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Can Price Uncertainty Explain Why and When Products Are Sold on Sale?

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**CAN PRICE UNCERTAINTY EXPLAIN
WHY AND WHEN PRODUCTS ARE SOLD ON SALE?**

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Working Paper No. 57

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ABSTRACT

This paper illustrates how the theory of price uncertainty can explain the sales and markdown practices of stores. Because of the uncertainty about the distribution of reservation prices, stores set high initial prices to determine which styles/colors are more highly valued by customers and then hold sales to sell those styles/colors with lower reservation prices. The dispersion of reservation prices is expected to be greater for fancy versus white shirts, for imports versus domestically produced shirts and for shirts sold at the end than the beginning of seasons. Greater price dispersion is inferred from a greater frequency of sales for fancy versus white dress shirts, for imports versus domestically produced garments and at the end than the beginning of seasons. A striking regularity is that garments with higher initial prices are systematically sold at a higher average percentage markdown. Uncertainty about reservation prices is greater the higher is the quality of garment. Females are still more adept at purchasing a men's dress shirt on sale than are males. Employed females have a higher probability of purchasing on sale than a female not employed but this probability decreases as hours worked increases. A full time female worker has a lower probability of buying on sale than a female at home.

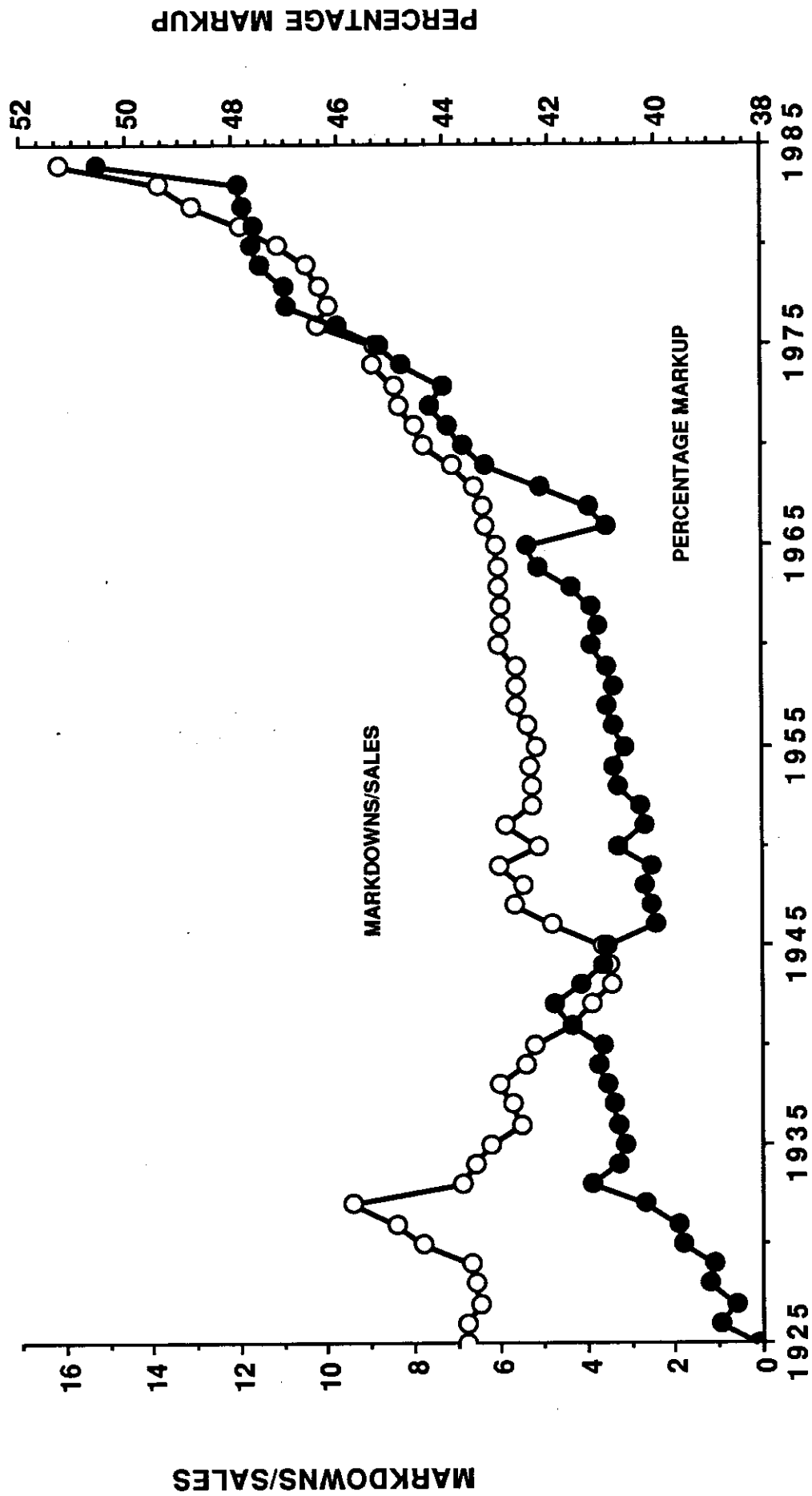
INTRODUCTION

The last twenty years has witnessed a revolution in retail pricing as stores have offered more sales. The pricing revolution is illustrated most vividly by the changes in the price policies of department stores. Twenty years ago markdowns were limited to slow selling women's fashion clothing and to selected departments, e.g. the January white sale. Now, many products and especially apparel products are sold by department stores at markdown. The extent of the sales explosion can be fully grasped by examining Figure 1 where the dollar value of all markdowns (on all merchandise sold in department stores) is expressed as a percentage of dollar volume (sales) and is shown from 1925 to 1984 [Pashigian 1988]. Dollar markdowns began to increase relative to dollar volume around nineteen seventy and have increased steadily and significantly since then. The upward trend since 1970 stands in sharp contrast to the meanderings of the series over the previous forty five years.¹

The basic causes of the recent growth in markdowns are not easily identifiable. Perhaps, there is no single cause. But, an important one is the growing importance of fashion and product variety, especially in apparel merchandising. The number of styles, fashions and colors has proliferated over time. The growing partiality toward color is reflected in a shift away from whites and to a greater reliance on prints and stripes between the mid-sixties and the mid-seventies. The wider color assortment and the growth of the casual clothing, where fewer dress guidelines exist, have complicated the job of the store buyer and increased number of purchasing errors made by merchandise buyers. Predicting what consumers will pay for the many more style and color combinations has become more of a herculean task. Buyers make more frequent purchasing errors and markdowns are the inevitable result of the unavoidable errors made by buyers.

An increase in (price) uncertainty appears to better explain what at first blush are contradictory changes in pricing policies of department stores. The growth in markdowns has distracted attention from another pricing change, the increase in the gross percentage markup (the term used in the industry is the percentage markon). Figure 1 shows the gross markup (before any markdowns are applied) began to rise at approximately the same time that dollar markdowns relative to dollar volume began to increase. The simultaneous rise in the percentage markup and dollar markdowns relative to dollar volume is to be expected if stores were stocking more fashion merchandise over time. Selling a fashion line involves greater uncertainty about what customers will pay for fashion merchandise. Some units in a line of clothing will be in greater demand with customers willing to pay relatively high prices for these items while others will be unexpected failures that can only be sold at lower prices. What distinguishes

**FIGURE 1: DOLLAR MARKDOWNS RELATIVE TO
DOLLAR SALES AND PERCENT MARKUP**



Source: NATIONAL RETAIL MERCHANTS ASSOCIATION

MCNAIR & MAY, THE AMERICAN DEPARTMENT STORE

fashion from basic clothing is the greater uncertainty about what prices customers will pay for the individual items in the line. Because of the greater dispersion in reservation prices, retailers will only carry the fashion line if the initial percentage markup is higher. As relatively more fashion merchandise has been stocked over time, stores have responded by increasing the percentage markup as well as the percentage of merchandise sold on sale.

While the pricing practices of retail stores are familiar to some economists, they remain a mystery to many, hidden away in, if not a black box, then certainly a gray one. Although the theory of price is the crown jewel of the profession, successful applications of the theory have been fewer in number. Many pricing practices in the private sector remain outside the purview of the profession unless, by chance, they are brought to light by either a persistent researcher or an antitrust case. What little is known about pricing practices of department and retail apparel stores comes to us from highly aggregated markdown data, either for the entire store or for highly aggregated departments. It is a rare event when a researcher has access to price data on individual transactions. The availability of such data is a unique feature of this study. The twin goals of the study are to identify 1) those product characteristics that increase a) the probability that an item is sold on sale and b) the percentage markdown and 2) which types of consumers have a greater propensity to purchase on sale. The main application will be to the purchase of men's dress shirts although some attention is given to the purchases of other products.

Section I reviews the price uncertainty theory of markdown pricing and proposes several testable implications of the theory. Section II briefly describes the unique features of the panel data made available by the MARKET RESEARCH CORPORATION OF AMERICA (MRCA) and defines several key variables. Section III displays regularities in markdown pricing patterns in graphs and tables. Section IV presents regression results of the effect of color, brand type, outlet type, imported merchandise and economic and demographic characteristics of buyers on 1) the regular price; 2) the probability a product will be sold on sale and 3) the percentage markdown.

I. PRICE UNCERTAINTY AND CLEARANCE MARKDOWNS

A theory of the optimal markdown was proposed by Lazear [1986] who derived the optimal percentage markdown for an individual store that has already stocked a line of clothing. Pashigian [1988] expanded the theory and showed how the optimal percentage markup and the optimal percentage markdown were determined simultaneously in an industry equilibrium. Because this study focuses solely on markdowns, the theory of the optimal percentage markdown will be briefly reviewed here. The interested reader can refer to the two articles for further details and embellishments.

Assume a store has already ordered a line of clothing, e.g. dresses, but is uncertain about what prices consumers are willing to pay for the different colors (styles) in the line. The prior cumulative price distribution of the reservation prices that consumers are willing to pay for the different colors is known to the store and is denoted by $F(P)$. Because the store does not know which of the different colors will be valued more highly, the store sets an initial (high) price of P_0 for each dress in the line. The dresses with colors for which consumer reservation prices exceed P_0 will sell out quickly. The colors that remain did not sell because consumers valued those colors at prices less than P_0 . Color selections in the first period inform the store manager that no probability mass lies to the right of P_0 for the remaining colors. The dresses sold in the initial period are obviously imperfect substitutes for those sold in the markdown period. Otherwise all consumers would wait to purchase in the markdown period. The theory implies that dresses sold in the initial period will have a different color (or style) composition than dresses sold in the markdown period.

The store revises the prior distribution of prices when it enters the markdown period because it has obtained new information from the pricing decision of the first period. It now knows consumers will pay less than P_0 for the remaining colors. It selects the optimal markdown price, P_1 , to maximize expected revenue in the markdown period.

$$(1) \quad ER_1 = P_1 \int_{P_1}^{P_0} f(P)/F(P_0) dP = P_1 \{F(P_0) - F(P_1)\}/F(P_0).$$

In the markdown period $f(p)/F(P_0)$ is the revised price distribution, given that the dress did not sell at P_0 for $P < P_0$. When selecting the optimal markdown price, the store is balancing a lower markdown price against selling a higher percentage of the remaining dresses. The optimal markdown price satisfies

$$(2) \quad F(P_0) - F(P_1) - f(P_1)P_1 = 0$$

The optimal first period price maximizes expected revenue given optimal pricing behavior in the markdown period. Expected revenue in the initial period equals

$$(3) \quad ER_0 = P_0\{1 - F(P_0)\} + P_1\{1 - F(P_1)/F(P_0)\}F(P_0).$$

A dress selected at random from the line has an expected revenue equal to P_0 times the probability it will be sold in the first period, $1 - F(P_0)$, plus P_1 times the probability it will be sold in the markdown period which equals the probability it did not sell in the first period times the conditional probability it sells in the markdown period. Dresses not sold at the end of the markdown period are assumed to be worthless.² The optimal initial price satisfies

$$(4) \quad (P_1 - P_0)f(P_0) + 1 - F(P_0) = 0$$

Equations 2 and 4 determine the optimal initial and markdown prices. For a given distribution of reservation prices, the optimal percentage markdown for items sold on sales can then be calculated,

$$(5) \quad \text{PMD/Sale} = (P_0 - P_1)/P_0;$$

and the percentage of all sold items that are sold on sale

$$(6) \quad \text{Percent} = \{F(P_0) - F(P_1)\} / \{1 - F(P_1)\}.$$

The average percent markdown over all units sold equals

$$(7) \quad \text{AVG PMD} =$$

$$\begin{aligned} & [\{ (P_0 - P_1)/P_0 \} \{ F(P_0) - F(P_1) \} + 0 \{ 1 - F(P_0) \}] / \{ 1 - F(P_1) \} \\ & = \{ (P_0 - P_1)/P_0 \} \{ F(P_0) - F(P_1) \} / \{ 1 - F(P_1) \} \\ & = (\text{PMD/Sale}) (\text{Percent}) \end{aligned}$$

The equilibrium values for (5) - (7) depend on the form and the parameters of the underlying price distribution. Pashigian [1988] finds an increase in price dispersion of reservation prices increases the percentage markdown for a uniform, symmetric triangular and right triangular price distribution. On the other hand the effect of increased price dispersion on the percentage of units sold on sale depends on the form of the price distribution. The percentage of units sold on sale is invariant to increases in price dispersion for a uniform distribution, increases for a symmetric triangular and a right triangle with a left mode and decreases for a right triangular price distribution with a right mode.

Several testable implications can be derived from the price uncertainty hypothesis. One direct implication is that more sales will be offered at the end of seasons. Customer selections at the beginning of each season identify the lines and the items within each line of clothing that are valued in excess of P_0 . The remaining items have reservation prices less than P_0 and can only be sold at markdown. This process of revelation implies that the size of the markdown and the percentage of units sold on sale should be higher at the end of a season than at the beginning.

The theory of uncertainty predicts that the percentage markdown will be larger for products with characteristics that are related to greater price uncertainty. Stores will have less historical price information to determine what price a product can be sold if color and/or style combinations change frequently. The underlying degree of price uncertainty may be expected to be greater for stripes than for whites because the store has had more experience selling white shirts. If so, a white dress shirt would be expected to sell for a smaller average percentage markdown than does a fancy shirt.³

Price uncertainty will be greater for imported than domestically produced items. Imported merchandise must be ordered earlier than domestically produced merchandise. Because of longer lead times, the probability of misjudging the market will be higher when fashion trends

change in the interim. Another implication of the the price uncertainty hypothesis is that imported garments will have a higher probability of selling at markdown and at a higher average percentage markdown. Pashigian [1988] found the growth of clothing imports was an important determinant of the growth of markdowns over time.

Although price uncertainty is an underlying cause of sales, it does not explain which types of consumers invest the necessary time to purchase at a markdown price. Searching for sales requires a greater investment of time by the consumer. The consumer must be willing to interrupt her or his schedule to take advantage of sales. Some consumers have learn to be more efficient in discovering sales than have others. A rudimentary theory of search would predict that the probability of purchasing on sale will be lower for those shoppers with a higher cost of time e.g. male versus female buyers or full time versus part time employed women or women at home. Because 63% of all men's dress shirts are purchased by females, it is an ideal product to evaluate the relative cost of time and shopping skills of male versus female buyers and of fully employed versus part-time female workers.

The growth of the two earner family has compressed more shopping time into the weekend. This compression of shopping time into the weekend for two earner families can be exploited to test a version of the price discrimination hypothesis. Price discrimination is often thought to be the underlying motive for markdown pricing - a technic to offer lower prices to those customers with more elastic demand curves. Acceptance of the price discrimination explanation requires more than a showing that prices are different. A valid application of the price discrimination theory requires a showing that customers who might be expected to have more elastic demand curves are the ones that purchase at markdown prices. High cost of time customers (male and female workers employed full time) represent a larger percentage of all buyers during the weekend. Since a larger percentage of all weekend shoppers are high cost of time buyers, stores should exploit this difference in the price elasticities by day of week and charge higher prices on the weekend than during the week. On the other hand, if weekend prices are not found to be higher than weekday prices, this would suggest that price discrimination cannot be successfully practiced by stores and is not the fundamental reason for markdowns.

II. MARKET RESEARCH CORPORATION OF AMERICA DATA

Market Research Corporation of America collects information on individual purchases by members of a consumer panel. In recent years the panel includes 11,500 households in the U.S.⁴ The data for this study were kindly made available to me by MRCA. All purchases were made in 1986.⁵ Each purchase by each member of a household is recorded in a diary. The MRCA data include: item purchased, date of purchase, name of store, brand name, import or not, type of fabric, size and color of garment purchased, sleeve length, income of household of buyer, sex of buyer, education of household head and of homemaker, hours worked by homemaker, number and age of children in household, price paid, regular price if bought on sale etc. These detail data are more comprehensive and vastly superior to publicly available data.

Much of the modeling effort was directed toward identifying variables which could serve as useful proxy variables for price uncertainty in the sale of men's dress shirts. The following candidates were used. They and the classification of outlets are discussed below.

1. Color: For many years white was the most "popular" color. Some readers will recall just how universal was the traditional white dress shirt or the white bed sheet. Whites have declined in popularity since the mid sixties [Pashigian 1988] and other solid colors and different types of prints and stripes (fancy) are now more popular. The detail color information for each garment was classified into one the following color categories:

1. White (or similar to white);
2. Other Solid (solid color other than white);
3. Mixed Solid (two or more solid colors) and
4. Fancy (stripe, pattern, spot etc).

White, other solid and the fancy categories account for most of the selections though the proportions among these three classes varies from one product category to another.

The demand for fancy shirt, which include print patterns, stripes etc., is more ephemeral because different colors combinations are continually introduced and discontinued. If so, a fancy dress shirt will have a higher probability of sale and a higher average percentage markdown than will a white dress shirt.

2. Type of Brand: Some brand names highlight fashion more than others. The recorded brand name of each purchase was classified into one of the following brand groups:

- a. Designer (e.g. Giorgi Armani, Bill Blass, Valentino and many others);
- b. Other Fashion (e.g. Laguna, Bonjour and other lesser known and younger fashion brands),
- c. Chain (Penney's, Sears, Wards and K-Mart's);
- d. Other Manufacturers (e.g. brands produced by Cluett, Peabody & Co., Manhattan Shirt Co. and many other manufacturers);
- e. Store Brands (private label brands e.g. brands sold by Macy's, May Co. etc.).
- f. Major was created for men's dress shirts and included Arrow, Van Heusen, Manhattan and Botony, brands with relatively large market shares in the men's dress shirt market.

Designer clothing is usually at the forefront of style and fashion changes. Price uncertainty would be expected to be greater when selling designer labels than labels that emphasize more conventional designs and styles. On the other hand a successful designer may not only be able to identify fashion trends but to exclude those colors or styles that would otherwise be commercial failures. The presence of this kind of discrimination means that the dispersion of reservation prices could in fact be lower for successful designers. Just which of these two opposing forces dominate cannot be predicted with certainty. If the average percentage markdown is larger (smaller) for designer brands, it can be inferred the dispersion in the distribution of reservation prices is larger (smaller).

3. Imports: As mentioned above, an imported garment is more likely to be sold on sale because the order times for imported merchandise are longer.

4. Type of Outlet: Markdown policies differ by type of store. MRCA identifies the type of outlet in which the purchase is made. The classification system adopted for use in this paper is:

- a. Big Three (Penney's, Sears and Wards),
- b. Department Stores (includes all department stores except those in the Big Three);
- c. Discount Stores; (many)
- d. Speciality Stores (e.g. Stern's, I. Magnin, Petrie and many others);
- f. Catalog Stores; and
- g. Other Stores (includes apparel stores, etc.).

III. REGULARITIES IN MARKDOWN PRICING

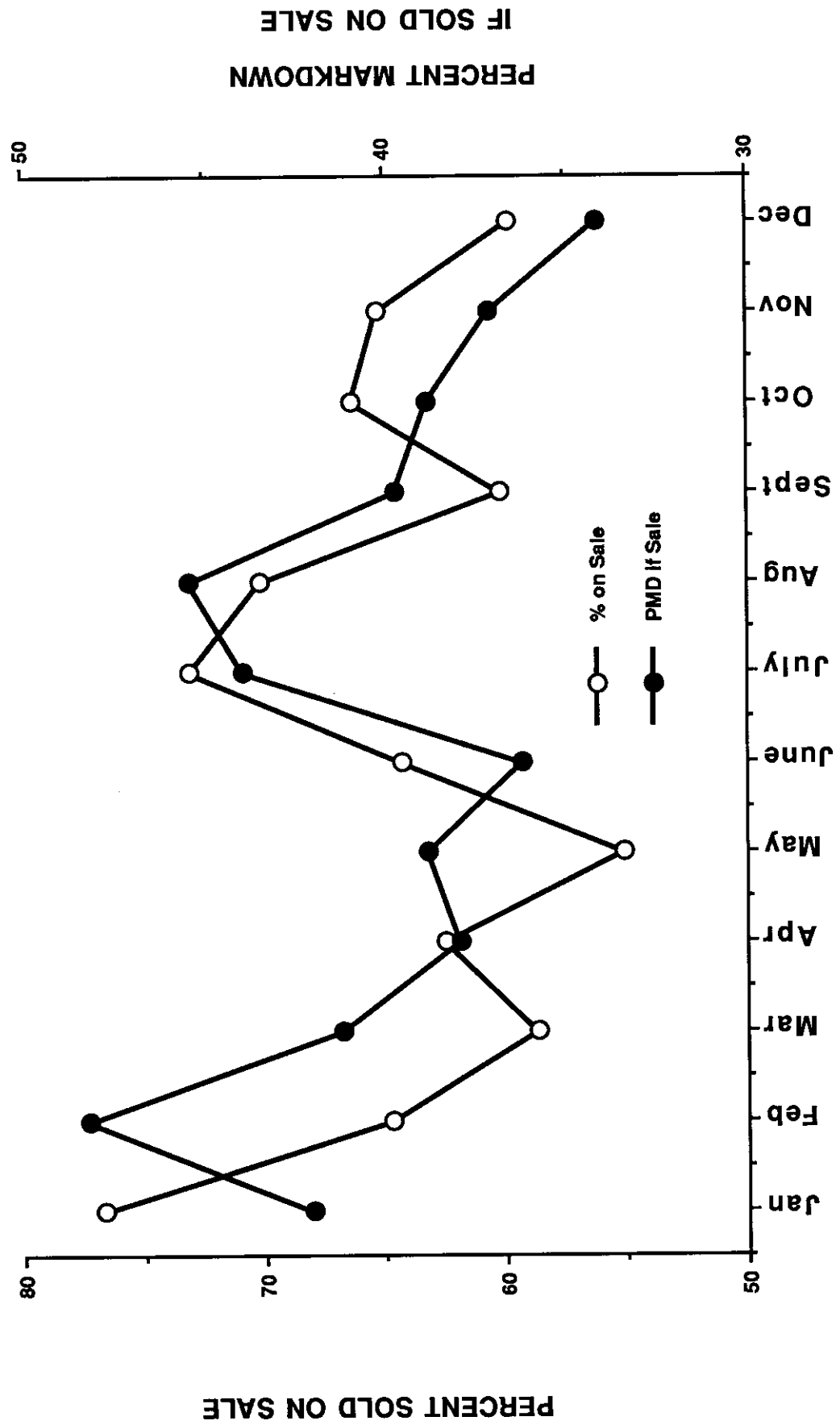
In this section several regularities in the pricing of men's dress shirts are illustrated in graphs and tables.

A. SEASONAL MARKDOWNS

The uncertainty theory predicts the probability a shirt is sold on sale and the percentage markdown will have a distinct seasonal pattern. The mean percentage markdown for all shirts sold in a month is the product of the percentage of items sold at markdown (Percent) and the mean percentage markdown for shirts sold on sale (PMD/Sale) (see equation 7). Figure 2 shows a seasonal pattern in Percent and PMD/Sale for men's dress shirts.⁶ Both measures are relatively low at the beginning of each season and peak at the end of each season, July and August for the spring/summer season and January and February for the fall/winter season. The seasonal in the percentage markdown for sale shirts peaks a month later than the peak in the percentage of shirts sold on sale. Shirts sold in August and February are truly remnants, in the left tail of the price distribution, and can only be sold after still larger markdowns are taken.

The price uncertainty theory predicts the characteristics of dress shirts sold at the end of a season will differ from those sold at the beginning of a season. The theory offers few clues as to just what characteristics should be different. However, a plausible argument can be made that price uncertainty is greater for fancy shirts. If so, fancy shirts should account for a larger percentage of unit volume in the clearance months. Figure 3 shows the market share of shirts by color and month. The market share of white shirts is relatively high at the beginning of the spring/summer season and the fall/winter season. On the other hand the market share of fancy shirts and the percentage markdown on fancy shirts (see Table 4) are relatively high during the clearance months, July and August during the summer and January and February during the winter. It is reasonable to infer that fancy shirts have greater price uncertainty associated with them since they are over represented during the clearance periods.⁷

**FIGURE 2: PERCENT SOLD ON SALE AND PERCENT
MARKDOWN ON SALE DRESS SHIRTS**



SOURCE: MRCA

FIGURE 3: MARKET SHARE OF MEN'S DRESS SHIRTS BY COLOR AND BY MONTH

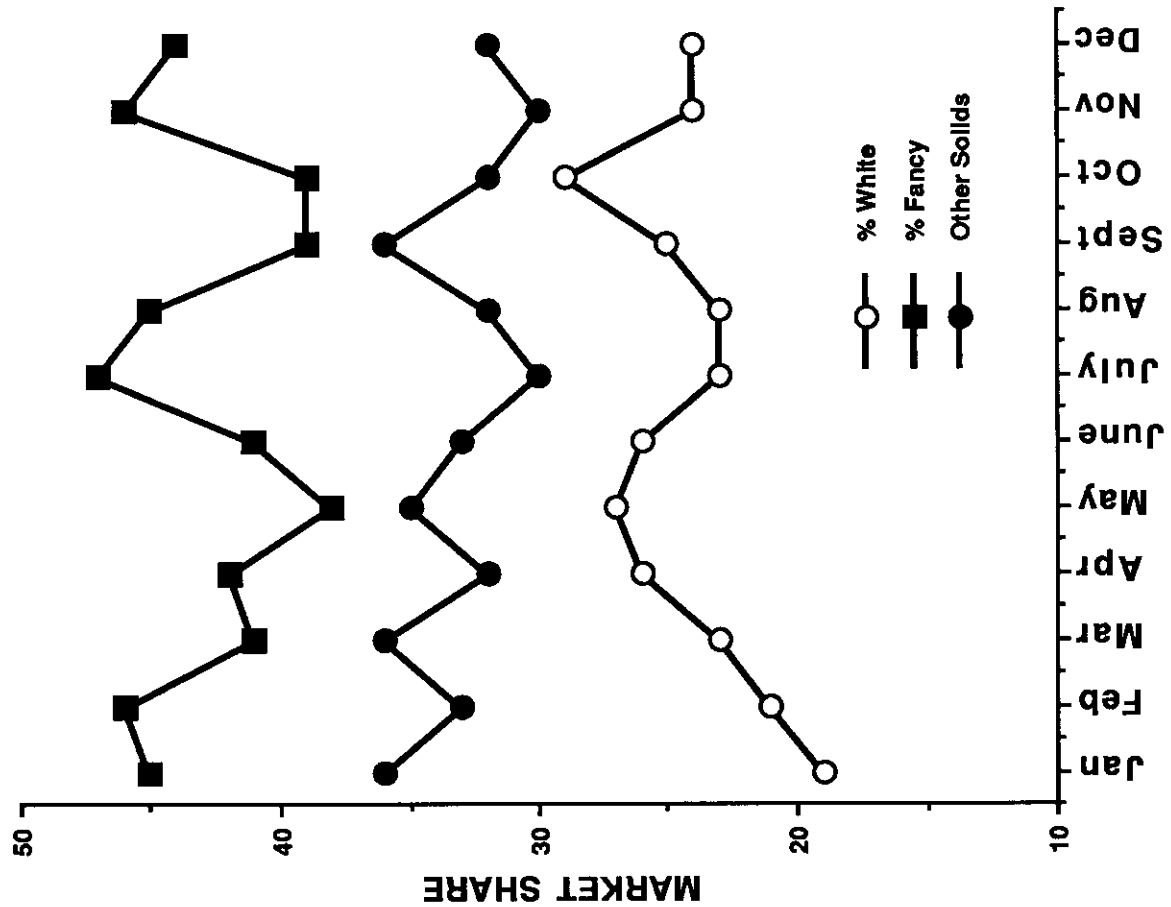


FIGURE 4: AVERAGE PERCENT MARKDOWN ON MEN'S DRESS SHIRTS BY COLOR AND MONTH

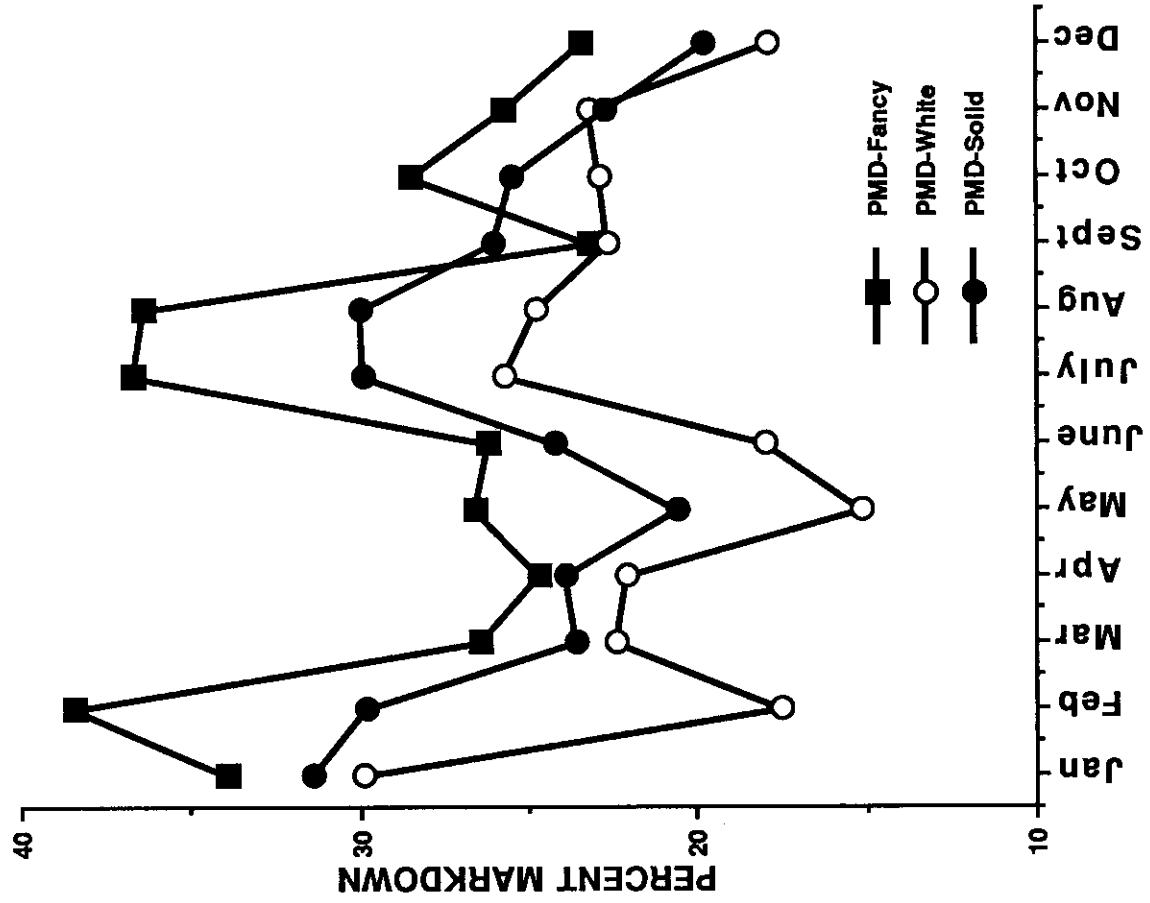


Figure 4 shows the monthly pattern in average PMD by color of shirt. The average percentage markdown for fancy shirts is usually larger than that of other solid shirts which in turn is usually larger than that of white shirts. At the beginning of each season the average PMD does not differ by much among the different color classes but by the end of each season the differences among the three color classes are larger. The near equality in the January percentage markdown among the three color categories is a surprise.

While these seasonal patterns are broadly consistent with the implications of the clearance theory of sales, they could also be consistent with a peak load pricing model. Under the peak load theory the price of shirts (and other items sold in stores) should be reduced during January and February and July and August, months with low traffic. The peak load pricing theory can be tested against the price uncertainty theory by determining whether prices are reduced on all shirts or just on shirts that are at the end of their season. Peak load pricing would require the prices of all shirts, whether they are short or long sleeve shirts, should be reduced during months of low store traffic. In contrast the price uncertainty theory predicts that only those shirts that are at the end of their particular season should be reduced. One test of these competing theories is to determine if long sleeve shirts are reduced less in July and August and short sleeve shirts are reduced less in January and February. If so, the evidence would be more consistent with the price uncertainty than the peak load hypothesis.

Figures 5 and 6 show the seasonal patterns of Percent and PMD/Sale are different for long and short sleeve shirts. In July and August the percentage of shirts sold on sale is relative high for short sleeve shirts and is relatively low for a long sleeve shirts. The opposite pattern exists in January and February. Figure 6 shows a pronounced seasonal pattern for the mean percentage markdown of shirts sold on sale. The results for July are puzzling because PMD/Sale is higher for long than short sleeve shirts, a result that is inconsistent with the price uncertainty hypothesis. This seasonal pattern suggests that the summer clearance sale for short sleeve shirts starts a bit later. Beginning in August and continuing to the end of the year the PMD/Sale of short sleeve shirts is, as expected, higher for short than for long sleeve shirts. In January PMD/Sale is just slightly higher for long sleeve shirts while it is much larger in February. While several anomalies are present in the data, the seasonal patterns appear to be more consistent with the price uncertainty than the peak load hypothesis. Stores appear to offer lower percentage markdowns at the beginning of seasons. At the end of seasons they reduce prices selectively on those garments which are at the end of their season. Markdown policy of stores appears to be determined more by the stage of the season and less by store traffic.

One result that stands out is the large percentage of shirts sold on sale even at the beginning of each season. For men's dress shirts 55.9 and 66.8 percent of long sleeve shirts are apparently sold on sale in September and October respectively, the beginning of the fall-winter season. The high level of apparent discounting at the beginning of each

FIGURE 5: PERCENT OF DRESS SHIRTS SOLD ON SALE: SHORT AND LONG SLEEVE SHIRTS

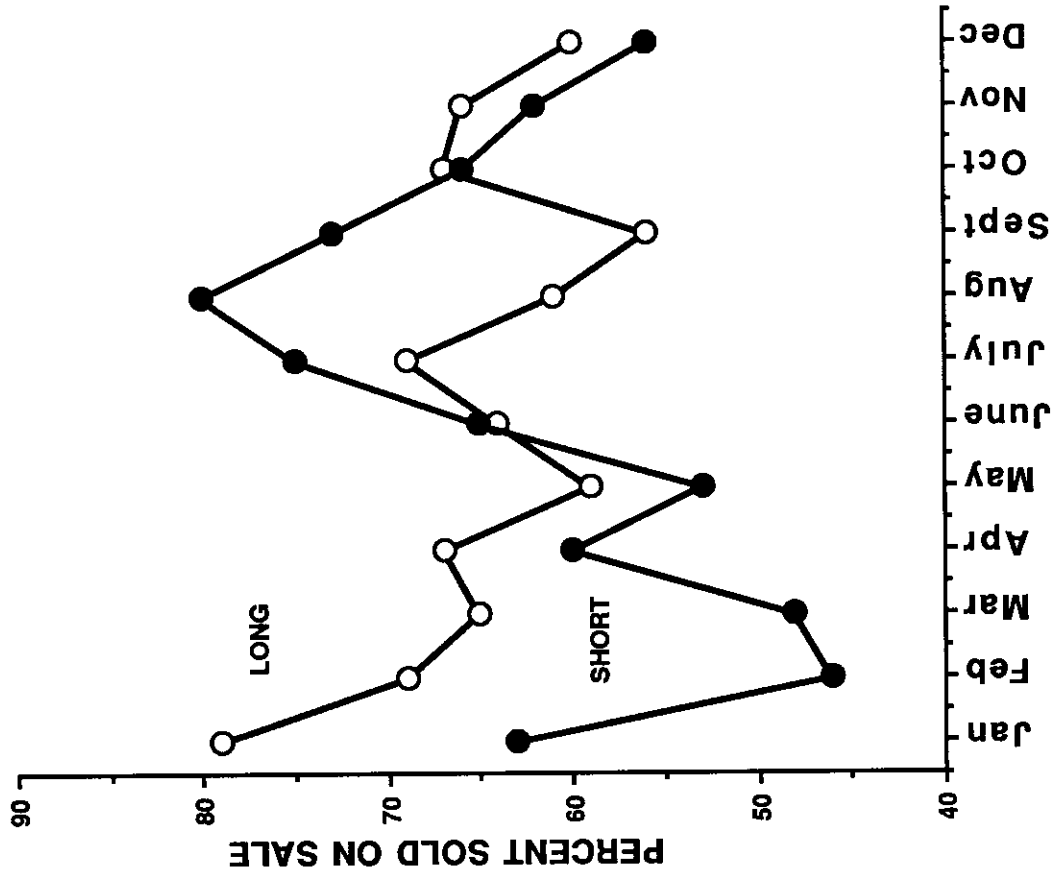
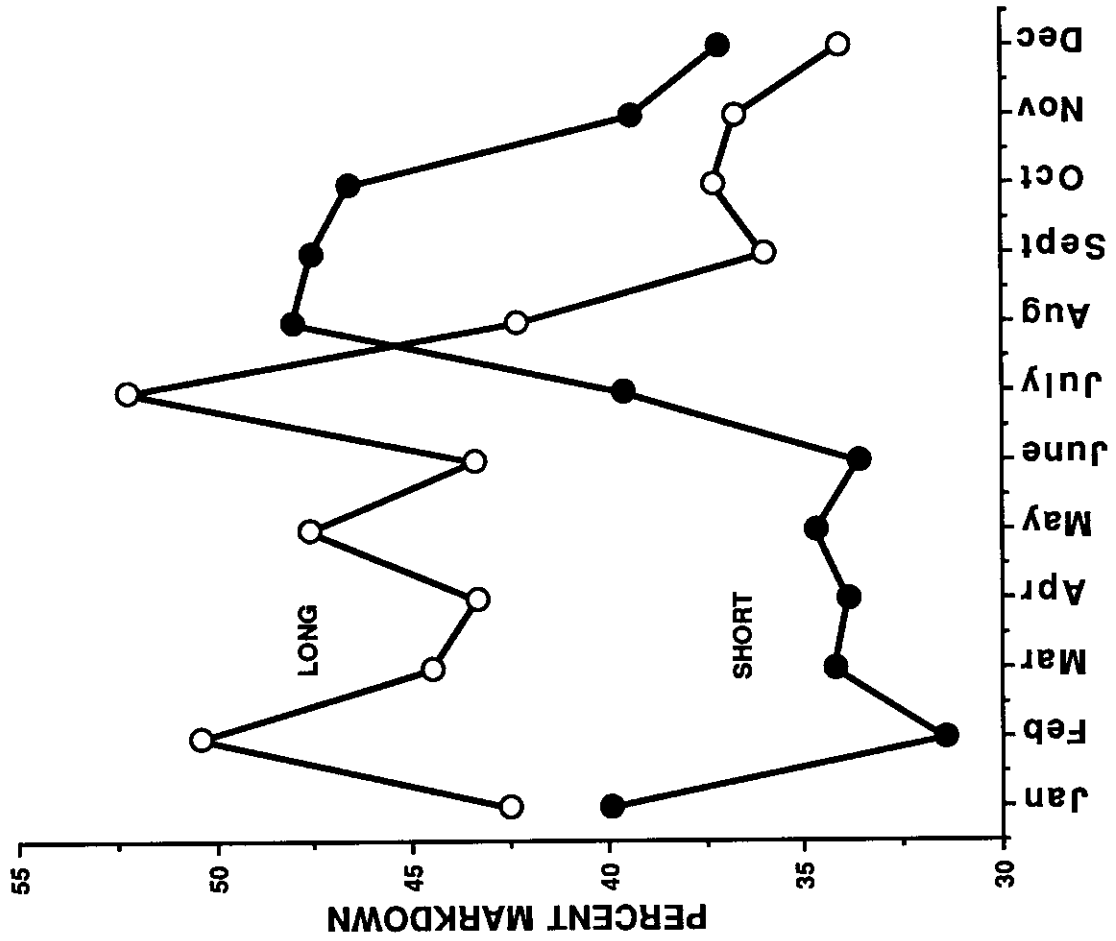


FIGURE 6: PERCENT MARKDOWN ON LONG AND SHORT SLEEVE SHIRTS SOLD ON SALE



season cannot be explained by the price uncertainty hypothesis. Some of these sales could be temporary promotional sales where a markdown is offered for a few days at a time, and then withdrawn [Varian 1980]. A substantial segment of sales activity would not be easily explained by the price uncertainty model. Two caveats deserves mention. First, product line introductions have increased in frequency over time. One popular apparel manufacture now has six introductions during each year.⁸ The "season" for each introduction has necessarily shortened and this will produce a minimum stream of markdowns throughout the calendar year. Second, some of the reported sales may be bogus. Stores may charge temporarily high initial prices to report large percentage markdowns subsequently. This deceptive practice has been prosecuted in a few cities but is difficult to police. Unfortunately the size of these artificial sales cannot be determined.

B. IMPORTS

Figure 7 shows imported merchandise has a higher average percent markdown for men's dress and sports shirts and women's blouses and shirts. This result is consistent with the times series findings reported by Pashigian[1988].

C. REGULAR PRICE

A striking and robust finding is that the average percentage markdown is higher for items with higher regular prices. Table 1 shows the average percentage markdown is higher the larger is the regular price in every product category.⁹ The percentage markdown in the quartile with the lowest regular prices averages 17.2 percent across the different products while the percentage markdown in the quartile with the highest regular prices averages 32.6 percent, or ninety percent higher.

Two explanations for this pricing regularity come to mind. One explanation is that shirts with higher regular prices include relatively more shirts that have been over-priced by stores. These pricing errors explain why shirts with higher regular prices will be sold on sale more frequently and at a larger average percentage markdown. Given a garment with known measurable characteristics, some stores will error and set the initial price too high while others will be set it too low. The upper quartile of regular prices will contain a larger proportion of items that have been priced too high just as the lower quartile will contain a larger proportion of items that have been priced too low. Of course some other factor must be operating in the lowest quartile because the average percentage markdown is 17 percent but should be close to zero if the initial price is abnormally low. A second explanation is that the regular price of an item is a proxy for price uncertainty. Within each category garments with higher regular prices have more quality features and higher quality garments often have more fashion or styling features. For example, dress shirts with higher regular prices are more often designer clothing, fancy, sold in department or speciality stores. If the regular price of a dress shirt is a more comprehensive summary measure of the fashion features of a

FIGURE 7: AVERAGE PERCENT MARKDOWN FOR IMPORTS (I) AND DOMESTIC (D) MERCHANDISE

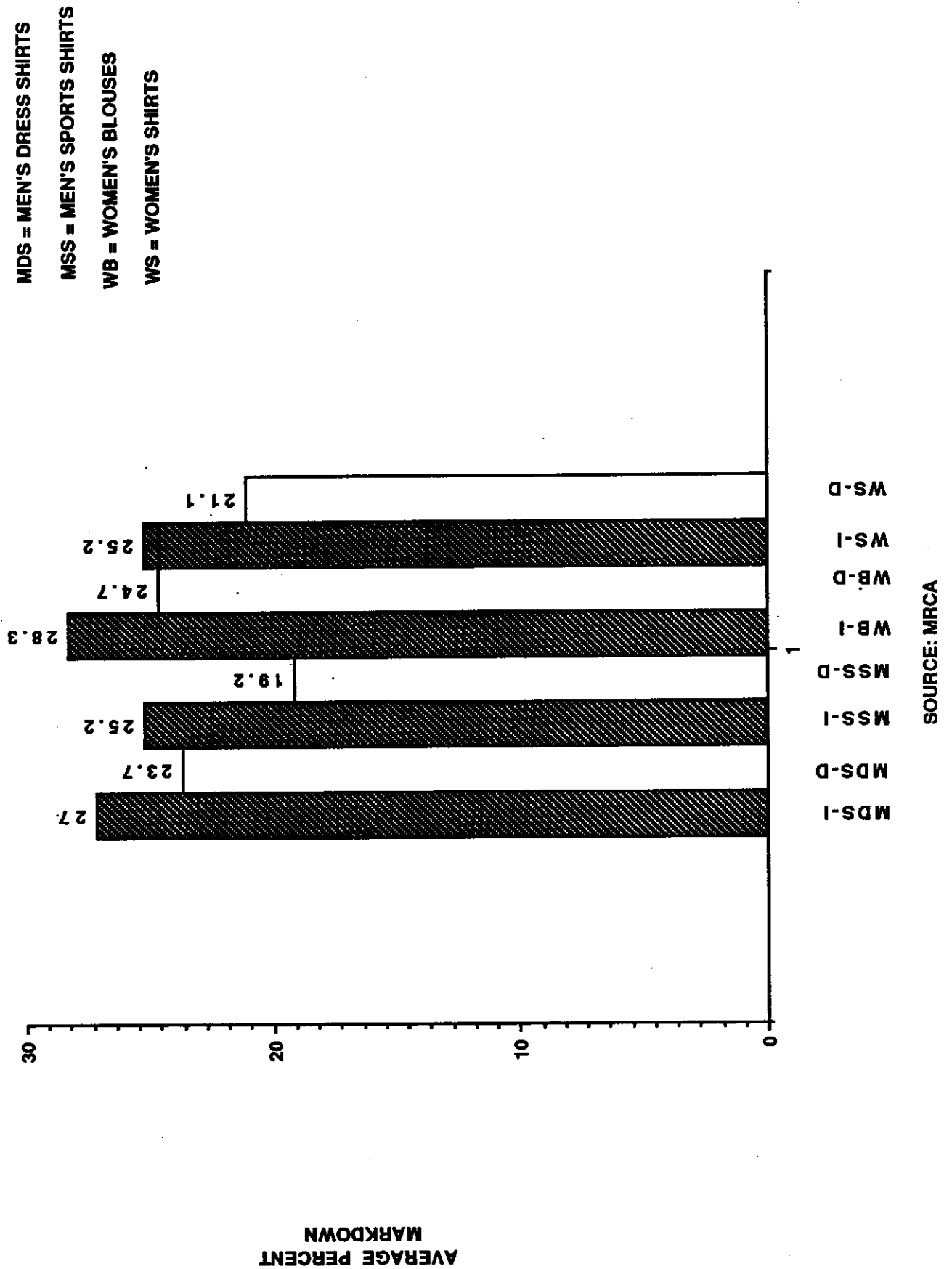


Table 1: Average Percent Markdown on Purchases Ranked by Quartile of Regular Price

<u>Men's Clothing</u>					
Regular Price	Dress Shirts		Sport Shirts		All Sweaters
	Long	Short	Long	Short	
1. Highest Quartile	34.6	29.7	30.5	30.5	32.1
2. Third Quartile	29.6	29.4	27.6	24.8	31.0
3. Second Quartile	24.6	20.7	23.8	16.9	25.8
4. Lowest Quartile	17.5	17.5	19.1	13.7	19.2

<u>Women's Clothing</u>				
	All	Shirts		All
	Blouses	Long	Short	Sweaters
1. Highest Quartile	35.4	31.7	32.8	36.5
2. Third Quartile	30.2	29.4	25.3	31.1
3. Second Quartile	23.7	19.8	18.9	25.2
4. Lowest Quartile	15.8	16.8	16.3	18.8

Source: Market Research Corporation of America

dress shirt than are the available measures of fashion (e.g. color), then the regular price acts as a proxy for the degree of price uncertainty and consequently would be expected to be directly related to the probability of sale and the percentage markdown. A test of these two hypotheses is presented below.

D. TYPE OF OUTLET

Price policies also differ by type of outlet. Some types of outlets sell more basic merchandise and cater to those customers who demand more functional clothing. Department stores and speciality stores offer better known brand names, fashion and more expensive clothing. Still other outlets offer brand name merchandise with less service and at special prices. Table 2 shows the average PMD for all purchases in each product category by type of outlet. For each product off-price stores offer the highest average markdown with department stores next in rank. Catalog outlets have the lowest average PMD while discount stores are below the industry average in all product categories. While there are systematic differences in pricing practices by type of store, this study takes these as given and does not try to explain these differences.

E. SEX OF BUYER:

Knowing the sex of the buyer is valuable information in predicting whether an item is purchased on sale. In households with an adult male present females purchase 60% of men's dress shirts and they purchase a larger percentage of men's dress shirts on sale than do male buyers. Table 3 classifies households by hours worked per week by the female (only for households with an adult male and female present). Females who are at home or are working more than 40 hours purchase a smaller proportion of all dress shirts purchased by the family units in those two categories. Overall, females purchase 68% of dress shirts on sale while males purchase only 61% on sale. One rather amusing finding is the more parsimonious selections by females when purchasing a dress shirt. Females select shirts with lower regular prices and presumably of lower quality than do males.

F. DAY OF WEEK:

The percentage of shirts purchased on sale rises throughout the work week and peaks on Friday, then dips on Saturday before rising again on Sunday. Figure 8 shows the average percent markdown on all shirts sold by day of week. Figure 9 shows sex differences in the distribution of purchases by day of week. A larger percentage of weekly Purchases by males is on Saturday than of weekly purchases by women. 10 The weekend customer is a high cost of time shopper and should have less elastic demand curve. The average percentage markdown is however not lower on the weekend even though relatively more weekend shoppers are male shoppers and full time employed women. If stores selected prices to exploit differences in price elasticities of demand by day of week, they would but do not charge higher prices on the weekend.

Table 2: Average Percentage Markdown by Type of Outlet^a

	<u>Men's</u>			<u>Women's</u>			Average For Outlet Type
	Dress Shirts	Sports Shirts	Sweaters	Blouses	Shirts	Sweaters	
Industry Average	25.5	22.3	27.0	26.1	23.0	27.8	25.3
Specialty	26.5 1.04	18.5 .83	26.5 .98	27.3 1.05	23.5 1.02	29.0 1.04	25.2 .99
Catalog	13.0 .51	17.8 .80	14.9 .55	11.5 .44	11.7 .51	13.8 .50	13.8 .55
Big Three	25.1 .98	24.0 1.08	27.4 1.01	26.2 1.00	24.2 1.05	26.5 .95	25.6 1.01
Department	27.2 1.07	25.3 1.13	28.4 1.05	30.2 1.16	27.5 1.20	30.9 1.11	28.3 1.12
Discount	23.7 .93	20.7 .93	24.8 .92	21.7 .83	21.0 .91	23.8 .86	22.6 .90
Off-Price	36.0 1.41	33.4 1.50	30.7 1.14	32.4 1.24	30.1 1.31	28.9 1.04	31.9 1.27
Other Outlet Types	25.0 .98	19.6 .88	29.6 1.10	28.8 1.10	22.6 .98	30.8 1.11	26.1 1.03

a Numbers below average percentage markdown represent outlet average relative to industry average for each product.

Source: Market Research Corporation of America

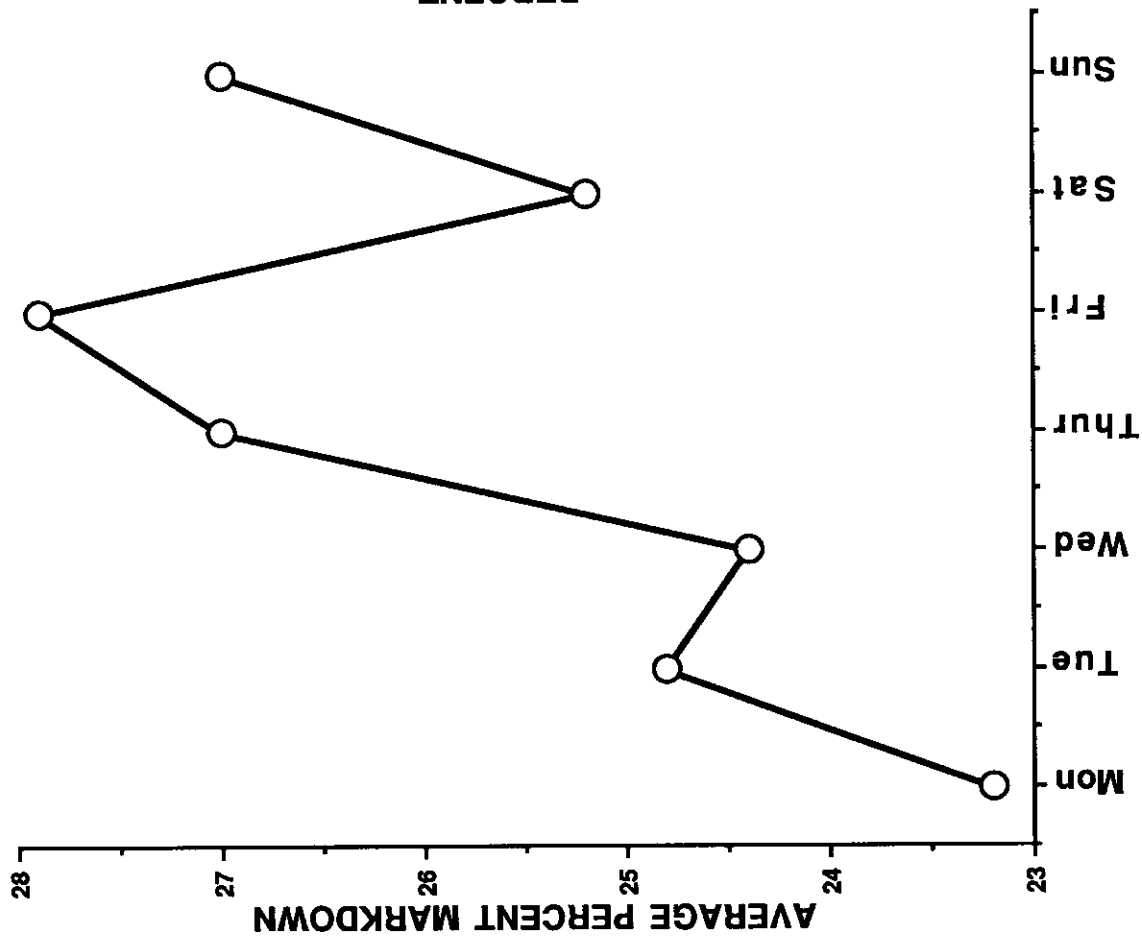
Table 3: Differences in Shopping Behavior By Sex of Buyer
(Husband and Wife Households Only)

Hours Worked by Home- maker	Total Units & Percent of Total Shirts Bought	Percent Bought by Female	Percent of Units Purchased On Sale		Mean Percent Markdown On Sale Purchases		Mean Price (\$)		Mean Regular Price (\$)	
			(F)	(M)	(F)	(M)	(F)	(M)	(F)	(M)
All	6,951 100%	59.9	68	62	40.0	39.6	11.84	12.86	16.94	17.85
0	3,097 45%	59.9	67	62	39.4	39.2	11.77	12.38	16.49	17.02
1-14	382 5%	64.1	72	72	40.7	44.1	11.29	12.10	17.13	18.22
15-29	804 12%	66.0	67	68	41.1	35.9	11.45	13.33	16.36	18.19
30-39	779 11%	60.3	72	63	39.6	39.2	11.82	13.67	17.59	20.71
40-59	1,820 26%	56.3	67	58	40.4	41.1	12.35	13.17	17.79	17.91
60+	69 1%	56.5	59	27	33.6	38.8	11.33	14.83	15.20	16.74

F denotes purchase by female
M denotes purchase by male

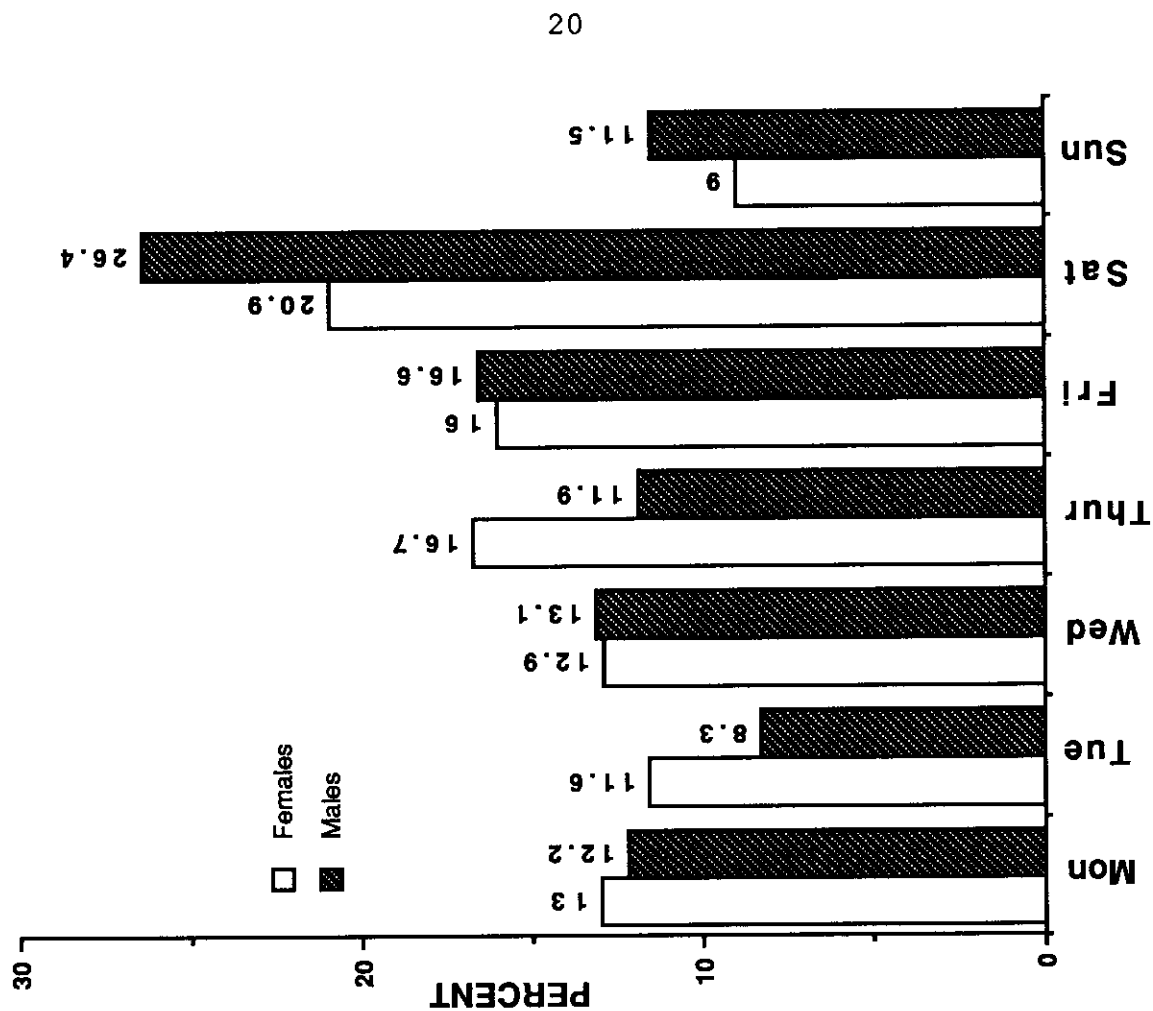
Source: Market Research Corporation of America

**FIGURE 8: AVERAGE PERCENTAGE MARKDOWN
ON DRESS SHIRTS BY DAY OF WEEK**



SOURCE: MRCA

**FIGURE 9: DISTRIBUTION OF PURCHASES OF
DRESS SHIRTS BY SEX OF BUYER
AND DAY OF WEEK**



SOURCE: MRCA

IV. REGRESSION RESULTS

This section presents regression results of the determinants of 1) the regular price of a dress shirt; 2) the probability of purchasing a dress shirt on sale and 3) the percentage markdown. Throughout the analysis the reference shirt is a short sleeve white dress shirt produced in the U.S., purchased on a Tuesday in July by a male buyer with a wife not in the labor force, sold in the "other" type of store and made by a firm in the "other" manufactures category.

A. REGULAR PRICE

Coefficient estimates of the determinants of the regular price are presented in Table 4. The regular (initial) price of a shirt is expressed as a linear function of shirt characteristics, the outlet type at which the shirt is sold, brand type, characteristics of the household, the sex of buyer and employment status of the female, the production source of the shirt and whether the shirt was or was not subsequently sold on sale. The latter variable is a dummy variable and is only included as an independent regressor in column 3. The regular price is measured in cents and did not vary significantly by month or day of purchase (controlling for other variables) so these variables were not included in the regression.¹¹

Columns 1 and 3 of Table 4 shows the regular price of a shirt is higher at specialty stores, while it is significantly lower at discount, off-price, Big 3 and catalog outlets (compared to the regular price at an apparel store, the reference group). It is significantly higher for designer and "other fashion" shirts. A fancy shirt carries a 97 cents premium compared to a white shirt and, not surprisingly, a long sleeve shirt is priced higher by \$3.15 than a short sleeve shirt. The regular price of an imported shirt is lower by \$1.81 than for a domestically produced shirt.¹² These are on the whole plausible results. Color, outlet, brand name, sleeve length and production source are significant determinants of the regular price.

Because the regular price of a shirt is a proxy for the quality and fashion features of a shirt, the demand for quality and fashion should be higher by buyers with higher household income or with more years of schooling. The results indicate a positive income and education elasticity for shirt quality and for fashion characteristics. The effect of sex of buyer on the quality of shirt purchased depends on the employment status of the female. The results in column 3 indicates females not in the labor force buy shirts with slightly lower regular prices but females in the labor force appear to purchase shirts with same regular price as males do. A buyer from a larger household selects shirts with lower regular prices. The regular price of shirts that are subsequently sold on sale is higher by \$2.31 which is 15 percent higher than the average regular price of shirts not sold on sale. These regression result confirm the earlier impression - shirts sold on sale carry higher regular price tags.

Table 4: Determinants of the Regular Price of Dress Shirts (OLS)

Variable	Est. (1)	t (2)	Est (3)	t (4)
1. Intercept	157	.8	151	.7
2. Outlet Type:				
a. Specialty	118	2.5	105	2.2
b. Catalog	-168	-3.3	-127	-2.5
c. Department	-18	-.6	-45	-1.5
d. Discount	-602	-17.6	-595	-17.6
e. Off-Price	-342	-7.3	-355	-7.6
f. Big Three	-221	-2.0	-219	-5.5
3. Brand Type				
a. Designer	468	13.8	464	13.8
b. Other Fashion	349	3.4	356	3.5
c. Major	-14	-.4	-28	-.8
d. Chain	-67	-2.0	-89	-2.6
e. Store Brand	-33	-1.0	-22	-.7
4. Color Type				
a. Fancy	116	4.5	97	3.8
b. Solid Color	-15	.6	-28	-1.1
c. Mixed Solid	576	4.4	555	4.3
d. Other	70	.4	126	.8
5. Imports	-167	-8.4	-181	-9.2
6. Log of Household Income	95	5.4	90	5.1
7. Log of Buyer Education	2.78	4.9	2.61	4.7
8. Female Buyer Not Employed	-40	-1.2	-57	-1.8
9. Female Buyer and Employed	66	1.3	51	1.0
10. Hours Employed of Female Buyer	-.90	-.7	-.44	-.3
11. Male Buyer and Wife Employed	47	.5	21	.3
12. Hours Employed of Female				
When Male Buyer	.004	.0	.79	.5
13. Child Less than Six Years in Household	17	.6	22	.8
14. Household Size	-.47	-5.3	-.48	-5.4
13. Age of Wearer	-.02	-.03	-.06	-.1
14. Long Sleeve Shirt	319	15.6	315	15.5

Table 4 (continued)

15. Shirt Is Gift Purchase	.05	.0	8	.4
16. Shirt Purchased on Sale			231	11.5
R ²	.195		.211	
MSE	786		779	
Sample Size	6724		6724	
Mean Regular Price (Cents)	1756		1756	

Source: Market Corporation of America

B. PROBABILITY OF PURCHASING ON MARKDOWN

The uncertainty theory predicts garments with features that are related to greater price uncertainty will have a higher probability of selling at markdown. Column 1 of Table 5 presents coefficient estimates for the probability a shirt is sold on sale. Because short sleeve shirts have a different monthly seasonal than long sleeve shirts, the dummy variables for month were interacted with the dummy variable for a long sleeve shirt. The intercept should be interpreted as the probability of purchasing a short sleeve shirt on sale in July, the reference month. The coefficient labeled month/short shows whether the probability of sale of a short sleeve shirt is either higher or lower than the probability in July. The monthly coefficient for long sleeve shirt shows whether the probability of sale of a long sleeve shirt is higher or lower than the probability of sale for a short sleeve shirt in that month.

There is a pronounced monthly seasonal in the probability of purchasing a dress shirt on sale. The probability of selling a short sleeve shirt on sale is significantly lower from January through June and from September through December compared to July (or August). Compared to a short sleeve shirt, the probability of purchasing a long sleeve shirt on sale is significantly higher in February and March and significantly lower from June through September. In each of the other months the probability of purchasing a long sleeve shirt on sale is not significantly different from a short sleeve shirt. A long sleeve shirt appears to have a significantly higher probability of selling on sale during the first three months of year and a significantly lower probability of selling at markdown from June through September. These results indicate the probability of purchasing a dress shirt on sale is relatively low at the beginning of each season and is relatively high at the end of each season.

Day of the week is another important determinant of the probability of purchasing a shirt on sale. Compared to Tuesday, the probability of buying a shirt on sale is significantly higher on Friday and Sunday but, surprisingly, not on Saturday. Just why the probability is lower on Saturday remains a puzzle.¹³ Department, discount and off-price stores sell a larger fraction of dress shirts on sale. Catalog outlets sell a significantly smaller proportion on sale, perhaps because prices are more rigid when printed in catalogs. Shirts sold at chain outlets (K-Mart, Penny's, Sears and Wards) are more likely to be bought on sale while store (private label) brands are less likely to be bought on sale than a brand produced by the "other" manufacturer group, the reference group. Although designer brands operate at the frontier of fashion, they do not have a higher probability of being purchased at markdown once the effects of color and other characteristics are controlled for. Imported, fancy and other solid shirts are more likely to be purchased on sale than are domestically produced and white shirts respectively.

Controlling for the regular price, higher income and better educated customers have no greater odds of purchasing on sale than do lower income and less educated customers.¹⁴ A female buyer not in the labor force has a higher probability of purchasing on sale than if her

Table 5: Determinants of Probability of Sale and Percentage Markdown

Variable	Probability of Sale (Probit)		Percentage Markdown (Tobit)	
	Est. (1)	t (2)	Est. (3)	t (4)
1. Intercept (July/Short Sleeve)	-1.11	-3.1	-.21	-2.0
2. Month-Sleeve Length				
a. January/Short	-.31	-1.6	-.07	-1.2
January/Long	.25	1.3	.07	1.2
b. February/Short	-.85	-4.3	-.21	-3.6
February/Long	.65	3.2	.21	3.5
c. March/Short	-.69	-5.7	-.19	-5.4
March/Long	.23	2.0	.13	3.6
d. April/Short	-.46	-4.1	-.13	-3.8
April/Long	-.01	-.1	.06	1.5
e. May/Short	-.64	-6.0	-.14	-4.4
May/Long	.09	.7	.09	2.2
f. June/Short	-.36	-3.9	-.10	-3.7
June/Long	-.31	-3.0	-.03	-.9
g. July/Long	-.29	-2.3	.009	.3
h. August/Short	.09	.8	.10	3.0
August/Long	-.53	-4.1	-.18	-4.9
i. September/Short	-.24	-1.8	-.0001	-.002
September/Long	-.42	-3.1	-.17	-4.3
j. October/Short	-.43	-2.6	-.02	-.4
October/Long	.06	.4	-.07	-1.4
k. November/Short	-.45	-2.5	-.01	-.2
November/Long	-.02	-.1	-.09	-1.7
l. December/Short	-.52	-4.0	-.12	-3.1
December/Long	.03	.3	-.007	-.2
3. Day of Week:				
a. Monday	.01	.2	-.0001	-.003
b. Wednesday	.02	.3	-.001	-.05
c. Thursday	.07	1.1	.02	.7
d. Friday	.17	2.6	.04	2.4
e. Saturday	.05	.8	.02	.9
f. Sunday	.18	2.4	.03	1.5
4. Outlet Type:				
a. Specialty	.08	.9	.03	1.2
b. Catalog	-.44	-5.3	-.17	-6.2
c. Department	.30	4.9	.04	2.9
d. Discount	.11	1.7	.03	1.8
e. Off-Price	.30	3.5	.17	7.5
f. Big Three	.05	-.7	.01	.5
5. Brand Type:				
a. Designer	-.12	-2.1	-.004	-.3
b. Other Fashion	-.19	-1.1	-.02	-.3
c. Major Brand	.08	1.5	.06	3.1
d. Chain	.32	6.5	.05	2.9
e. Store Brand	-.14	-2.5	-.02	-1.2

		Est.	t	Est.	t
Table 5 (continued)					
6. Color Type:	a. Fancy	.17	4.1	.07	5.8
	b. Other Solid	.15	3.5	.06	4.7
	c. Mixed Solid	.08	.4	.08	1.2
	d. Other	-.66	-2.3	-.08	-.8
7. Import		.24	7.0	.07	6.6
8. Log of Household Income		.01	.3	-.001	-.1
9. Log of Buyer Education		.13	1.4	.03	1.1
10. Female Buyer Not Employed		.20	3.7	.07	4.2
11. Female Buyer and Employed		.18	2.1	.04	1.8
12. Hours Worked by Female Buyer		-.006	-2.5	-.002	-2.4
13. Male Buyer and Wife Employed		.24	2.1	.11	3.2
14. Hours Worked by Wife of Male Buyer		-.008	-2.8	-.003	-3.9
15. Child Less than Six		-.08	-1.6	-.02	-1.7
16. Household Size		.03	2.3	.008	1.9
17. Age of Wearer		.001	.6	.0001	.3
18. Woven		.13	2.3	.05	2.8
19. Gift Purchase		-.05	-1.2	-.02	-1.9
18. Regular Price of Shirt		3.5-04	13.1	.0001	14.1
19. N			6724		5048
20. Log of Likelihood		n.c.			-2447

Source: Market Research Corporation of America

n.c. denotes not computed

husband purchases the shirt (row 10 in column 1). An employed female has a still higher probability of purchasing on sale but this probability declines as hours employed by the wife increases (rows 11 and 12 in column 1).¹⁵ The point estimates imply that a female working forty hours per week has a lower probability of purchasing on sale than a female at home. Interestingly, a male buyer whose wife is in the labor force also has a higher probability of buying on sale than if the wife is at home and the probability that a male buys on sale also decreases as the hours employed by the wife increases (rows 12 and 13 in column 1). The point estimates imply that a male with a full time working wife has a lower probability of purchasing on sale than a male with a wife not in the labor force.

Because designer brands have more fashion features, it is a mild surprise to the author not to find a higher percentage of designer shirts sold on sale. One inference that can be drawn from this result is that designer brands have less, not more, price uncertainty associated with them. This would occur if successful designers can not only anticipate fashion trends but can anticipate which colors and styles will be commercial failures and exclude them from their lines. It appears that this foresight is sufficiently important to reduce the dispersion of reservation prices for the designer brands.

C. THE PERCENTAGE MARKDOWN

Column 3 of Table 5 shows regression results for the Tobit model of the determinants of the percentage markdown. The monthly pattern in the percentage markdown is similar to the monthly variation in the probability of purchasing on sale. The average percentage markdown on short sleeve shirts is relatively high during January although lower than the July level. The percentage markdown for short sleeve shirts is significantly lower than the July level from February through June. It increases in July and is significantly larger in August than in July. It does not differ significantly from September to November (compared to July) but is significantly lower during December. The average markdown on long sleeve shirts declines and remains low from February through June. Then it increases in July when it is not significantly different from the July markdown for short sleeve shirts. It is significantly lower than the markdown on short sleeve shirts during August and September. The percentage markdown on long sleeve shirts declines from August to December. In summary the average percentage markdown for long sleeve shirts is at a relatively high level in January and in February and then declines modestly from March to June. It increases in July before decreasing in the subsequent months. With a few exceptions the results for the other variables are similar to those in column 1. Generally, the determinants of the probability of selling on markdown are also the determinants of the percentage markdown.

The average percentage markdown is higher on a shirt with a higher regular price. A shirt with a higher regular price tag not only has a higher probability of being sold on sale but at a significantly higher percentage markdown. Two explanations for the latter regularity have been proposed. First, price uncertainty may increase with the regular price. If shirts with higher regular prices have more unmeasured fashion features, they will have a higher probability of sale and a

higher percentage markdown when sold on sale. Second, stores may error and either over or under price shirts. Shirts with abnormally high regular prices can only be sold after the store recognizes its pricing mistake and at a larger percentage markdown.

It may be possible to shed light on these two explanations by decomposing the regular price into a predicted part based on the known characteristics of the transaction, and the unexplained part, the residual. The regular price equation in Table 5 can be viewed as a hedonic price equation which takes account of the product, store and customer characteristics to predict what the regular price of a shirt should be. The predicted regular price is what the initial price should have been given the measured product, store and customer characteristics. If price uncertainty increases with the predicted regular price then the predicted regular price will be a significant determinant of the percentage markdown.

The residual of the regular price equation could reflect a pricing error by the store, either over or under pricing a shirt with given characteristics, and/or unmeasured quality and fashion features. If the residual primarily measures pricing mistakes by stores, a negative residual means a shirt was initially underpriced by the store. A shirt with a negative residual will have a high probability of selling at the abnormally low initial price, i.e. with no markdown. A shirt with a positive residual is initially overpriced and has a higher probability of selling on sale and at a higher percentage markdown because the initial price is too high.

If each residual is divided by the regular price to create a relative residual, a shirt with positive relative residuals should be sold at a percentage markdown which equals the size of the positive relative residual and shirts with negative relative residuals should be sold at the initial (low) price (without a markdown). Two new variables were created and introduced into the probability of sale and the PMD regressions. One of the new variables is the negative relative residual, where the value of the relative negative residual is either the residual divided by the regular price or zero if the residual was positive and the second new variable is the positive relative residual which equals the positive residual divided by the regular price or zero if the residual is negative. The strongest prediction of the effect of these two variables can be made when they are introduced into the PMD regression. The pricing error hypothesis implies the coefficient of the positive relative residual should equal one in the PMD equation and the coefficient of the negative relative residual should be zero. If a shirt is over priced by 10%, it should be markdown by 10% before it can be sold. If the shirt is under priced by 10%, it will be sold at the initial price.

If the two relative residuals just measure fashion effects which increase as the size of the relative residual increases, the coefficients of the the negative and the positive relative residuals should be the same. If price uncertainty increases as the size of the residual increases, then a shirt with a negative relative residual will be sold at markdown because the shirt has a few unmeasured fashion

features. As the numerical value of the negative relative residual increases (becomes less negative), the percentage markdown should be larger because the shirt has still more fashion features. Shirts with positive relative residuals have still more fashion features and PMD will be still larger.

If the relative residuals are caused by a combination of pricing errors and fashion effects, then the percentage markdown will increase as the size of the negative relative residual increases because of the fashion effects. The percentage markdown on shirts with positive relative residuals will increase at a faster rate with increases in the positive relative residual because of unmeasured fashion effects and over pricing of the shirt. The coefficient of the positive relative residual will be greater than the coefficient of the negative relative residual. If the residual is caused by pricing mistakes alone, the coefficient of the positive relative residual will equal one and the coefficient of the negative relative residual will equal zero in the PMD equation. If the residual just measures fashion effects, the coefficient of the positive relative residual should equal the coefficient of the negative relative residual.

Column 1 of Table 6 shows the results when the probability of sale is the dependent variable and column 3 shows the results for the percentage markdown. In these regressions month, sleeve and day of week variables are included as well as the predicted regular price and the two variables for the relative residual.¹⁶ The predicted regular price reflects the combined effects of the other independent variables. In both of the equations the predicted regular price has a positive and significant coefficient. This evidence suggests that shirts with higher predicted regular prices probably have more fashion features and therefore greater price uncertainty.

In both equations the coefficients of the negative and positive relative residuals are positive and significant. Since the coefficient of the adjusted negative residual is not zero, this implies that negative residuals are not caused solely by pricing mistakes and that price uncertainty increases with the size of the residual. The coefficient of the positive relative residual is smaller than the coefficient of the negative relative residual in the probability of sale regression, a disappointing and unexplained result. In the PMD regression the coefficient of the positive relative residual is larger than the coefficient of the negative relative residual. Shirts that are over priced are not reduced solely to correct for over-pricing for then the coefficient of the positive relative residual would equal one. Because the coefficient of the negative relative residual is positive and is less than the coefficient of the adjusted positive residual, it appears that the residuals are caused by both pricing mistakes and price uncertainty.

Table 6: Probability of Sale and Percentage Markdown on Dress Shirts

Variable	Probability of Sale (Probit)		Percentage Markdown (Tobit)	
	Est. (1)	t (2)	Est. (3)	t (4)
1. Intercept (July/Short Sleeve)	.55	4.7	.19	6.3
2. Month-Sleeve Length				
a. January/Short	-.33	-1.7	-.06	-1.3
January/Long	.30	1.5	.04	.7
b. February/Short	-.95	-4.7	-.25	-4.5
February/Long	.81	4.0	.25	4.0
c. March/Short	-.71	-6.0	-.20	-6.0
March/Long	.38	3.2	.13	2.9
d. April/Short	-.55	-5.0	-.16	-5.5
April/Long	.13	1.0	.06	1.4
e. May/Short	-.65	-6.2	-.16	-5.7
May/Long	.16	1.2	.05	1.0
f. June/Short	-.38	-4.1	-.12	-5.2
June/Long	-.23	-2.2	-.03	-.7
g. July/Long	-.27	-2.2	.04	1.3
h. August/Short	.10	.8	.08	2.9
August/Long	-.47	-3.6	-.16	-3.7
i. September/Short	-.23	-1.7	.01	.4
September/Long	-.37	-2.8	-.20	-4.2
j. October/Short	-.44	-2.8	-.05	-1.3
October/Long	.13	.8	-.07	-1.3
k. November/Short	-.51	-3.0	-.08	-1.8
November/Long	.10	.6	-.05	-1.0
l. December/Short	-.54	-4.3	-.12	-3.7
December/Long	.12	1.1	-.03	-.8
2. Day of Week				
a. Monday	-.03	-.5	-.02	-.9
b. Wednesday	-.03	-.5	-.01	-.7
c. Thursday	.04	.6	.007	.4
d. Friday	.14	2.2	.14	2.4
e. Saturday	.003	.1	.002	.1
f. Sunday	.11	1.5	.02	1.1
3. Predicted Regular Price	1.6-04	3.3	.42-04	3.4
4. Positive Relative Residual	.35	2.6	.30	8.4
5. Negative Relative Residual	.82	15.6	.22	15.3
N	6725		6725	
Log of Likelihood	n.c.		-3340	

n.c. not computed

CONCLUSIONS

This study has demonstrated how the price uncertainty hypothesis can explain many pricing and sale practices of retail stores. The price uncertainty hypothesis focuses on the dispersion of reservation prices. This dispersion differs from one type of garment to another depending on the characteristics of the garment. Greater dispersion in the distribution of reservation prices was postulated for fancy than white shirts, for imported than domestically produced shirts and for shirts that are sold at the end rather than the beginning of each season.

The sales practices of stores are consistent with each of these implications of the uncertainty hypothesis. Fancy shirts have a higher probability of selling at markdown compared to white shirts. The monthly seasonal in markdowns indicates markdowns are offered relatively less frequently early in the season and relatively more frequently at the end of the season. The market share of fancy shirts was found to be higher during clearance months. If price uncertainty is greater for fancy shirts, then a greater percentage of fancy shirts should be and are sold during the clearance months. The percentage markdown tends to be higher for short sleeve shirts than for long sleeve shirts at the end of the spring-summer season and the opposite pattern is observed at the end of the fall-winter season. Generally, stores do not offer markdowns on all available shirts at the end of each season but are selective in offering discounts - offering markdowns on just those shirts that are at the end of their particular season. Price uncertainty was expected to be greater for imports because of the longer lead times on foreign orders. Imports have a higher probability of selling on sale and at a higher average percentage markdown for both men's and women's merchandise.

One surprising finding of this study is that garments with higher initial prices have a higher percentage markdown. This regularity was observed repeatedly, for men's dress and sport shirts and sweaters and for women's blouses, shirts and sweaters. A naive explanation of this finding is that stores systematically over price higher quality goods. The price uncertainty hypothesis offers a subtler explanation. If fashion features are more prominent in garments with higher regular prices, then garments with higher regular prices will have a greater degree of price uncertainty. Therefore, shirts (and other types of garments) with higher regular prices will have a higher probability of selling at markdown and at a higher percentage markdown. Shirts with higher predicted regular prices are in fact sold at higher percentage markdowns. Shirts with lower than predicted regular prices are also discounted but by a smaller percentage than shirts with higher than predicted regular prices. A theory of pricing errors would predict that shirts that were initially underpriced should not be sold on sale. Hence, shirts with relatively low initial prices probably priced low because they have some but fewer fashion features. Shirts with higher than predicted regular prices have more fashion features and greater price uncertainty and are therefore discounted by a larger percentage.

The price uncertainty hypothesis cannot explain the surprisingly high level of measured sales activity, particularly at the beginning of seasons. The relatively high frequency of sales at the beginning of each season suggests that the role of price policy is not simply to identify those styles and fashions that will be popular during the coming season. At this stage one can only speculate about the causes of the high level of sales at the beginning of each season. One deserving line of inquiry would examine the effect of more frequent product introductions on the probability of sale. This paper has assumed that there are just two seasons, fall/winter and spring/summer. However, the number of product introductions for some brands has increased over time. The number of "seasons" has increased so the length of each season has declined. Stores offer markdowns more frequently throughout the year just to shed the remaining stocks of the previous season and to prepare for the introductions of the coming season. The increase in the number of introductions will increase the fraction of goods sold on sale in the early fall and the early spring. One other caveat should be repeated. The measured level of sale purchases may be artificially high. Stores can post artificially large initial markups to feature artificially large percentage markdowns a short time later. If so, the mystery becomes one step removed - that of explaining why this has become a more profitable practice now than twenty years ago.

The purchase decisions of the panelists show a female buyer has a higher probability of purchasing a men's dress shirt on sale than does a male buyer. Although female participation rates and the cost of time of a representative female have increased over time, it still appears the representative female has a lower cost of time than the male. A female not in the labor force purchases relatively more shirts on sale than does a male buyer. The effect of employment status of a female on the probability of buying on sale is more complicated. An employed female has a higher probability of buying on sale than a female not in the labor force but the probability of buying on sale declines as the number of hours worked increases. A full time female worker has a lower probability of buying on sale than one that is not in the labor force. The allocation of shopping time within the family unit, as reflected in the share of purchases by sex of buyer, shows the opportunity cost of shopping is higher for females at both ends of the spectrum - those who are not employed and those who are employed full time. Males purchase a larger percentage of shirts in each of these two types of households. Although one should not make too much of this because the purchase of shirts would only account for a small portion of time devoted to household duties, there are signs that males assume relatively more of the burdens of the shopping when the female cost of time is higher.

FOOTNOTES

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1. Markdowns increased at the beginning of the Depression because the severity of the Depression was underestimated. The decline in markdowns during World War II was due to the introduction of price and output controls.

2. The theory assumes a representative consumer does not act strategically by waiting to purchase a favorite color during the markdown period because the probability of finding the favorite color during the markdown period is lower. Strategic behavior by customers is less likely when the selling seasons are short and fashion changes from one season to another. Clearly, there should be less frequent markdowns on classic or basic clothing, where style remains constant from season to season, or for hard goods where the product is homogeneous and where product design is relatively stable over time. For these kinds of products stable or "every day" low prices should be observed more frequently.

3. Even a white garment could have numerous fashion features that vary from one white garment to another. For example, a white blouse could refer to either a simple functional blouse or a blouse with a distinctive neckline, unusual button treatment and various other frills. On the other hand possible variations on a white dress shirt are more limited in number so that color type is a more important measurable variation for men's dress shirts than for blouses.

4. MRCA sells the data to textile, apparel and general merchandise firms. A description of MRCA data is presented in [Reibstein 1978].

5. Items purchased in December of 1985 but process in 1986 were deleted. Items recorded with a zero price were also deleted. When several items of the same product were purchased simultaneously, the average price paid was substituted. For example, 88% percent of the transactions for men's dress shirts were single unit purchases and accounted for 75% of total dress shirt sales.

6. Seasonal data reported by the National Retail Merchants Association also shows dollar markdowns relative to dollar sales peaks in January and then in July. A comparison of the distribution of yearly markdowns by month reveals that the market share of yearly markdowns offered in the months of June and December has been increasing over time. Hence the traditional markdown periods of January and February and July and August have been lengthening in recent years to include June and December (National Retail Merchants Association).
7. The market share of fancy shirts is also relatively high from November and December. The high market share for fancy shirts during November and December cannot be explained by the price uncertainty hypothesis. Perhaps, fancy shirts are first introduced in November and December. The average percentage markdown is comparatively low in November and December so the relatively high market share is not due to lower prices on fancy shirts during November and December.
8. Liz Claiborne has six seasons in the year - Pre-Spring, Spring One, Spring Two, Fall One, Fall Two and Holiday [Lardner].
9. Within each product category, all purchases were divided into quartiles after all items were ordered by the regular price. Then the average percentage markdown in each quartile was calculated.
10. Weekend shoppers have higher household incomes than do week day shoppers.
11. The regular price was lower in January and December but not in the other months of the year or across the days of the week.
12. This is not an universal result since imported blouses tend to carry higher regular price tags
13. This is not necessarily a common pattern. The probability of purchasing on sale peaks on Saturday for women's blouses.
14. If the regular price is excluded from the regression, the coefficients of household income and of buyer education are positive. Both groups tend to purchase shirts with higher regular prices and the probability of a sale increases with the regular price.
15. Entering the labor force may raise the probability of purchasing on sale because working reduces the cost of acquiring information about the incidence of sales and raise the opportunity to take advantage of sales. If the job is located close to a mall or a central city retail center, the employed female will acquire information and take advantage of sales at a lower cost than a female who is not in the labor force.
17. The residuals were derived from the regression results in column 1 of Table 5.

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