

Since eTech’s DVD-R and Notebook served as comparison standards, Experiment 3 first compared the magnitude perceptions of their prices individually for the two price-ending conditions. As expected, both products were not significantly different (DVD-R: \( F_{1,176}=0.65, p > 0.05 \); Notebook: \( F_{1,176}=0.74, p > 0.05 \)), which showed that the participant referents were the same. A 2x2 mixed factorial ANOVA was used to test H3, which examined the moderating effect of magnitude on perceptual underestimation for 9-ending prices. The ANOVA result showed a main effect of price ending (\( M_0=3.33, M_0=3.84; F_{1,176}=18.23, p < 0.001 \)). However, the two-way interaction between price ending and price length was not significant (\( F_{1,176}=0.47, p > 0.05 \)). Therefore, we could not find support for H3.

Next, we performed a further analysis to examine the price-consciousness effect. Participants were divided into high (\( n=87 \)) and low (\( n=91 \)) subgroups, using the same procedure followed in Experiment 1. Since the price-length effect is not significant, H4 was tested using a MANOVA, with the two price
magnitude perceptions as dependent variables, and price ending and price consciousness as between-subjects factors. As expected, the MANOVA yielded a significant interaction between price ending and price consciousness (Wilks' Lambda=0.96, p < 0.05). Figure 3 depicts the mean of the price magnitude perception across the eight conditions. Similarly, when the perceivers were low price-conscious, price magnitude perception was significantly smaller in the 9-ending price condition (M$_{299}$=3.24, M$_{29,999}$=3.18) than in the 0-ending price condition (M$_{300}$=3.95, M$_{30,000}$=4.47, p$_{3}$-digit<0.01, p$_{5}$-digit<0.001). However, when the perceivers were high price-conscious, price magnitude perception in the 9-ending price condition (M$_{299}$=3.51, M$_{29,999}$=3.71) was not different from those in the 0-ending price condition (M$_{300}$=3.71, M$_{30,000}$=3.47, p$_{3}$-digit >0.05, p$_{5}$-digit > 0.05). We found, therefore, consistent with H4, that for a more price-conscious consumer, it is less likely to exert the price length effect.

![Figure 3](image_url)

**Figure 3. Price Magnitude Perception for Each Price Ending x Price-Consciousness Condition**

### 3.3.3. Discussion

The results of Experiment 3 indicate that a 9-ending price with a lower left-most digit creates perceptual underestimation under both three-digit and five-digit price conditions. Unexpectedly, however, price length does not moderate perceptual underestimation of a 9-ending price. One limitation that the
design may impose is that the effect of price length may be confounded by motivational factors (e.g., involvement). Consumers might be more motivated in a five-digit price condition, in which case they would give more attention to every price digit rather than dropping off the right digits. On the other hand, the price-consciousness effect remained significant in Experiment 3. For both three-digit and five-digit price conditions, price consciousness moderated the underestimation effect of the 9-ending price.

4. GENERAL DISCUSSION

This section presents the major findings of the current study, explains the implications of the findings, and discusses the limitations of the study.

4.1. Major Findings

In three experiments, we found support for the moderating effects of the left-most digit, the distances between the target price and the reference price, and the consumer characteristic (price consciousness) on the perceptual underestimation of a 9-ending price. In the majority of past research regarding price ending, prices end in the cent column. In contrast, the current study examined prices ending in the dollar column to determine whether 9-ending prices exert the same effects as previous findings.

The results showed that a 9-ending price was not always perceived as smaller than a 0-ending price, as reported by Lambert [1975], Anderson and Simester [2003], and Thomas and Morwitz [2005]. The first experiment in the current study found that consumers perceive a 9-ending price to be lower than a 0-ending price if the left-most digit changes. The second experiment showed that consumers perceive a 9-ending price to be lower than a 0-ending price when the target price is close to the comparison standard price. These findings are consistent with those of Thomas and Morwitz [2005]. The third experiment
revealed that consumers perceive a 9-ending price to be lower than a 0-ending price whenever the price is a three-digit or five-digit number.

In all three experiments, we further divided subjects into two groups, (high and low price-conscious), and showed that the perceptual underestimation of a 9-ending price diminishes in the high price-conscious group. Across the three experiments, it was clear that the 9-ending price is more likely to exert the underestimation effect when consumers are less price-conscious. Highly price-conscious consumers, on the other hand, are likely to scrutinize prices, may possess more knowledge about the persuasive pricing tactics of marketers, and are therefore less likely to be misled by 9-ending prices.

4.2. Implications of Study

Prices play a complex role in consumer purchase evaluations. Retail prices tell how much the consumer must pay to get the product – thus playing a “constraint” role. Retail prices, however, also act as cues to evaluate values of various product attributes – thus playing a “quality signal” role [Erickson and Johansson, 1985; Lawson and Bhagat, 2002].

Previous studies mention that 9-ending prices exert level effects (underestimation effects) and convey a low-price image and low-quality image [Stiving and Winer, 1997; Gedenk and Sattler, 1999]. However, in a highly competitive market, the quality of a mature product is quite similar among firms. Therefore, consumers may be more concerned about whether the purchase is a good deal, and 9-ending prices may be more favorable. Such an effect is congruent in prices in the dollar column as well as the cent column.

However, any price setter who would like to exploit the 9-ending price strategy to affect consumer perceptions and have an actual effect on sales should note that a 9-ending price is not catholicon. To achieve the greatest effect, a price setter should consider both the objective and subjective factors that moderate the perceptual underestimation of 9-ending prices. The price setter should consider the left-most digit and decide whether to use a reference price. When the
left-most digit does not change, and the reference price is far from the target price, the 9-ending price effect is limited. The price setter should also assess whether overusing the 9-ending price will cause a negative effect.

In addition to the preceding factors, price setters should also consider what kind of consumers they will face, before making price-ending decisions. A low price-conscious consumer is likely to be confused by a 9-ending price, but a high price-conscious consumer would not be. The 9-ending price does not work with an acute, high price-conscious consumer. The effect of a 9-ending price not only depends on objective factors, such as whether the left-most digit is smaller, and whether there is a reference price, and the distance between the target and the reference, but also on subjective factors, including individual difference variables. After all, the perceived magnitude of price comes from people’s perceptions, and everyone is distinct and different. That is why it is important for price setters to consider whether their target customers are high or low price-conscious before setting a 9-ending price.

The findings of the current study also have implications for consumer evaluations. Seeing a 9-ending price such as $199, the consumer should be more attentive to the fact that the price is very near $200, and not merely “$100 and some dollars.” Consumers need to be aware that retailers often set a 9-ending price to produce a lower price illusion.

4.3. Limitations of Study

The current study has three limitations. First, because college students served as the research subjects, one should be careful about generalizing the results to a general population. Although some studies criticize the use of student samples, other studies conclude that the differences between “college students” and “real people” are small and that students are appropriate surrogates for “real people” [Brown and Brown, 1993]. James and Sonner [2001] suggested that
traditional student subjects are not appropriate surrogates in advertising research, but that non-traditional working adult students seem to be a good substitute for real consumers. In Experiment 1 and Experiment 2 of the current study, student samples may not be a problem because the subjects were working graduate students and working undergraduate students, respectively. The subjects in Experiment 3 were traditional undergraduate students. In all three experiments, we chose products with which students are familiar in order to mitigate the flaw of student samples.

A second limitation of the current study is that the analyses were limited to only a few price formats. The 99-ending price examined in this study is one of the just-below prices. Do other just-below prices, such as 95-ending 97-ending, 98-ending, and so on, have similar effects as the 99-ending price? Furthermore, does the value of the left-most digit influence the left-most digit effect? Specifically, this study compares $299 with $300. What would happen if the comparison were between $799 and $800? The answers to these questions require further research.

The third limitation is that the price-magnitude perception is subject to individual difference variables. This study considers only the impacts of price consciousness. Future research should continue exploring other individual difference variables, such as product involvement and product knowledge, which would influence price perception.

REFERENCES


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