The Timing and Magnitude of Retail Store Markdowns: Evidence from Weekends and Holidays

Elizabeth J. Warner, Robert B. Barsky

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THE TIMING AND MAGNITUDE OF RETAIL STORE MARKDOWNS: EVIDENCE FROM WEEKENDS AND HOLIDAYS*

ELIZABETH J. WARNER AND ROBERT B. BARSKY

We examine daily prices of eight goods at seventeen retail stores collected in Ann Arbor, Michigan, over a four-month period from November 1 to February 28. We focus on weekly and seasonal price patterns, and on the frequency of price markdowns or "sales." There were frequent markdowns in the intensive shopping period prior to Christmas, and a tendency for such sales to occur on weekends. We interpret these findings as evidence that a significant number of markdowns are timed to occur when shopping intensity is exogenously high. We complement the imperfect information-based motives for sales in the literature by contributing an additional element based on the role of bulk shopping and increasing returns in the shopping technology.

I. INTRODUCTION

The occurrence of periodic price markdowns or "sales" on a variety of items is one of the most pervasive and well-known of all microeconomic phenomena. Hence it is surprising that economists have written relatively little on this topic. Explanations of the existence, scope, timing, and magnitude of sales are not a standard topic in courses in price theory, and there are few if any well-established empirical principles that would provide a basis for analyzing the temporal and spatial patterns of markups and subsequent markdowns in retail product markets in any given set of circumstances.

Sales are also of potential interest to macroeconomists. Given the apparent infrequency of price changes (what some call the inertia or "stickiness" or prices), markdowns are perhaps the most visible source of nominal price variation over time in customer markets.[1] In addition to its role as applied microeconomics, this

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1. Of course, the retail sector accounts for only a fraction of total business, and the price markdowns we examine occur at considerably higher frequencies than the business cycle frequencies. The recurrence of the same economic phenomena at

paper discusses what macroeconomists can learn about the cyclicality of markups and the frequency of price changes, particularly the sales associated with weekends and holiday periods such as the post-Thanksgiving weekend and the pre-Christmas season more generally.[2]

Varian [1980] views sales as a form of price discrimination in which firms effectively offer lower prices to consumers with superior information or lower search costs. Customers with inferior information or high search costs detect sales less frequently and thus are more likely to purchase at full price. The Varian model revolves around sales that must be costly to detect and thus unpredictably situated in time or space. The random sales feature appears less suited to addressing some gross characteristics of the behavior of retail markdowns that we document in this paper: in particular, the simple, predictable, and publicly known patterns of sales on weekends, at holiday periods, and (especially) on holiday weekends, that are concentrated at mall and outlet stores and take place at all or most stores simultaneously. Nevertheless, there remains a great deal of erratic price behavior in the data, leaving an important role for the price discrimination hypothesis as an element of any comprehensive treatment of sales.

Lazear [1986] presents a theory of pricing over time for an idiosyncratic good (a "designer dress"), the demand for which is uncertain. The item is offered initially at a substantial markup over marginal cost, and the price is periodically reduced until the item is sold out. When many designer dresses with different patterns are offered at once, Lazear's model becomes a theory of clearance sales: the items that turn out ex post to be most desirable in the eyes of purchasers sell early on at full price, and the less desirable items sell at a markdown later on in the process. Pashigian [1988] and Pashigian and Bowen [1991], building on Lazear, develop a number of empirical predictions about the nature and timing of markups and markdowns that are collectively referred to as the "fashion hypothesis." These articles present evidence from department store sales of men's shirts (and, to a lesser extent, several other items of clothing). The fashion hypothesis predicts that

different frequencies (day versus night, weekly, yearly, cyclically) is stressed by Hall [1989] and parallels the concept of "fractiles" in the theory of chaotic processes.

2. As the empirical work in the paper will make clearer, the pre-Christmas season is in some cases best thought of as a period when retail prices unexpectedly fail to rise, rather than a period of an absolute drop in prices. Since much of our discussion focuses on price relative to marginal cost, the economics is much the same. See also Hall [1989, p. 17].

markdowns will tend to be concentrated in markets for idiosyncratic or heterogeneous goods (e.g., patterned shirts) rather than "generic" items (such as white and solid color shirts), an implication that is apparently sustained in the limited market Pashigian examines. Pashigian further applies the fashion hypothesis to explain why there has apparently been a secular increase since World War II both in initial "markons"[3] and in average observed markdowns. Fashion, he argues, has become more important in recent years, and goods are more heterogeneous. Hence there is more uncertainty on the part of sellers as to customers' valuations of the various items, and a greater resultant gap between the price at which the (ex post) most popular items sell and the equilibrium "clearance" price for the less successful items.

The fashion hypothesis/clearance sale paradigm has a number of impressive successes in the retail clothing market, documented in Pashigian [1988] and Pashigian and Bowen [1991]. It has not, however, been applied to the markets for a wide variety of other retail items in which sales (markdowns) are a central phenomenon, and in which the fashion hypothesis appears a priori less applicable, e.g., because the items are homogeneous or because styles change little over time. Further, it cannot account for the prevalence of markdowns at large department stores located at malls, as opposed to boutiques and specialty shops which have, if anything, a more idiosyncratic and less well-defined selection of items than department stores.

More fundamental, however, are two anomalies stressed by Pashigian and Bowen [1991] themselves. First, there are a rather large number of markdowns in the pre- rather than the post-Christmas season: "The percentage of shirts sold on sale at the beginning of each season is unexpectedly and surprisingly high [p. 1030]. . . . The high level of reported markdowns at the beginning of seasons is clearly inconsistent with the uncertainty hypothesis and with the price discrimination hypothesis as well" [p. 1037]. The frequent pre-Christmas sales show up clearly in our data, which while considerably less fine than the MRCA data used by Pashigian and Bowen [1991], cover a much wider range of items than clothing.

The second anomaly is the predominance of weekend sales:

> Overall, a larger percentage of shirts are sold on sale from Friday to Sunday than from Monday to Wednesday. What is surprising about this is that a larger

3. Markon is the term used in the industry to represent the gross percentage markup over average cost.

percentage of weekend customers are males or females who are full-time workers and come from higher income households. These are precisely the types of customers who would be expected to have *less* elastic demand curves and would pay higher prices if price discrimination was a feasible pricing policy. Yet, sales activity appears to be higher on the weekend when customers with less elastic demand curves are more prevalent than during the first part of the week [Pashigian and Bowen 1991].

We estimate the weekly pattern of prices for a variety of goods and a variety of store types. We find a quite robust "weekend effect"—prices falling as the weekend approaches and rising on Monday.

The present paper contributes an additional element to the understanding of markdowns, presenting theory and evidence suggesting the importance of a quite different motive for sales. This motive, while not discussed in the academic economics literature, appears to be well-known to the managers of department stores. On days characterized by an exogenously high intensity of shopping activity (e.g., Friday nights and Saturdays, and the period between Thanksgiving and Christmas when the bulk of retail purchases of durable and semidurable goods takes place), the search for lowest price takes place more efficiently. Customers for whom it does not pay to search or travel very much when only one item is to be purchased will invest more in information and transportation to obtain the lowest possible price when purchasing a number of units of the same good or a number of different items for which search and travel costs can be at least partly "shared." Because consumers are more vigilant and better informed in the high demand states, individual retailers perceive their demand to be more elastic in such periods. The optimal markup of price over marginal cost is thus lower, and the market achieves an outcome closer to that of perfect competition.

The particular type of "thick market" explanation of sales that we stress appears to provide a satisfactory account of weekend and pre-holiday sales (of which the Thanksgiving weekend, which combines both, is the most dramatic example). It is intended to complement, rather than substitute for, the imperfect information-based price discrimination mechanism of Varian [1980] and the fashion/clearance sale hypothesis of Lazear [1986], Pashigian [1988], and Pashigian and Bowen [1991]. Clearance sales are no doubt a dominant gross feature of the seasonal pattern, and the Varian mechanism is needed to account for the erratic high frequency pattern of prices at the individual good and individual store levels, especially in the early part of the season. As Pashigian

and Bowen [1991, p. 1037] also conclude, no single theory can account for all of the observed features of the data.

In addition to the weekly and seasonal behavior of markdowns, we are interested in the frequency with which prices are changed, partly because the "menu cost" notion has played a significant role in recent macroeconomic debates (see the papers in Mankiw and Romer [1991]). The introduction of sales into the consideration of price dynamics (an appropriate choice, since these markdowns represent changes in realized transaction prices), presents a picture of price dynamics that is at first blush far more flexible than the usual view [Okun 1981; Cecchetti 1986; Kashyap 1995]. Individual prices change very often, and by nontrivial amounts. We defer until the end of the paper, however, any discussion of macroeconomic implications.

The plan of the paper is as follows. Section II presents our data and principal empirical findings. Section III discusses the interpretation of the findings and what they might imply about the economic determinant of sales. It includes an illustrative theoretical example, based on Salop [1979], in which high-volume shopping leads to lower rather than higher prices—in contrast to what Pashigian and Bowen [1991] call the "peak load" hypothesis. Section IV contains a rather speculative discussion of possible implications for macroeconomics and a brief summary.

II. Basic Facts about the Data

The survey used in this paper documents prices of a fairly broad subset of consumer goods during the 1987 Christmas holiday season. The following describes the survey data and establishes various price patterns of interest.

The survey was conducted by Warner in Ann Arbor, Michigan, between November 1, 1987, and February 29, 1988. Table I specifies the general categories selected as well as the specific items priced.[4] Table II is a complete list of the selected outlets for each item.[5] Data collection was accomplished by visiting the outlets and recording observed prices. Eight items were priced daily among a total of seventeen outlets. The outlets and the goods remained the same for the duration of the survey.

4. If the name brand item was unavailable at one of the outlets at the start of the survey, then the item was chosen according to the italicized description in Table I.

5. A description of the outlets can be found in the Appendix.

TABLE I
THE BASKET OF GOODS DEFINITIONS

Category	Item	Description
Action figure	GI Joe	*Plastic, painted military figure with movable joints*
Bathroom linens (towels)	Fieldcrest by Royal Velvet	Face, hand, body, *100 percent cotton terry cloth, solid* colored towels
Bicycle	Huffy Vortex	*BMX boys 20" tires,* front/rear sidepull caliper brakes, *unassembled*, highrise handlebar, prostyle diamond frame, nylon cord tires, wheel disks
Photographic equipment (camera)	Minolta Freedom 200	*35mm single lens reflex, autofocus, built-in flash, motorized film advance,* auto DX
Power tools (drill)	Black & Decker	*⅜", ¼ H.P.,* 2.2 amps, 1200 max rev/min., *variable speed, reversible,* key chuck, #7144
Food processor	Big Oskar	Sunbeam #14121, *large capacity, variable speed,* continuous feed slicing, shredding attachment, reversible slicing, 600 watts
Men's sweater	Crewneck	*100 percent cotton*, pullover, avg. size range, *solid color*
Television	Sony KV1367	*13" color, portable, random access tuner, cable ready,* no remote, trinitron color

Daily prices were collected for eight products at a minimum of four stores per product. Whenever possible, the same model in each product group was priced across stores. For example, at the discount department store number 1 (DDS 1), the Minolta Freedom 200 camera was priced for the entire four-month period. If that model camera happened to be stocked out, that day's observation is simply unavailable. All prices collected reflect, as closely as possible, the final purchase price paid by a consumer including any reductions taken at the register or mail-in rebates exclusive of sales tax.[6]

Table III presents descriptive price statistics for the eight products at the various outlets. Columns 2 and 3 allow a compari-

6. In general, the prices are shelf prices. At one store computer prices were readily available to the customer and were observed as well. If there was a discrepancy between a computer price and the observed shelf price, the store was questioned as to which price the consumer would actually pay. The price the store said it would honor was then recorded.

TABLE II
OUTLET SELECTION

Item	Type of outlet
Action figure	TS (2)
	CDS (1)
	DDS (4)
Bathroom towels	CDS (4)
	LS (1)
Bicycle	TS (1)
	CDS (2)
	DDS (3)
Camera	DDS (3)
	AS (1)
Drill	HS (1)
	DDS (3)
Food processor	CDS (1)
	DDS (2)
	AS (1)
Sweater (men's)	MCS (1)
	CDS (2)
	DDS (1)
Television	AS (3)
	CDS (2)
	DDS (1)

DDS = Discount Department Store; MCS = Men's Clothing Store; CDS = Chain Department Store; LS = Linen Store; AS = Appliance Store; HS = Hardware Store; TS = Toy Store
All numbers in parentheses indicate the number of stores selected from.

son between pre- and post-Christmas average prices for each item at each of the stores. The principal patterns that appear are elaborated upon below.

There are examples in the survey data of outlet-specific items[7] that had a lower average price before Christmas, as well as cases that had a lower average price after Christmas. Outlet-specific items with a lower average price before Christmas comprise just over 45 percent of the list, while about 35 percent of the items have a lower average price after Christmas, and nearly 20 percent of the outlet-specific items have unaltered price tags throughout the period. Five out of the eight products have lower average prices before Christmas for at least half of the outlet-specific items within

7. We will sometimes use the term "outlet-specific item" to refer to a manufacturer model-numbered good at a specific store. Each observation for an outlet-specific item is the price of a particular manufacturer's model at a particular store on a given day. There are a total of 40 outlet-specific items.

TABLE III
SUMMARY PRICE STATISTICS

Item	Average price	
	Before Christmas	After Christmas
Action figure		
TS 1	3.88	3.81
CDS 1	2.93	2.99
TS 2	2.69	2.69
DDS 1	2.96	2.96
DDS 2	2.84	2.84
DDS 3	2.96	2.73
DDS 4	2.69	2.57[a]
Total	2.99	2.97
Bathroom towels		
CDS 2	13.54	13.21
CDS 3	26.97	28.88
CDS 4	24.75	24.75
CDS 5	29.91	26.97
LS	15.64	15.97
Total	22.08	21.84
Bicycle		
CDS 1[b]	73.47	75.29
CDS 1[c]	99.99	99.99
TS 2	112.63	109.99
DDS 1	119.99	89.98
DDS 2	119.99	[d]
DDS 4	118.70[a]	119.92
Total	105.82	99.03
Camera		
DDS 1	103.32[a]	109.41[a]
DDS 2	107.02[a]	108.40[a]
DDS 4	105.35	109.97[a]
AS 1	129.99[a]	129.99[a]
Total	111.63	113.90
Drill		
HS	29.01	32.29
DDS 1	27.99	32.38
DDS 3	24.43[a]	28.97[a]
DDS 4	23.97[a]	32.11[a]
Total	26.79	31.91
Food processor		
CDS 3	95.33	93.67
DDS 1	79.71	69.67
DDS 2	82.89	72.04
AS 1	79.88	79.88
Total	84.45	78.83

TABLE III
(CONTINUED)

Item	Average price	
	Before Christmas	After Christmas
Sweater		
CDS 2	31.87	18.28[a]
CDS 3	56.63	41.08[a]
MCS	29.73	33.26
DDS 3	20.76	26.30[a]
Total	34.89	30.61
Television		
CDS 1	295.46	303.48
CDS 3	363.56	388.32[a]
AS 1	323.50	314.07
AS 2	329.95	261.51
AS 3	255.97	257.92
DDS 1	260.93	267.72
Total	304.90	299.36
Overall		
Total number of outlet-specific items with average price:		
Lower before Xmas	18	
Lower after Xmas	14	
Same throughout sample	7	

Store categories are as indicated below. Individual stores have been identified by a number when more than one exists within a category.

DDS = Discount Department Store; MCS = Men's Clothing Store; CDS = Chain Department Store; LS = Linen Store; DS = Drug Store; AS = Appliance Store; TS = Toy Store; HS = Hardware Store

a. Average price for this item when it was in stock.
b. Model #45709.
c. Model #45175.
d. This item was unavailable after Christmas.

that product group. On the other hand, if item prices are averaged across outlets, then half of the products are clearly *lower priced* after Christmas, two are virtually unchanged, while only two of the product groups have a lower price before Christmas.[8]

Figures I through IX plot representative examples of the data in real time, while Tables IV, V, and VI present detailed markdown information that permit an inter- and intra-outlet comparison of

8. It is worth noting, however, that if we had transactions data and thus were able to weight prices by volume, then prices on those days associated with markdowns would receive a higher weight than prices on other days. As we demonstrate below, markdowns in the first half of the sample tend to occur on weekends, which are also the high-volume shopping days. Therefore, transactions-weighted prices for the pre-Christmas period would be lower than the straight averages shown in Table III. At the very least, these statistics do not support the view that prices overall are substantially lower in the January clearance sale period.

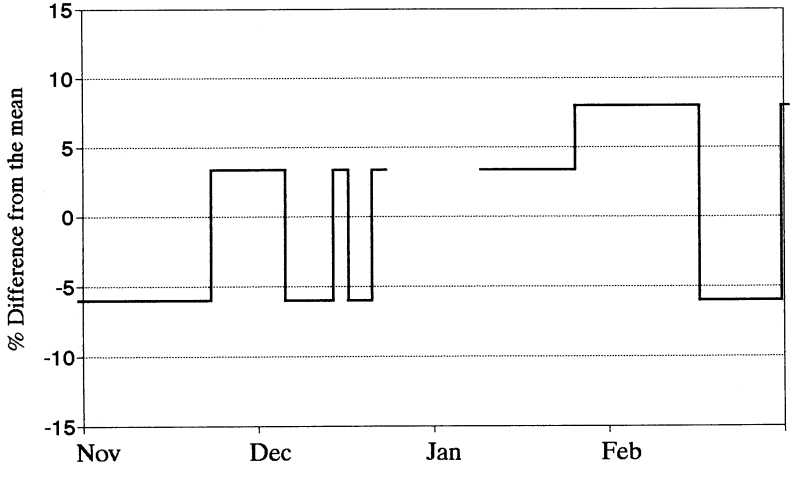

FIGURE I
Single Store Data
Camera at DDS1

pricing behavior. Each entry in these tables indicates the magnitude of the markdown and the dates during the sample period that the markdown took place. As explained in the footnote, a "W" highlights weekend sales. In contrast to a finding that is widely

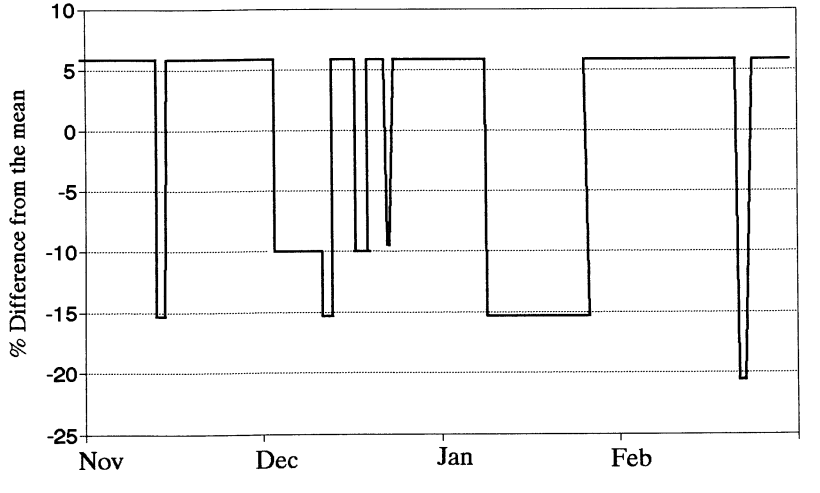

FIGURE II
Single Store Data
Food Processor at CDS3

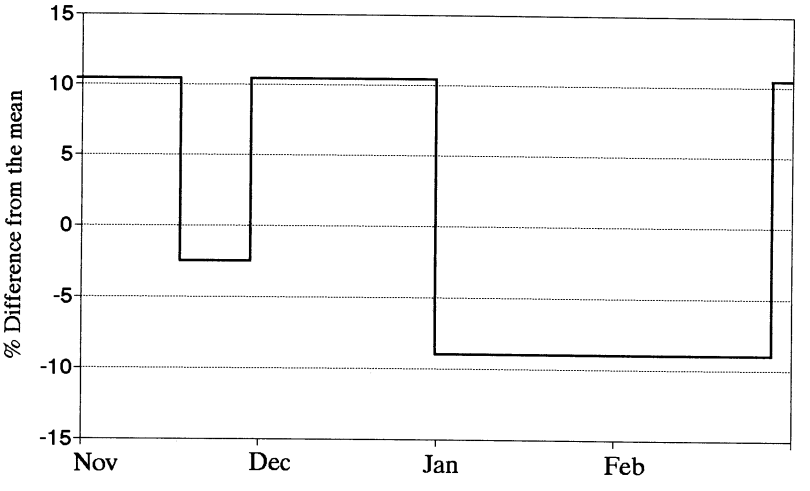

FIGURE III
Single Store Data
Food Processor at DDS2

reported in the literature (for example, Cecchetti [1986], Kashyap [1995], Carlton [1986], and Okun [1981]), prices in the survey data changed quite often.[9] All outlets in the sample, save one (CDS4), reduced price for at least one of the products followed in the survey data set. All of the products experienced a price reduction within the sample period at least at one of the outlets. There were both short duration and long duration price reductions (see Figure I through IX for examples). Sales before Christmas tended to be more frequent but shorter in duration than sales after Christmas (e.g., price patterns shown in Figures II, III, VII, VIII, and IX). Compatible with the Lazear-Pashigian clearance sale notion, there are examples of stepwise price reductions aimed at eliminating stock (e.g., the price of the sweater at chain department stores 2 and 3; the sweater at CDS 3 is shown in Figure IX).

Table IV presents markdown behavior for each item organized by product group. There were a total of 62 "temporary sales" (price reductions followed by a price increase) in the survey data listed in columns 1 and 2. Most of the temporary reductions were exactly reversed (51 out of the 62 temporary sales involved the price being

9. Our results are more reminiscent of Stigler and Kindahl [1970] who stress the flexibility of transactions prices as compared with the rigidity of list prices. It may be worth noting, however, that prices fluctuate in a rather rigid fashion typically oscillating between two or three benchmark levels.

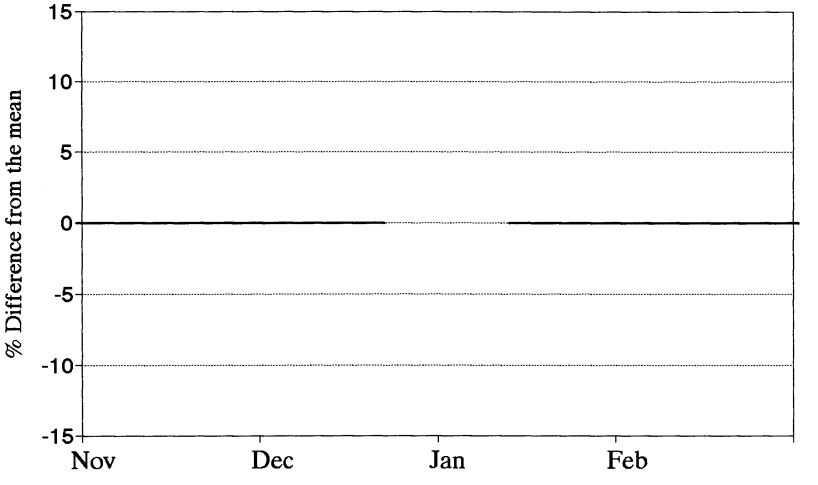

FIGURE IV
Single Store Data
Camera at AS1

marked down and then returning to the former price; see Figures I, II, III, VII, VIII, and IX for specific examples). A large portion of the temporary markdowns (45 percent) were between 15 and 25 percent. Nearly two-fifths of the temporary sales were markdowns

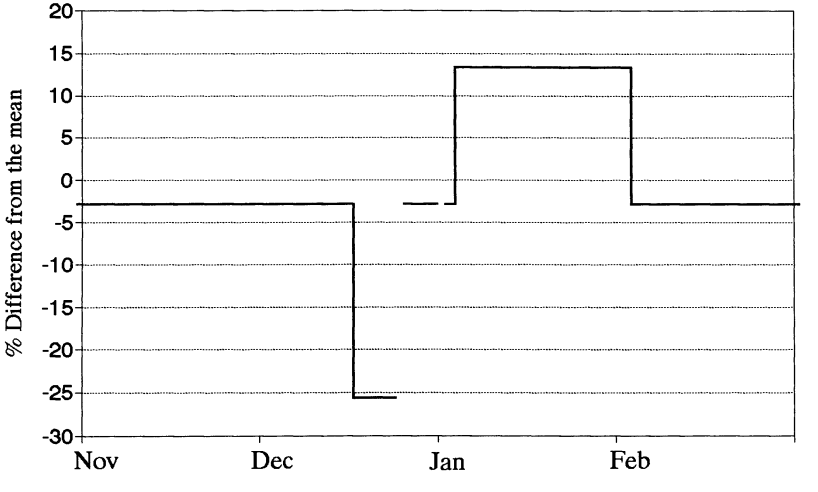

FIGURE V
Single Store Data
Drill at HS

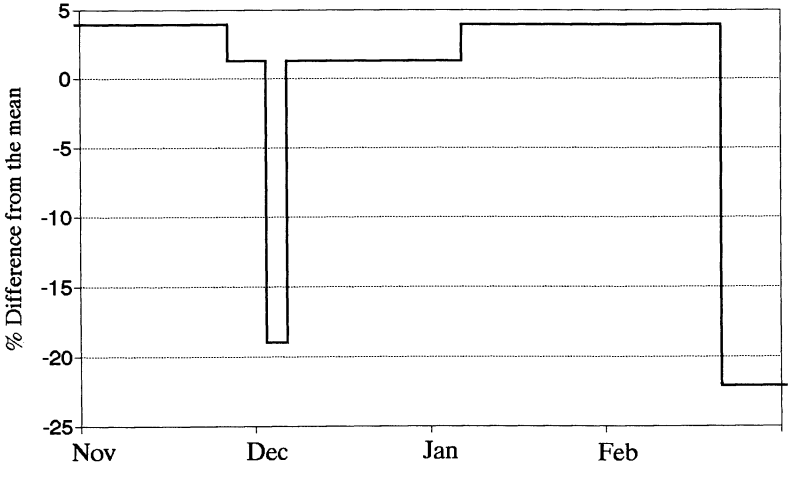

FIGURE VI
Single Store Data
Toy at TS1

of less than 15 percent, and the remaining portion (18 percent) of the sales were over 25 percent off. Nearly 70 percent of these sales occurred before Christmas, while only 30 percent occurred after Christmas. Those temporary sales that occurred before Christmas

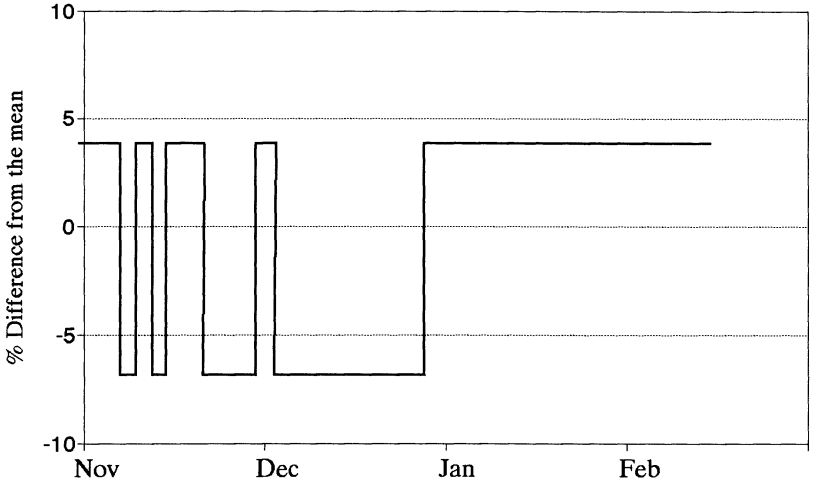

FIGURE VII
Single Store Data
TV at CDS3

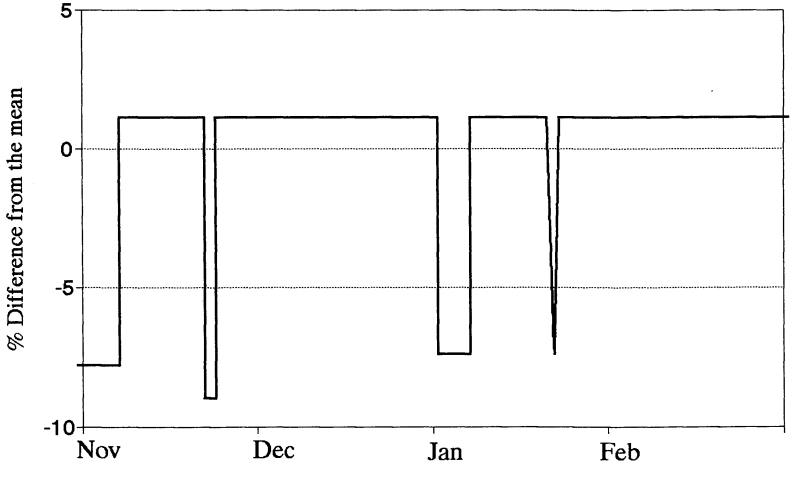

FIGURE VIII
Single Store Data
TV at AS3

ranged from a low of 6 percent to a high of 40 percent. Both large and small markdowns occurred after Christmas, but the largest markdowns predominantly occurred after Christmas and were permanent markdowns (e.g., sweaters).

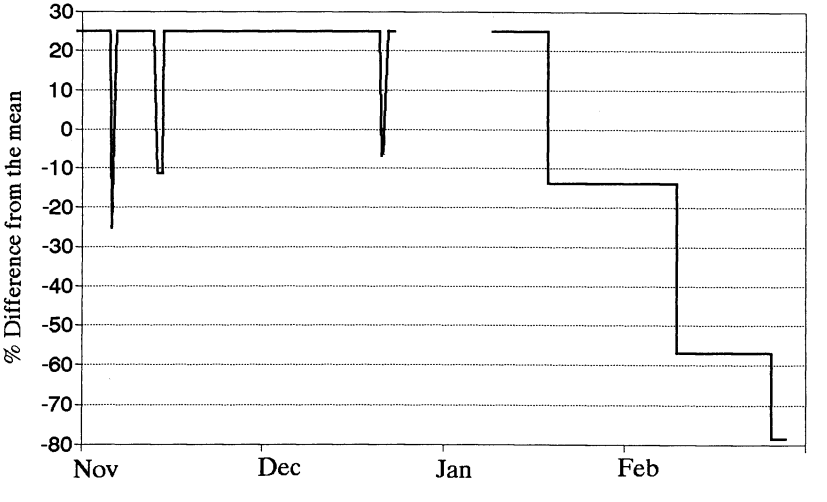

FIGURE IX
Single Store Data
Sweater at CDS3

Some coordination of price reductions within item categories did seem to occur. For example, the price of the drill was reduced before Christmas at all of the stores (a manufacturer's rebate). Two of the discount stores reduced price on the Minolta camera during roughly the same two weeks in January. Price reductions of the television set occurred at more than one store the weekend after Thanksgiving, a few days after New Year's, at the end of January, and the latter part of February.

Table V reorganizes the information contained in Table IV by outlet. Some evidence suggestive of storewide sales is apparent. The clearest example occurred at chain department store 3. Three out of four of the items followed were marked down November 13 and 14. Price reductions occurred for two of the items on December 22, and two other items were reduced in price the first part of December. The chain department store 1, as well, reduced price of the television and the bicycle immediately following Thanksgiving. Again within December the markdowns of the action figure and the bicycle occurred roughly in the same time period.

Table VI summarizes the conditional markdown behavior across items and outlets. The table makes clear the distinction between sweaters and the other items on the list. Due to the Lazear clearance sale scenario, sweaters are marked down quite drastically. Average price reductions on all other items are more modest in comparison, ranging from 7 to 18 percent off. The magnitude of average price reductions is similar across stores (MCS is a men's clothing store in which the only item priced in the survey is a sweater). However, the chain department stores do mark down more on average than the discount department stores (traditionally a lower regular priced outlet). Perhaps some marking up to subsequently mark down is taking place. Also, appliance stores that specialize in more "big ticket" items on average tend to mark down price the least.

One of the most interesting patterns found in this work is in the timing of sales across the days of the week. Prices fall as the weekend approaches. Figure X shows the average weekly pattern in the log level of prices implied by a regression of percentage price changes on seven daily dummies. The data were pooled across all products and stores. Prices reach their lowest levels on Fridays and Saturdays (Friday night is, of course, the effective beginning of the weekend) and rise to their weekly peak on Mondays.[10]

10. The seven daily dummies sum up to -0.14 rather than to zero because there is a slight downward trend in the sample as a whole.

TABLE IV
MARKDOWN STATISTICS ORGANIZED BY GOOD

Item	Short duration markdown w/subsequent markup[a] percent	Long duration markdown w/subsequent markup[b] percent	Markdown w/o subsequent markup percent	Consecutive markdowns w/o subsequent markup[c] percent
Action figure				
TS 1	22 (12/3–12/6)		25 (2/19–2/29)	
CDS 1		10 (12/16–12/24)		
TS 2				
DDS 1				
DDS 2				
DDS 3			9 (1/6–2/29)	
DDS 4		8 (12/26–1/15)		
Bathroom towels				
CDS 2		27 (12/6–1/23)		
CDS 3		21 (11/1–2/11)		
CDS 4				
CDS 5			16 (12/3–2/29)	
LS	16 (11/15–11/21)			
Bicycle				
CDS 1[d]	15 (11/8–11/11)	15 (11/27–12/7)	13 (1/30–2/29)	
		13 (12/11–12/24)		
CDS 1[e]				
TS 2			15 (11/8–2/29)	
DDS 1		38 (1/2–1/31)		
DDS 2				
DDS 4	8 (12/17–12/19)[W]			
Camera				
DDS 1	9 (12/17–12/20)[W]	9 (11/1–11/22)		
		9 (12/6–12/13)		
		13 (2/15–2/28)		
DDS 2	9 (11/1–11/7)	9 (2/10–2/27)		
	9 (11/27–11/29)[W]			
DDS 4				
AS 1				
Drill[f]				
HS	34 (12/17–12/23)	14 (11/1–1/2)	14 (2/2–2/29)	
DDS 1		15 (11/1–1/2)		
DDS 3		17 (11/1–11/27)		
DDS 4		21 (11/1–12/27)		
Food processor				
CDS 3	20 (11/13–11/14)	15 (12/3–12/12)		
	15 (12/17–12/18)	20 (1/8–1/24)		
	15 (12/22)			
	25 (2/19–2/21)[W]			
DDS 1	6 (11/27–11/29)[W]		14 (12/30–2/29)	
DDS 2		12 (11/18–11/29)		
		18 (12/31–2/25)		
AS 1				

TABLE IV
(CONTINUED)

Item	Short duration markdown w/subsequent markup[a] percent	Long duration markdown w/subsequent markup[b] percent	Markdown w/o subsequent markup percent	Consecutive markdowns w/o subsequent markup[c] percent
Sweater				
CDS 2		25 (12/10–1/2)		58 (1/10–1/14)
				69 (1/15–1/17)
				78 (1/18–1/30)
CDS 3	40 (11/6)			31 (1/20–2/9)
	30 (11/13–11/14)			66 (2/10–2/25)
	25 (12/22)			83 (2/26–2/27)
MCS	40 (11/27–11/29)[W]	50 (1/18–2/5)		
DDS 3		19 (11/4–11/16)		
		19 (11/24–12/6)		
		30 (12/20–12/29)		
Television				
CDS 1	18 (1/10–1/12)	15 (11/6–11/21)	20 (2/19–2/29)	
		17 (11/27–1/1)		
		18 (1/23–2/15)		
CDS 3	10 (11/7–11/9)[W]	10 (11/21–11/29)		
	10 (11/13–11/14)	10 (12/3–12/27)		
		18 (2/13–2/28)		
AS 1	19 (11/24)	28 (1/23–1/31)	3 (2/11–2/29)	
	28 (11/27–11/29)[W]			
AS 2	22 (1/2–1/5)	22 (1/25–2/10)	18 (2/23–2/29)	
	18 (1/14–1/19)			
	30 (2/19–2/20)			
AS 3	9 (11/1–11/7)			
	10 (11/22–11/23)			
	8 (1/2–1/6)			
	8 (1/20)			
DDS 1		7 (12/1–12/31)	11 (2/29)	

Store categories are as indicated below. Individual stores have been identified by a number when more than one exists within a category.

DDS = Discount Department Store; MCS = Men's Clothing Store; CDS = Chain Department Store; LS = Linen Store; DS = Drug Store; AS = Appliance Store; TS = Toy Store; HS = Hardware Store.

Numbers in parentheses represent the specific days within the sample period that the item is marked down. The sample period ranges from 11/1 to 2/29. The weekend after Thanksgiving is 11/27–11/29.

a. A short duration markdown is defined to be a temporary markdown of seven or fewer days in duration.

b. A long duration markdown is defined to be a markdown of longer than seven days in duration.

c. These are stepwise markdowns characteristics of Pashigian-type clearance sales.

d. Model #45709.

e. Model #45175.

f. The Black and Decker drill had a manufacturer's rebate through the first of January.

W. The specified markdown occurred over a weekend.

Table VII presents evidence of the basic robustness of the weekly pattern, both across stores and across goods. Column (1) presents the coefficients used to produce Figure X. Both Friday and Monday price changes are significant at the 1 percent level. The predicted percent change in price on Friday is −0.68 percent compared with a predicted increase of 0.39 percent on Monday.

TABLE V
MARKDOWN STATISTICS ORGANIZED BY OUTLET

Item	Short duration markdown w/subsequent markup[a] percent	Long duration markdown w/subsequent markup[b] percent	Markdown w/o subsequent markup percent	Consecutive markdowns w/o subsequent markup[c] percent
TS 1				
Action figure	22 (12/3–12/6)		25 (2/19–2/29)	
TS 2				
Action figure				
Bicycle			15 (11/8–2/29)	
DDS 1				
Action figure				
Bicycle		38 (1/2–1/31)		
Camera	9 (12/17–12/20)[W]	9 (11/1–11/22)		
		9 (12/6–12/13)		
		13 (2/15–2/28)		
Drill		15 (11/1—1/2)		
Food processor	6 (11/27–11/29)[W]		14 (12/30–2/29)	
Television		7 (12/1–12/31)	11 (2/29)	
DDS 2				
Action figure				
Bicycle				
Camera	9 (11/1–11/7)	9 (2/10–2/27)		
	9 (11/27–11/29)[W]			
Food processor		12 (11/18–11/29)		
		18 (12/31–2/25)		
DDS 3				
Action figure			9 (1/6–2/29)	
Drill		17 (11/1–11/27)		
Sweater		19 (11/4–11/16)		
		19 (11/24–12/6)		
		30 (12/20–12/29)		
DDS 4				
Action figure		8 (12/26–1/15)		
Bicycle	8 (12/17–12/19)[W]			
Camera				
Drill		21 (11/1–12/27)		
CDS 1				
Action figure		10 (12/16–12/24)		
Bicycle[d]	15 (11/8–11/11)	15 (11/27–12/7)	13 (1/30–2/29)	
		13 (12/11–12/24)		
Bicycle[e]				
Television	18 (1/10–1/12)	15 (11/6–11/21)	20 (2/19–2/29)	
		17 (11/27–1/1)		
		18 (1/23–2/15)		
CDS 2				
Bathroom towels		27 (12/6–1/23)		
Sweater		25 (12/10–1/2)		58 (1/10–1/14)
				69 (1/15–1/17)
				78 (1/18–1/30)
CDS 3				
Bathroom towels		21 (11/1–2/11)		
Food processor	20 (11/13–11/14)	15 (12/3–12/12)		
	15 (12/17–12/18)	20 (1/8–1/24)		
	15 (12/22)			
	25 (2/19–2/21)[W]			

TABLE V
(CONTINUED)

Item	Short duration markdown w/subsequent markup[a] percent	Long duration markdown w/subsequent markup[b] percent	Markdown w/o subsequent markup percent	Consecutive markdowns w/o subsequent markup[c] percent
Sweater	40 (11/6)			31 (1/20–2/9)
	30 (11/13–11/14)			66 (2/10–2/25)
	25 (12/22)			83 (2/26–2/27)
Television	10 (11/7–11/9)[W]	10 (11/21–11/29)		
	10 (11/13–11/14)	10 (12/3–12/27)		
		18 (2/13–2/28)		
CDS 4				
Bathroom towels				
CDS 5				
Bathroom towels			16 (12/3–2/29)	
AS 1				
Camera				
Food processor				
Television	19 (11/24)	28 (1/23–1/31)	3 (2/11–2/29)	
	28 (11/27–11/29)[W]			
AS 2				
Television	22 (1/2–1/5)	22 (1/25–2/10)	18 (2/23–2/29)	
	18 (1/14–1/19)			
	30 (2/19–2/20)			
AS 3				
Television	9 (11/1–11/7)			
	10 (11/22–11/23)			
	8 (1/2–1/6)			
	8 (1/20)			
HS				
Drill	34 (12/17–12/23)	14 (11/1–1/2)	14 (2/2–2/29)	
LS				
Bathroom towels	16 (11/15–11/21)			
MCS				
Sweater	40 (11/27–11/29)[W]	50 (1/18–2/5)		

Note. Store categories are as indicated below. Individual stores have been identified by a number when more than one exists within a category.

DDS = Discount Department Store; MCS = Men's Clothing Store; CDS = Chain Department Store; LS = Linen Store; DS = Drug Store; AS = Appliance Store; TS = Toy Store; HS = Hardware Store.

Numbers in parentheses represent the specific days within the sample period that the item is marked down. The sample period ranges from 11/1 to 2/29. The weekend after Thanksgiving is 11/27–11/29.

a. A short duration markdown is defined to be a temporary markdown of seven or fewer days in duration.

b. A long duration markdown is defined to be a markdown of longer than seven days in duration.

c. These are stepwise markdowns characteristic of Pashigian-type clearance sales.

d. Model #45709.

e. Model #45175.

W. The specified markdown occurred over a weekend.

Column (3) shows that the basic pattern is unaltered when month, item, and store dummies are included. The results are robust. The basic pattern of the lowest price occurring on Friday and peaking on Monday is unaltered across various model specifications. We

TABLE VI
CONDITIONAL PRICE MARKDOWNS

	% Δ P from "list"	Standard error
Item by good		
Bike	−18	0.52
Action figure	−9	0.53
Bathroom towels	−14	0.50
Camera	−7	0.20
Drill	−18	0.37
Food processor	−16	0.24
Sweater	−39	1.10
Television	−12	0.48
Item by outlet		
TS	−13	0.50
DDS	−15	0.34
MCS	−33	1.39
CDS	−20	0.61
LS	−16	5.20 E-08
AS	−8	0.75
HS	−16	0.59

These are the average percent difference from list for those days the good is on sale.

obtain comparable results when we run separate models for each item, pool similar stores, or pool similar items. An additional noteworthy implication of Table VII is that prices are indeed lowest in January, but tend to return in February to December's level. We find this particularly interesting because if clearance sales were the only price pattern, one would expect February prices to be the lowest of the four months.

Finally, we explore the interaction between the weekend and holiday effects. Figure XI shows that the weekend effect, though qualitatively the same as in Figure X, is stronger in the pre-Christmas period. The before-Christmas price changes −0.83 percent from Thursday to Friday. Weekend-holiday interaction appears in its strongest form on the weekend following Thanksgiving, shown in Figure XII. The "Thanksgiving effect" leads to a price change of −2.23 percent on the Friday following Thanksgiving. One-third of the products that *ever* experience markdowns are marked down during this weekend, and 22 percent of all weekend sales[11] occurred on Thanksgiving weekend. Thus, Thanksgiving

11. Weekend sales are defined to be markdowns of three or fewer days in duration either starting on Friday or Saturday.

Figure X--Mean Price Pattern
By Day of The Week

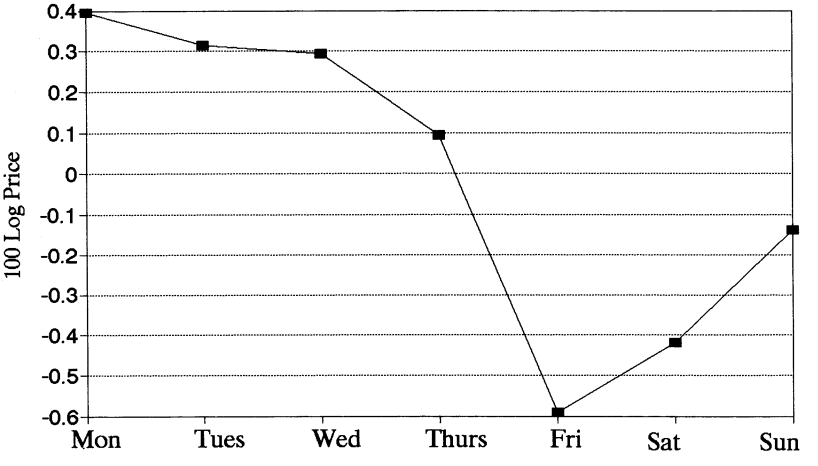

FIGURE X
Mean Price Pattern
by Day of the Week

weekend sales occurred with an excess incidence given by more than a factor of three.[12]

Though the weekly pattern of prices reflected in the regressions is quite robust, the magnitude of the average markdown is not large. Naturally, only a fraction of the outlet-specific items are marked down on a given day. Following Pashigian and Bowen [1991], we therefore also present some statistics on conditional average markdowns (i.e., average markdowns for those goods that are "on sale").[13] In terms of the weekend effect, there are 585 Friday observations (roughly, there are 15 Fridays in the four-month period and 40 outlet-specific items). Out of the 585 observations, 231 were marked down.[14] That is, 39 percent of the

12. There are sixteen possible weekend sales in the survey period. If sales are random, then 1/16 of the eighteen weekend sales (approximately one) would have occurred on Thanksgiving weekend. Instead four of the eighteen weekend sales took place on Thanksgiving weekend.

13. We diverge from Pashigian and Bowen in using ordinary averages rather than a tobit model, since we do not view the observations as the outcome of a latent variable model of the retailer's pricing choices.

14. An outlet-specific item was considered on sale if the price differed from (was lower than) its usual price. In general the usual price is the "list" price, but at some stores, such as discount department stores, the good is never sold at list. In

TABLE VII
DETERMINANTS OF THE PERCENT CHANGE IN PRICE OF SURVEY ITEMS

Variable	(1) Coeff.	(2) t	(3) Coeff.	(4) t
Intercept	−0.080	−0.48	−0.030	−0.07
Day				
Monday	0.474	2.05	0.465	2.01
Wednesday	0.058	0.25	0.058	0.25
Thursday	−0.120	−0.50	−0.118	−0.50
Friday	−0.605	−2.55	−0.606	−2.55
Saturday	0.252	1.08	0.252	1.08
Sunday	0.360	1.54	0.360	1.53
Month				
December			−0.049	−0.27
January			−0.054	−0.31
February			0.050	0.28
Item				
Action figure			−0.082	−0.39
Camera			−0.046	−0.17
Drill			−0.075	−0.24
Food processor			−0.054	−0.22
Sweater			−0.625	−2.32
Television			−0.036	−0.15
Store type				
Discount Department Store			0.090	0.21
Chain Department Store			−0.036	−0.09
Appliance Store			0.131	0.28
Men's Clothing Store			1.25	2.08
Hardware Store			−0.143	−0.23
Toy Store			−0.070	−0.15
R^2	0.006		0.009	
DW	2.13		2.14	
N	4280		4280	

The reference good for the third column is a set of towels sold at a linen store purchased on a Tuesday.

outlet-specific items were on sale on the weekend (once again, Friday signals the effective beginning of the weekend). The average markdown for those outlet-specific items on sale on Friday was 20 percent. In terms of Thanksgiving, we consider the three days after Thanksgiving (Friday, Saturday, Sunday). There are 114 observations (38 outlet-specific items times the three days; 2 of the outlet-specific items were unavailable that weekend). Over the

such instances, the price that was considered the "everyday" selling price was considered the usual price.

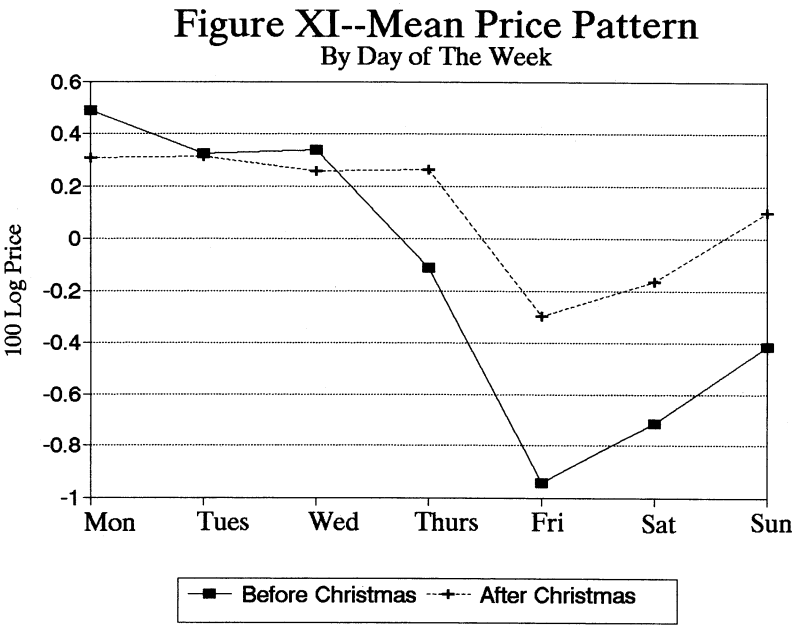

FIGURE XI
Mean Price Pattern
by Day of the Week

three days, 49 of the 114 observations were marked down (roughly, out of the 38 available outlet-specific items, 16 were on sale). For those goods on sale over the Thanksgiving weekend, the average markdown was 17 percent. Finally, for those outlet-specific items that were on sale, the average markdown was approximately 15 percent in November, 16 percent in December, 22 percent in January, and 16 percent in February.

III. A MICROECONOMIC INTERPRETATION OF SALES ON HIGH-VOLUME SHOPPING DAYS

That clearance sales consistent with the fashion/uncertainty hypothesis are the single most dominant feature of the seasonal pattern of sales is not in dispute. However, the pricing patterns emphasized here are not those characteristic of clearance sales. First, the fashion hypothesis applies most directly to goods that display considerable heterogeneity. None of our goods are high-

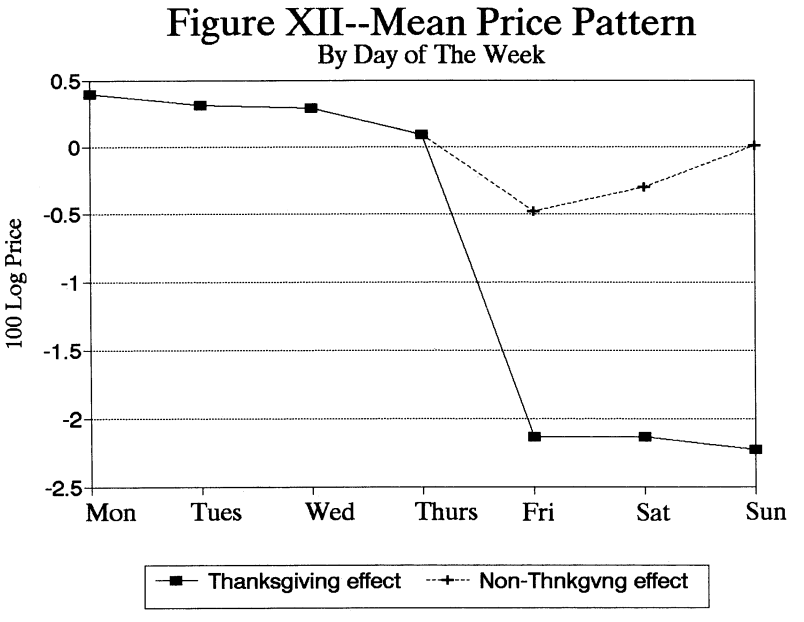

FIGURE XII
Mean Price Pattern
by Day of the Week

fashion items. All of the items in our data, save one (the sweater), are name brand items found at numerous stores. Thus, demand revelation is likely to be less of an issue. It is noteworthy that the sweater is the item that most closely followed the clearance pattern, both confirming the fashion/uncertainty hypothesis and flagging its limitations.[15] More importantly, under the fashion hypothesis, once the price is marked down, it is never increased. In the case of the temporary sales that involve a fall in price followed by a price increase, the fashion hypothesis appears not to be applicable.[16]

Average prices for standardized items at individual outlets were somewhat lower before Christmas than after. As reported in Section II from Table IV, nearly 70 percent of the temporary price reductions occurred before Christmas. Likewise, there is a very

15. Looking at seasonal patterns of major components of the CPI, it is interesting to note that the importance of deterministic seasonality is much more significant for apparel than for other categories. See Warner [1993].

16. These temporary price reductions are for the most part those "early in the season" sales that troubled Pashigian and Bowen.

robust, though not quantitatively large, tendency for prices to fall toward the weekend, so that the level of prices typically reaches its trough on Friday and Saturday. Retail stores orient temporary price reductions around the weekend (Thanksgiving weekend in particular) and the period preceding Christmas. Weekends and the month or so prior to Christmas as may constructively be viewed as times when shopping intensity is exogenously high, so there is a sense in which the retail industry displays a "downward-sloping" supply curve.

Bulk Purchases and Fixed Costs of Shopping in the Salop Model

The well-known "circular city" model of Salop [1979] is normally used to discuss interactions between fixed costs, entry, and the equilibrium markup (see Weitzman [1982] and Tirole [1989]). Here we show that if instead the number and location of firms is fixed while the volume of shopping per household increases, Salop's model implies that the equilibrium markup should fall. We interpret this as saying that bulk shopping on weekends and in the pre-Christmas period has a tendency to lead to price reductions, or at least to mitigate against any tendency for price to rise due to "peak-load" shopping.

A fixed number of firms (otherwise identical) are located a unit distance apart on a circle. Let L be the number of shoppers residing uniformly between any two adjacent stores. Only one type of good is bought and sold, and each consumer exogenously purchases y units of the good per period. Stores are always able to supply additional units at marginal cost c, which may or may not depend on output. Store 0 competes with adjacent stores for customers. By symmetry, we need only consider the decision to purchase at store 0 versus one neighboring store, store 1. A shopper located at z is indifferent between store 0 and store 1 if

$$p_0 y + kz = p_1 y + (1 - z)k, \tag{1}$$

where p_0 is the price charged by store 0, p_1 is the price charged by store 1, and k is the total transportation cost per unit of distance. Therefore, the location of the shopper who is indifferent between store 0 and store 1 is given by

$$z^* = 1/2 + y/2k(p_1 - p_0), \tag{2}$$

The demand curve for store 0 is accordingly $2z^*L$, accounting for shoppers located z^* distance away on either side of store 0.

Store 0 maximizes its profits taking the price of its neighbors as given. Store 1 faces a completely symmetric problem.

The symmetric Bertrand equilibrium is given by

$$p = c + k/y, \tag{3}$$

Equation (3) gives a simple and readily interpretable expression for the equilibrium (absolute) markup, $p - c$. It is the ratio of the travel cost to the number of units purchased per household. In the presence of an increasing returns to scale shopping technology, the intention to purchase a greater number of units leads households to undertake higher travel and search costs. Firms perceive greater competition for their market area, and thus a higher elasticity of demand leads to a lower markup in peak demand periods.

In the simple example above, consumers buy an exogenous amount of a single product. The implications can be extended to a multigood case. Shopping for Christmas presents, or a weekend trip to the mall, is probably best characterized as the purchase of a list of goods during a single shopping trip. If stores are located together at shopping centers, if a number of goods are purchased in a bundle in a department store, or if the same newspaper or catalog provides information about multiple items, then at least part of the total transaction cost is shared across goods. An expansion of the perceived market area will cause multigood stores to compete more vigorously with respect to the overall package they offer consumers, although it will not necessarily result in sales on the same items at each store on a given day. This is of course in line with what we observe. In the case of stores located together at shopping malls, note that once consumers make a trip to inspect one good, comparison shopping for other goods is facilitated. We would expect that to put pressure on the market power of all stores in a mall.[17] The increased incentive for consumers to peruse newspaper advertisements or catalogs would have the same general effect.

17. It is often noted that "sales" have become an increasingly ubiquitous phenomenon in the last twenty years. Pashigian [1988] and Pashigian and Bowen [1991] have shown how the fashion/uncertainty hypothesis would predict an increase in late-in-the-season sales of the clearance variety due to an increase in the importance of fashion and the heterogeneity of goods offered. It is tempting to hypothesize that the increase in weekend and pre-Christmas sales has to do with the greater proportion of retail business taking place at malls rather than at neighborhood stores, and that weekend trips to malls are increasingly favored, as a higher fraction of women work during the week.

Alternative Explanations of Lower Markups in High Demand States

It is interesting to note that the thick market effect in our example applies to an increased volume of purchases per household, but does not apply to an increase in the number of households in the market (an increase in L). The Salop model with fixed costs and entry does have the implication that higher L raises the elasticity of demand and reduces the markup by allowing more firms to cover their fixed costs and thus increasing competition in the product space. This is perhaps the principal point of Weitzman [1982]. Although L probably does increase during the Christmas season, entry and exit of firms is certainly not a plausible story for the high frequency fluctuations we are concerned with. However, Barsky [1992] shows that in the Grossman-Shapiro [1984] model of informative advertising, the increased incentive for existing firms to advertise in response to a larger potential market has the same effect as entry. Axarloglou [1993] presents a variant of Weitzman's model in which multiproduct monopolists offer a wider range of goods at a lower markup in higher demand states. Both of these versions of the Salop model could be applied to monopolistically competitive retailers and thus could explain the price patterns emphasized in Section II.[18]

Pashigian and Bowen [1991] note that the brief sales early in the season may be "promotional sales" (or what some may call "loss-leaders"). The idea is to advertise one or more items at a low price with the aim of capturing customers either who buy other goods at full price on the same visit, or who develop "customer loyalty" and return to the store more or less regularly in the future.[19] Such models of customer loyalty as the one sketched briefly by Stiglitz [1984, pp. 353–54], or Bils' [1989] development of the Phelps and Winter [1970] model of optimal dynamic pricing policies, tend to imply that it is the entry of new, as yet uncommitted, customers that puts downward pressure on markups. These sorts of models provide the basis for a formal analysis of promo-

18. Pricing strategies designed to capture market share are known as "brand switching" in the marketing literature as discussed in Blattberg and Neslin [1989].

19. The marketing literature stresses increasing store traffic as an important incentive for price reductions. Increasing the volume of customers and thus increasing the potential for other purchases may very well be a key pricing strategy during the Christmas season. Such Christmastime purchases may also lead to buying later at full price. This is known as purchase reinforcement. See Blattberg and Neslin [1989].

tional sales. It seems probable to us that periods of high-volume shopping are characterized by the entry of many new consumers and thus are probably favorable environments for promotional sales.

Finally, there may be economies of scale and scope on the side of the retailer. Large orders may receive quantity discounts from the manufacturer, or at least have lower per-unit shipping costs. There is an important overhead component to the employment of salespeople. Though "contestability" (see, e.g., Tirole [1989]) or "potential competition" due to threatened entry of entirely new firms is not a plausible explanation of price variation over short periods, as noted above, entry and exit from niches in product space does appear to be a reasonable response to changes in temporary profit opportunities. In this manner, prices may be driven down in periods when average selling cost is low.[20]

IV. Possible Implications for Price Rigidity in Macroeconomics

A key stylized fact of the business cycle is that aggregate output volatility is large relative to the volatility of the general price level. An important strand of recent thinking in macroeconomics (see Blanchard [1988] and the papers in Mankiw and Romer [1991]) focuses on rationalizing the tendency of prices to move slowly, while explaining the volatility of output with reference to the behavior of imperfectly competitive firms that find it profitable to satisfy increased demand within the region where price exceeds marginal cost.

The present work has possible implications for price rigidity. On the one hand, we would be reluctant to push any business cycle analogies too far, as we are dealing with high frequency, anticipated disturbances, in contrast with the lower frequency, partly stochastic nature of the business cycle. On the other hand, weekend and holiday shopping appears to have the advantage of allowing us readily to identify an exogenous demand disturbance that can be interpreted as a purposeful and anticipated unevenness of expenditure over the week and over the season. The pricing patterns over the week and over the four months might conceivably shed some light on the dynamics of price change more generally. In

20. The cost-side explanations and our demand-side story have in common a dependence on a hypothesized increasing returns technology in the retail process as a whole.

particular, we identify two sets of issues. One involves the frequency of individual price changes and possible ramifications for the "menu cost" paradigm. The second concerns thick market effects, countercyclical markups, and the tension between output smoothing and the bunching of output that Hall has dubbed "temporal agglomeration."

Menu Costs, the Frequency of Individual Price Changes, and Aggregate Price Behavior

It is quite apparent that prices at individual outlets change rather frequently. This does not on its face support the emphasis on infrequently changing individual prices that is the hallmark of some papers cited in the New Keynesian literature (see Carlton [1986], Cecchetti [1986], and Kashyap [1991] on the empirical end and Mankiw [1985] and Blanchard and Kiyotaki [1987] on the theoretical side). Instead, the aggregate price level appears much more sluggish than prices of individual goods or at individual stores.[21]

Of particular interest to many macroeconomists is the apparent nonresponse of nominal prices in the short run to changes in the money stock. Lucas [1977] emphasizes the relative unimportance to the firm of monetary and macroeconomic shocks, in comparison with idiosyncratic demand developments. Retailers may change prices frequently in response to real seasonals in demand while not responding rapidly to innovations in money precisely because weekend and holiday effects are more "first-order" to the individual firm than are monetary disturbances.

Finally, it would be misleading to leave the impression that the frequent price changes in our data are a sign of classic price flexibility without noting the strong tendency for price to fluctuate between the regular price and at most a few sale prices, as mentioned in Section II. Such numbers as 10 percent and 20 percent are highly typical markdowns. While managerial costs of obtaining information alone can presumably explain much of this behavior, an additional consideration may be that such "traditional" sale prices help, in the case of temporary sales, to provide assurance to consumers that a markdown this week is not likely to be followed by an even larger markdown next week.

21. Warner [1993] documents the contrast between the nonseasonality of the aggregate CPI and the considerable seasonal price variation of disaggregated CPI categories.

Countercyclical Markups, Temporal Agglomeration, and Output Volatility

The bulk of retail activity takes place in the month or so preceding Christmas. Most would agree that this high level of shopping intensity can be regarded as largely exogenous, and thus the pre-Christmas season has the character of a demand-induced macroeconomic boom (see also Barsky and Miron [1989]). Weekends, too, have some of this property, with the Thanksgiving weekend of course representing the most extreme case.

The pricing patterns observed in our survey data (particularly price reductions on high-intensity shopping days) show some possible signs of thick market effects as discussed by Hall [1989]. Peak-load considerations do not cause prices to rise so as to smooth away the tendency for economic activity to bunch around weekends and the pre-Christmas period. Instead, peak activity is apparently associated with an increase in economic efficiency either in the form of reduced markups and increased competition or in the form of scale economies on the supply side. The possible relevance of these thick market economies in explaining business cycle behavior, though difficult to explore, certainly deserves consideration.

APPENDIX: OUTLET DESCRIPTION

Appliance Stores. These are stores in which various household durable goods are sold, including such items as kitchen appliances, stereos, VCR's, and televisions. Two of the stores in this group are chains located in various other states. The third store in this group is a local competitor.

Chain Department Stores. These are stores noted for carrying a wide variety of consumer items. These items are generally located at shopping malls, and most are found throughout the country.

Discount Department Stores. These are all chain department stores that have developed a reputation for charging lower prices.

Hardware Stores. This is a local hardware store that sells a line of mostly high quality power tools.

Toy Stores. These are two nationwide chains, and both sell an assortment of children's toys. One of the stores represented here has developed a reputation for charging lower prices.

Men's Clothing Store. This store sells an assortment of men's apparel.

Linen Store. This is a nationwide chain that specializes in household linens. It attempts to maintain a reputation for charging lower prices.

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