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This article reports the adaptation of an experimental technique for establishing response scales for product classes. Experimental results further validate the price-limit hypothesis first confirmed in Europe. Implications for demand estimation, new product pricing, and product line pricing are discussed.

Measuring Price Thresholds by Psychophysics and Latitudes of Acceptance

INTRODUCTION

Recent price research reports the phenomenon of price limits (thresholds), i.e., that buyers have ranges of acceptable prices for contemplated purchases [1, 2, 3, 4, 7, 8]. The first four studies have used survey methodology that is subject to the usual questions of internal validity. However, rigorous ways of experimentally validating the price-limit concept are available. In particular, two experimental methodologies readily lend themselves to the problem of measuring price thresholds.

Psychophysics

Psychophysicists have long studied the problem of measuring an individual's response thresholds for physical stimuli. These are points or regions on a scale where responses shift from positive to negative or vice-versa. In the more sensitive experimental methodology, selected stimuli chosen from a range of values extending from a point where the subject rarely detects the stimulus to a point where he always does are presented several times in a prearranged order. The measurement of interest is the relative frequency of the occurrence of detection for each stimulus value.

Own-Category Procedure

Sherif and Hovland [9] have developed the own-category procedure for measuring individual responses

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to subjective stimuli. Individuals with differing latitudes of acceptance are asked to classify a series of items into categories such as most acceptable, acceptable, and unacceptable. From these individually determined categories it is then possible to determine regions of acceptance and rejection.

Purpose of This Study

To discover a way of measuring individuals' perceptions of price for various products, the psychophysical methods and the own-category technique were used in separate experiments with different groups of subjects. Details of the psychophysical experiment have already been reported [7]. The purpose of this article is to:

1. Briefly summarize the psychophysical experiments for determining price thresholds;
2. Present the methodology and results of the own-category experiment for determining price thresholds;
3. Comparatively analyze the two experimental techniques for determining price thresholds;
4. Discuss implications of the price-threshold concept for pricing strategies.

PSYCHOPHYSICAL EXPERIMENTS

The psychophysical experiments for determining price thresholds were conducted in two phases. In the first, the method of limits was adapted to determine the approximate region of the price limits. Undergraduate subjects from the University of Massachusetts gave approximate price limits for eight products (see Table 1 for product list and price limits).

In the second phase, the method of constant stimuli was adapted by presenting subjects with a set of 14 prices concentrated around either the lower or higher acceptable price limits determined in the first phase. For

Table 1
PRICE LIMITS

Product	Low price limit (dollars)			High price limit (dollars)		
	Psychophysical		Own category ^a	Psychophysical		Own category
	Linear interpolation	Normal graphic process		Linear interpolation	Normal graphic process	
Blouse	3.58	3.80	—	10.87	9.70	—
(Dress) shoes	10.50	9.00	8.75	19.50	19.10	19.75
Hair spray	0.57	0.59	—	1.88	1.88	—
Hair dryer	14.99	13.80	—	24.25	23.50	—
After-shave lotion	1.62	1.75	—	3.20	3.38	—
Dress shirt	3.33	3.25	—	7.25	6.50	—
Electric shaver	13.00	13.75	—	24.90	22.50	—
Sport coat	23.70	24.75	21.50	54.68	51.76	49.50

^a Used experimentally on only two products, shoes and sport coat.

each of the two price limits, the price stimuli were presented serially in ascending and descending order. As a check against possible order bias, the same stimuli values for each limit were presented in random order. Details of procedure and design are in [7].

OWN-CATEGORY EXPERIMENT

Method

Recognizing some limitations of the psychophysical adaptations (discussed below), a second experiment used the own-category methodology, adapted from Sherif [8]. Subjects were 57 high school students (29 females, 28 males) and the experiment was administered at the high school. Subjects judged a series of prices for a predetermined product category (sport coat for males, shoes for females).¹

Series stimuli were photocopied slips of paper, each bearing a price and arranged in random order. The female subjects were presented a series of 61 prices ranging at 50-cent intervals from \$5 to \$35. The male subjects were presented a series of 63 prices ranging at one-dollar intervals from \$10 to \$72.

The administrators of the experiment were two graduate students, carefully trained to administer psychophysical experiments. The administrator first explained that he was going to pass out an envelope with price slips inside. Subjects were told to sort the prices into a number of piles of their own choosing. If subjects were not interested in purchasing the item for themselves, they were told to assume they were interested in buying it for a gift. The administrator then passed out the envelopes, a printed instruction sheet, and two category identification slips. These were end category labels, but

¹ These two categories were selected after interviews with local store owners on the students' shopping behavior. These interviews asked for items usually purchased by high school students and the range of prices normally paid for the popular items. From these interviews it was apparent that high school students were involved in purchase decisions for clothing and shoes.

the subjects were not required to use them. The printed instruction sheet detailed the procedure the subjects should follow.

After the subjects completed this task, the administrator gave each a second instruction sheet, which indicated how subjects should label their piles, and labels for categorization.

Results

As with the psychophysical experiments, the hypothesis that the subjects would have an acceptable range of prices for a considered purchase was confirmed. Table 1 shows the computed price limits for the psychophysical experiment (phase two) and the own-category experiment. As can be seen, the results are quite close for the two products used. Specifically, 23 females and 22 males indicated a low price threshold and 27 females and 27 males indicated a high price threshold. The binomial test was significant ($p < .001$); thus it was concluded that for some products individuals have an acceptable range of prices for considered purchases.

The following table indicates the mean number of categories used in categorizing the prices:

	Males (sport coats)	Females (shoes)
Number of categories (\bar{x})	3.92	5.03
Scale center	\$36.50	\$15.25

As can be seen, females were more discriminating than males, since on the average they used slightly more than one additional category, despite the fact the males' price range was twice the females' price range (\$10 to \$72 vs. \$5 to \$35). The scale center is the limit between the two middle categories if the subject used an even number, or the midpoint of the middle category if the subject used an odd number [6, p. 343]. The scale centers of the above table and the category limits of Table 2 represent median values.

The values in Table 2 are limits computed for cate-

Table 2
CATEGORY LIMITS OF ACCEPTABLE AND OBJECTIONABLE
CATEGORIES, IN DOLLARS

Categories	Males		Females	
	Lower	Upper	Lower	Upper
Most acceptable	25.00	39.50	10.50	15.50
All acceptable	21.50	49.50	8.75	19.75
Unacceptable (high)	50.00	72.00 ^a	20.00	35.00 ^a
Unacceptable (low)	10.00 ^b	21.00	5.00 ^b	8.50

^a Not a median value, but an imposed high end point.

^b Not a median value, but an imposed low end point.

gories labeled as most acceptable, acceptable, and unacceptable. Again it is clear that subjects had a range of acceptable prices and that the scale center was in both cases within the most acceptable category, albeit above the midpoint. Also, the scale centers were below the stimuli centers (\$36.50 vs. \$41.00 and \$15.25 vs. \$20.00).

What does it mean when the subject calls a particular price "acceptable" or "unacceptable"? Partly, the communicative significance of the response is determined by the conventional meaning of the response word [7, p. 330]. But some significance is determined by the subjects' perceptions of the price stimuli relative to the product they are judging. The data of the own-category procedure are in a form that permits a quantitative description of subjects' definition of each judgment category.

In the current experiment, it is possible to sort each subject's responses into seven or fewer categories. That is, all prices labeled acceptable, but positioned in piles other than most acceptable, can be called acceptable-low or acceptable-high relative to the most acceptable category. Similarly, all prices labeled unacceptable can be labeled unacceptable-low or unacceptable-high, again relative to the most acceptable category. Subjects using the end category labels provide the other two categories, unacceptable-too cheap and unacceptable-too expensive. Now by computing the limens of each of these categories, the width of each category in stimulus units (price) is known. These measurements provide a quantitative record of the subjects' definitions of each judgment.

Figures 1 and 2 show the cumulative frequency functions and graph the transitions from each category to the adjacent category. The category limens are defined as the prices where the probability of a price being included in the designated category equals the probability of its being included in the immediately adjacent category.

At the bottom of the figures are the obtained response scales in the stimulus units—prices. In particular, the width of the acceptable price range is Categories 3 to 5.

The dotted lines indicate the scale centers. No assumptions about the response scale have been made; the calculations describe only how the subjects used the response scale and are in the units of the stimulus scale.

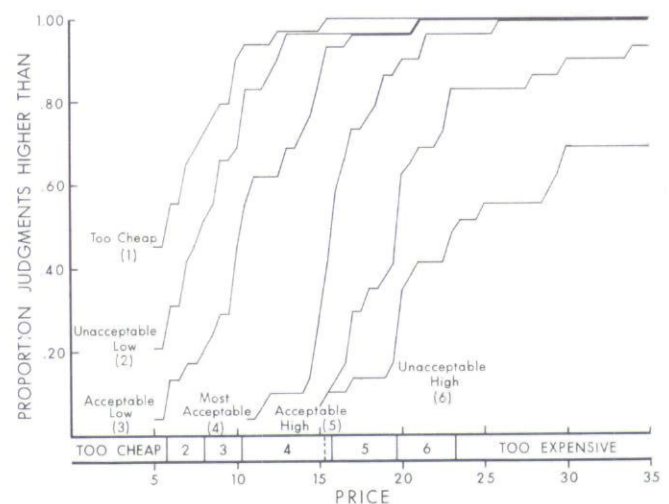
Looking at Figures 1 and 2, the width of each end category is indeterminate because each is open at the extreme (although the price of zero dollars provides a natural end for low prices). Of interest, the six category limens for females (but not males) could be computed. Again, it is apparent the female students were more discriminating in their judgments than the male students. However, a quantitative definition of the response categories, *most acceptable*, *acceptable*, and *unacceptable*, was determined for both groups. In this sense, there is a measure of the range of acceptable prices derived from a set of subjective judgments.

COMPARATIVE ANALYSIS OF THE TWO EXPERIMENTAL TECHNIQUES

Both experiments support the hypothesis of an acceptable range of prices. In this sense, there is no apparent difference between the two experimental techniques.

However, there is a strong difference in the established aims of the two techniques. In traditional psychophysical experiments, subjects are asked to respond to physical stimuli, *but the magnitude of the stimuli is unknown to them*. Thus subjects' responses to the stimuli can be assumed to be directly related to physical sensation, and, therefore, the subjects' categorizations of the stimuli are objectively determined. But when adapting psychophysical techniques to pricing experiments, there is no way to hide the magnitude of the stimulus (price), and so subjects react to the known magnitude of the

Figure 1
CUMULATIVE FREQUENCY FUNCTIONS AND
CATEGORY LIMENS—FEMALES



price. Hence, when categorizing a specific price for a contemplated purchase as acceptable or unacceptable, subjects can be assumed to be reacting to that price relative to an entire set of purchase decision variables. Therefore, the reaction to the price stimulus is subjective at best.

Another problem encountered with the psychophysical experiments was the limited number of stimuli values that could be presented to a subject in one sitting. Thus his attention was directed toward obtaining only one of the two (low or high) price thresholds. As a result, the range of acceptable prices obtained does not necessarily correspond even to a single individual's perception, since no subject was exposed to the entire range of feasible prices for the given product. Rather, the range of acceptable prices is inferred as the distance between the two median limits derived from different samples.

The judgment that a given price for a specified product is acceptable or unacceptable reflects an evaluation by the buyer and is relative to the entire set of purchase decision variables. In part, this judgment process is subjective and involves an evaluative set of categories already established from past behavior. Also, subjective judgments vary more from subject to subject than do objective judgments. That is, the reference scale underlying subjective judgments is quite different and more variable.

The own-category experimental technique is specifically designed to establish a measurement scale when the underlying judgments are subjective in nature and when these judgments, in part, reflect some social significance. In addition, the own-category technique allows each subject to see a wider range of stimulus values and removes the problem of the subjects' knowing the stimulus value. Also, the own-category technique permits each individual to establish his own categories, both in number and width, and thus the resulting scale is more

Figure 2

CUMULATIVE FREQUENCY FUNCTIONS AND CATEGORY LIMENS—MALES

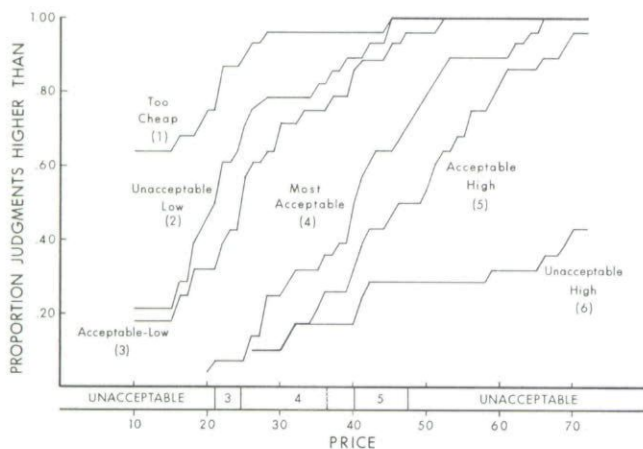
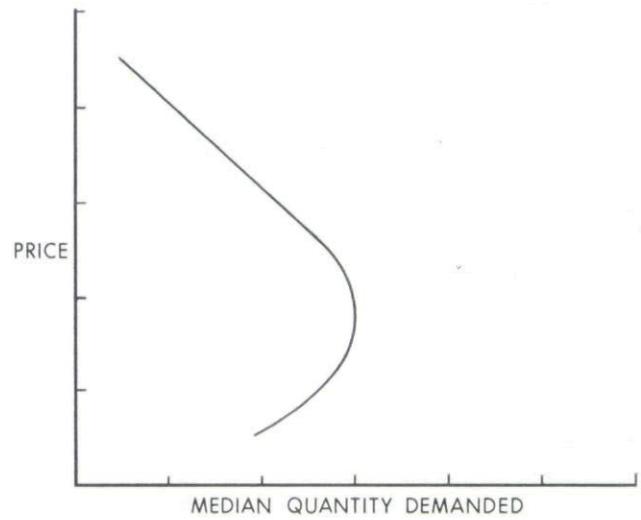


Figure 3

DEMAND CURVE IMPLIED BY PRICE-LIMIT CONCEPT



likely to reflect the subject's true subjective perceptions, without the experimenter's perceptions necessarily being reflected in the scale.

DISCUSSION

Despite some of the limitations of previous research on the price-limit hypothesis, the conclusions from the experiments have been identical. At the level of primary demand, buyers do have ranges of acceptable prices for considered purchases; prices outside the acceptable range, both low and high, are considered objectionable. The most immediate implication is that demand provides not only an upper constraint on a pricing decision (pricing what the market will bear) but also a lower constraint. Previously, the belief has been that cost is the low constraint on the price decision, with competition and demand providing upper constraints. Specifically, the cost-plus price decision model may, at times, lead to a pricing error despite satisfying the cost and competition constraints. For if the desired market target's median lower price limit is above the cost-plus price, then more than 50% of the desired market will perceive the cost-plus price as objectionable.

Also, many of the established procedures of demand estimation become suspect upon accepting the price-limit hypothesis. These procedures are often based upon an implicit assumption of an inverse price-quantity relationship. However, another implication of the price-limit concept is that there is a part of the demand curve with a positive slope. Figure 3 illustrates the backward bending demand curve implied by the price-limit concept. Given that these traditional demand estimation procedures may be based upon an assumed relationship of questionable validity, then they are suspect.

Moreover, the results of these experiments suggest

there is much variability in individual responses to price. Hence, the acceptable price range for a market segment is a statistical result. And any statements about the response scale constructed must be phrased in terms of probability. The stochastic nature of the price-demand relationship strongly suggests interval estimating procedures should be given preference over point estimating procedures when trying to estimate demand.

The existence of price lining at the retail level as well as the establishment of product lines for similar products by manufacturers suggests that marketing men, at least intuitively, are aware of the reality of the price-limit concept. Yet the literature on product-line pricing does not indicate the importance of establishing the lowest price (low end price), the highest price (high end price), or the price differentials between products in the product line *from a demand point of view*. Given that the objective of selling similar products with different features at different prices is to appeal to different market segments, then it becomes imperative to determine the acceptable price range for each market segment. The rationale for the lowest price or any price decision cannot be "that is all we can afford and still meet our objectives." The optimum price differentials must be determined by considering the acceptable price range for the intended market segment, and not by applying cost-plus decision rules to the additional features built into the higher-priced model. Similarly, the addition of a new product to the product line raises the question of how to differentially price the product.

CONCLUSION

This article has reported the adaptation of an experimental technique for establishing response scales for product classes. Experimental results further validate the price-limit hypothesis first confirmed in Europe using survey methodology, and now confirmed in the United States using experimental methodology. In many re-

spects, questions of internal and external validity of these methodologies have less significance in attempting to mitigate this hypothesis.

As the validity of the price-limit hypothesis becomes stronger in the primary demand situation, the implications for demand estimation, new product pricing, and product line pricing become more important. Perhaps the most important implication of the price-limit hypothesis is the need to place more emphasis on demand as a price-decision determinant than has been historically true. It is certainly true that more research is needed on the psychological and sociological aspects of price.

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