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Empirical Investigation on the Determinents of Retail Prices*

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Abstract

This study utilizes a rich data set from multiple retail chains to investigate the determinants of retail prices identified from marketing literature: wholesale price, retail competition, time elapsed since last promotion. The empirical results indicate that although all three factors are statistically significant in explaining the observed retail prices, they differ in the extent to which they explain retail price variation. The competing retail prices appear to explain more of variations in retail prices than other factors do. It is also found that a substantial variation in the pass-through of a brand exists across retailers. I also find positive cross-retail price responses, i.e., price reductions in competing retailers tend to lower the prices in a retailer. Regarding the impact of time since last promotion, the result supports the concavity of the effect of the variable. In terms of the direction, the overall effect of TLP is positive initially and then decays.

Keywords: Retail Prices, Wholesale Prices, Retail Competition, Promotion

INTRODUCTION

Retailers of consumer packaged goods take several factors into account when they make decisions on product prices. Retailers' pricing behaviors and their determinants have been major research issues among marketing researchers. According to the literature on retail pricing, retail prices of a brand in a repetitively purchased

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product category are affected by several factors the sources of which can be classified into two major types. One major source of the determinants of retail prices would be the behaviors of the supplier of goods such as brand manufacturers and wholesalers who make decisions on wholesale prices and trade promotion activities. The other source of the determinant of retail prices would the profit maximizing behaviors of the retailer who would take into account factors such as retail inventory levels and competition among retailers. Prevailing retail prices would be an outcome of the interaction among various factors from both sources.

Regarding the impact of manufacturers' behaviors and trade deals on retailer pricing, Lal, Little, and Villlas-Boas (1996) studied the profitability of trade promotions when retailers are allowed to forward buy and found that although the forward buying is profitable to the retailer as products are available at lower prices, forward buying can reduce the competition intensity among manufacturers which can leads to a higher level profitability for manufacturers than in the case where retailers' forward buying is not allowed. In a setting of markets with multiproduct retailers, Lal and Villas-Boas (1998) showed that retailers offer the same discount on different products sometimes but at other times they offer a smaller discount on a brand with a bigger trade promotion support. An important observation that can be made from the results of theoretical models on the role of trade deals in retail pricing is that retailers have an incentive to forward buy for profitability and that retailers do not fully pass-through trade deals to consumers. Such prediction is well supported empirically. Besanko, Dube, and Gupta (2005) studies the pass-through behavior of a major U.S. supermarket chain for 78 products and found that pass-through varies substantially across products and across categories. From their cross-sectional study, they found that the average pass-through rates are over 60% for 9 out of 11 categories, indicating that the wholesale prices and trade deals are still important determinants of retail prices although retailers do not fully pass-through trade deals.

Some empirical studies try to describe and explain weekly variations in retail prices and study the impact of various factors on retail prices. Pesendorfer (2002) investigated sales or temporary price reductions in ketchup products in Springfield, Missouri and found that intertemporal demand effects play a role in determining retail

prices. That is, the demand increases as time elapses since the last sale and temporary price reductions in ketchup products are well explained by the time periods since the last promotion. Chintagunta (2002) studied the category pricing behavior of a retailer using an empirical model in which the retailer's pricing equation is derived from the category profit maximization behavior. Specifically, he investigated the extent to which three factors affect retail prices. The first factor is the side payment from manufacturers to the retailer other than regular trade promotion. The second component is the retailer's incentive to promote its own store brands in addition to the profit maximization incentive. The third one is retail competition and store traffic. He decomposed the retail price of a brand into effects due to wholesale prices, markup from the category profit maximizing behavior implied by the demand function, additional side payments, retail competition, and the retailer's objectives for the store brand and found that the retail appears to take side payment from manufacturers into account when setting retail prices and to try to maximize the share of the store brand in addition to the category profit.

This paper also aims to study empirically the determinants of retail prices. Specifically, it attempts to contribute to the literature by comparing the importance of various factors that were separately studies in existing studies. This study is differentiated from previous ones in that wholesale price, retail competition, and intertemporal demand effects are simultaneously considered in to explain weekly variations in retail prices. Unlike Shankar and Bolton (2004) who study retailers' choice pricing strategy between Hi-Lo and EDLP, my study is interested in retailers' weekly pricing behaviors. So this study looks into the issue of figuring out the relative importance of three major factors in retailers' weekly pricing decisions. I identify three alternative views on major players in determining retail price variations. The first view is that manufacturers drive retail prices. In this view, wholesale prices would be the key determinant of retail prices. The second view is that competing retailers drive retail prices. As a retailer competes for customers with other retailers in the same market, the retailer should want to remain competitive in prices. In this view, other retailers' prices would be the key variable explaining retail prices. The third view is that low value consumers drive retail prices. The existence of the low value consumers who buy on promotions only would offer an incentive for the retailer

to engage in price discrimination between regular consumers and deal-prone consumers. Thus retailers would set retail prices below a regular level from time to time in order to serve the low value segment while regular consumers are served evenly across periods. Therefore, in this view, the elapsed time since the recent promotion would determine retail prices.

While existing studies have investigated the extent that some of those factors drive retail prices, this study is differentiated in that it tries to account for three factors simultaneously. This is enabled by the use of a rich data set that contains information on wholesale prices as well as on retail prices in competing retailers. While Pesendorfer (2002) did not consider the impact of wholesale prices, this study take wholesale prices into account. In Chintagunta (2002), the data set is from one single retail chain and therefore competitive forces in retail are captured indirectly through store traffic to the focal retailer. Such indirect approach, however, may not capture the true impact of retail competition on retail pricing since store traffic can be influenced by factors other than competitive forces among retailers such as seasonality. In contrast, my study utilizes data from several major retailers in a market so that the impact of prices in other retailers is directly measured.

This paper is organized as follows. The following section provides a detailed description on the data set. Then, the model and the empirical results are presented, followed by conclusion and suggestion for future research direction.

DATA

An account level scanner data set collected in a western city in the United States is used for this study. The data set contains information on weekly chain level retail prices, wholesale prices, retail promotion activities of four major brands in a consumer packaged goods category at three competing retail chains in a regional market. The availability of retail prices at competing stores is a major feature of the data set that enables a direct assessment of the effect of the prices of other retailers on retail prices. There are 114 weeks in the data set. Table 1 presents descriptive statistics of retail prices and wholesale prices of four brands in three retailers. As presented in table 1, there are enough variations in retail prices

Table 1. Retail Prices and Wholesale Prices

		Mean	Std. Dev.	Min.	Max.
Retail Prices					
R1	B1	5.4531	0.5202	4.1336	6.5593
	B2	4.4579	1.0283	3.2068	6.5898
	B3	4.9103	0.6158	3.1042	6.1569
	B4	4.7567	0.6147	3.5114	5.9972
R2	B1	5.4884	0.6442	2.9844	6.4187
	B2	4.4742	0.7298	3.0565	5.7056
	B3	4.7230	0.5600	3.0577	5.7373
	B4	4.8200	0.5452	2.8571	5.6661
R3	B1	4.9684	0.7278	3.7040	6.7462
	B2	4.0036	0.5683	3.3099	4.9982
	B3	4.3919	0.6751	3.2940	5.8789
	B4	4.6169	0.8493	2.7240	6.1312
Wholesale Prices					
	B1	4.8755	0.5897	3.6898	5.7485
	B2	2.8746	0.1749	2.7816	3.3970
	B3	3.0500	0.3724	2.8058	4.0691
	B4	3.2505	0.3199	2.8888	3.9381

across weeks. Standard deviations of weekly prices are more than 10% of the average prices for most brands. Although all brands in the data set are national brands, substantial variations across brands are also observed. Brand B1 is the most expensive among all brands in all retailers, 20% more expensive than the cheapest brand B2. I also observe substantial variations in retail prices across retailers. Retailer R3 tends to have lower average prices than others while retailers R1 and R2 have similar price levels. Average retail prices at retailer R3 are around 10% lower than those at other retailers.

Interestingly, R3 engages in promotions less frequently than other retailers as shown in table 2. Table 2 presents descriptive statistics of the time elapsed since last promotion. If there is any feature or display activity in a week, that week is recorded as promotion week. Obviously, promotion frequency varies across brands. For example, on average, brand B1 is put on promotion in every 3.54 weeks in retailer R1. But it would take 13.11 weeks on average for B2 to be promoted in the same retailer. Retailers are homogeneous in the

Table 2. Time Elapsed since Last Promotion (TLP)

		Mean	Std. Dev.	Min	Max
R1	B1	3.54	2.93	1	13
	B2	13.11	10.86	1	42
	B3	3.90	3.32	1	14
	B4	6.00	5.38	1	23
R2	B1	4.05	3.00	1	14
	B2	10.97	11.12	1	43
	B3	3.46	3.18	1	15
	B4	5.92	5.14	1	24
R3	B1	7.81	5.12	1	22
	B2(1)	n.a.	n.a.	n.a.	n.a.
	B3	4.53	3.42	1	15
	B4	9.82	7.03	1	28

(1) There is no promotional activity for B2 in R3 during the data period.

sense that the order of promotion frequency among brands is quite consistent across retailers. That is, brand B1 and B3 are mostly frequently promoted while B2 is the least frequently promoted in all retailers. However, retailers are heterogeneous in the average level of promotion frequency. Retailer R3 engage in feature or display promotion less frequently than other retailers. It would take 7.81 weeks for brand B1 to be promoted in R3 while R1 and R2 promote that brand in every 3.54 week or 4.05 week respectively. B2 is not promoted in R3 during the data period. Combined with retail price information, it can be concluded that retailer R3 has lower average prices and engages in feature and display promotions less frequency than other retailers do.

As presented in Table 1, wholesale prices are the same across retailers, consistent with Robinson-Patman act which requires the seller to offer the same price terms to customers at a given level of trade. That is, manufacturers or wholesalers are supposed to offer the same wholesale prices to all retailers in the same region. Wholesale prices also show enough weekly variations for most brands. Standard deviations are more than 10% of the average wholesale prices. One exception is brand B1 which has a very small variation in wholesale prices but a relatively large variation in retail prices. Brand B1 has the highest wholesale prices and B2 has the lowest. It appears that retailers do not make as much profit per unit

Table 3. Within-Chain Market Shares

		Mean	Std. Dev.	Min	Max
R1	B1	0.2715	0.0870	0.0726	0.5462
	B2	0.0633	0.0286	0.0055	0.1498
	B3	0.5295	0.0888	0.3193	0.8659
	B4	0.1358	0.0461	0.0561	0.2952
R2	B1	0.2503	0.0820	0.1163	0.6324
	B2	0.0626	0.0319	0.0246	0.1509
	B3	0.5862	0.0902	0.3043	0.8026
	B4	0.1009	0.0582	0.0287	0.4105
R3	B1	0.2269	0.0748	0.1131	0.4196
	B2	0.0448	0.0162	0.0235	0.1059
	B3	0.5964	0.0936	0.3299	0.7854
	B4	0.1319	0.0840	0.0494	0.5168

from B1 as they make from other brands. Price-cost margin from B1 is around 12% at retailers R1 and R2 and it is only 2% at retailer R3. But price-cost margins of other brands are more than 45% in retailer R1 and R2, and more than 39% in the cheapest retailer R3.

Based on volume sales information, I compute within-store market shares among the four brands. As presented in Table 3, I find similar patterns in the within-store shares across retailers. On average, brand B3 has the highest shares, ranging from 53% to 60%. Brand B2 is the weakest brand among the four. The average market shares very similar across retailers while the average retail prices are substantially lower in retailer R3. This implies that the overall lower prices at retailer R3 does not provide any advantage or disadvantage to any brand. More importantly, any possible difference in retailer pricing among retailers cannot be related to relative market shares among brands.

ANALYSIS

In order to describe the weekly variations in retail prices, a multiplicative model is used. That is, the following regression model is used to capture the effects of three factors—wholesale price, retail competition, and low value consumers.

$$\log P_{rjt} = \alpha_{rj} + \beta_{rj} \log \omega_{jt} + \sum_{s=1, s\neq r}^{3} \gamma_{rsj} \log P_{sj,t-1} + \delta_{rj1} TLP_{rjt} + \delta_{rj2} TLP_{rjt}^2$$

where P_{rjt} is the retail price of brand j at retailer r during week t,
ω_{jt} is the wholesale price of brand j during week t,
and TLP_{rjt} is the time elapsed since last promotion on brand j at retailer r.

In the model, β captures the effect of the wholesale prices on retail price. It measures the pass-through rate of wholesale prices on retail prices. I use log-log specification as done in Besanko, Dube, and Gupta (2005). One would expect β to be positive. The impact of retail competition is captured through γ. The coefficients of the lagged competitors' prices, γ_{rsj}'s, are the effects of the lagged price of brand j at a competing retailer s on the price of the same brand at retailer r. Note that I use lagged retail prices as explanatory variables. There are two reasons for using lagged prices. First, it would take some time for a retailer to monitor and respond to competing retailers' prices. Second, econometrically, using lagged prices instead of current period prices as explanatory variables can remove the concern of the possible simultaneity. The sign of γ describes the nature of the interaction among retailers. If a retailer's price promotion ignites price competition among retailers, γ would be positive. The coefficient δ captures the effect of the time elapsed since last promotion. I use a quadratic specification to allow for possible concavity or convexity in such effect.

The estimation results of the regression model are presented in Table 4. As expected, the pass-through rates, β's, are estimated in general to be positive. For retailers R1, the pass-through rates of B3 and B4 are significantly positive. For retailer R2, the pass-through rates of B2 and B3 are positively estimated. Although the estimates of the pass-through rates of B2 in R1 and B4 in R2 are negative, they are not statistically significant. For R3, three estimates of pass-through rates are significantly positive while the pass through of B2 is negative. One notable observation would be that, within a brand, the pass-through varies substantially across retailers. The pass-through of B1 is insignificant in R2 but significantly positive in R1 and R3 with its magnitude larger in R3 than in R2. For B2, the pass-through is negative in R1 and R3 but positive and more than 0.9 in R2. For B3 whose pass-through is significantly positive

Table 4. Estimation Results (Full Model)[1]

		Intercept (α)	Wholesale Price (β)	Lagged Price at R1 (γ)	Lagged Price at R2 (γ)	Lagged Price at R3 (γ)	TLP (δ_1)	TLP^2 (δ_2)	R^2
R1	B1	**0.8324**	0.1456		**0.1686**	**0.1886**	**0.0284**	**-0.0027**	0.2968
	B2	0.1554	-0.3104		**0.1487**	**1.0143**	-0.0009	0.0001	0.7717
	B3	0.6586	0.4861		0.0354	**0.1975**	**0.0333**	**-0.0034**	0.4980
	B4	0.2774	0.6541		**0.1540**	**0.1537**	0.0072	-0.0002	0.6795
R2	B1	**0.9002**	0.0181	**0.3979**		0.0540	-0.0038	0.0009	0.1367
	B2	-0.4743	**0.9545**	**0.3796**		0.2512	**0.0079**	-0.0002	0.4465
	B3	**0.7853**	**0.3683**	0.0954		0.1374	0.0100	**-0.0017**	0.3589
	B4	**1.0974**	-0.1997	0.2212		**0.2313**	0.0018	0.0000	0.2327
R3	B1	-0.1540	**0.5993**	**0.4180**	0.0062		0.0241	-0.0012	0.5173
	B2[2]	**0.8441**	**-0.2877**	**0.5038**	0.0647		n.a.	n.a.	0.7690
	B3	**0.0980**	**0.7642**	**0.2650**	0.0047		0.0369	-0.0022	0.4540
	B4	**-0.6443**	**1.1575**	0.0321	**0.4328**		**0.0163**	**-0.0006**	0.5683

(1) Estimates in bold faces are statistically significant at 5% level of significance.
(2) No promotional activity is observed for B2 at R3.

in all retailers, the magnitude of the pass-through is substantially larger in R3 than in other retailers. The cross-retailer variation of the pass-through is more dramatic when it comes to brand B4. R3 passes through the wholesale level discount of that brand more than it receives. A 1% discount in wholesale price of B4 would result in a 1.1575% discount in retail price in R3. But R1 would respond to such a discount in wholesale price by lowering its retail price by 0.6541% only and R2 may not change its retail price. In summary, the results indicate that pass-through varies across brands within a retailer and across retailers within a brand. It has been already found by Besanko, Dube, and Gupta (2005) that pass-through varies substantially across products and categories in a retail chain. In addition to their findings, my study contributes to the literature with additional finding that the pass-through of a brand varies across retailers. Unlike Besanko, Dube, and Gupta (2005) who used data from a single retail chain, I use data from multiple chains so that such finding can be made. Note that the within-chain brand market shares do not show such variations as shown in table 2. So the cross-retailer variations in pass-through rates cannot be related to relative brand shares differences among retailers. Interestingly, the brand, category, or market specific variables used in the study by Besanko, Dube, and Gupta (2005) cannot be used to explain such cross-retail variations because those variables are common to all retail chains in the same market and the within-chain brand shares are similar across retailers.

Competing retailers' prices have significant impacts on retail prices. Out of 24 estimates of the effect of lagged prices at competing retailers, γ's, 13 estimates are significantly positive. Others are positive but insignificant. Thus, in general, promotions such as temporary price reductions in competing retailers tend to lower the prices in a retailer.[1)] Note that this result is consistent with the result of Chintagunta (2002) who finds that the retail prices are lower than the sum of wholesale prices and economic margins because the retailer take the store traffic into account. The finding of my study verifies his claim using direct information on competing retailers' price showing that a retailer would lower its price if

1) As noted earlier, lagged prices are used to remove the possible concern of simultaneity. Nevertheless, I also estimate the model using current prices at competing retailers instead of lagged prices and find similar results. The results are available upon request.

competing retailers offer lower prices. It appears that the magnitude of such effects are asymmetric among retailers. For example, a 1% reduction in the price of B1 in R1 would lead to a 0.4180% reduction in the price of that brand in retailer R3 while the same discount in R3 would lead to a 0.1886% reduction in R1.

The time elapsed since last promotion (TLP) also appears to affect retail prices. I find significant effects of TLP on retail prices for B1 and B3 in R1. In R2, such effects are observed for B2 and B3 but their magnitudes are substantially smaller than in other retailers. Since retailer R3 does not have any promotion on B2, the effect of TLP cannot be assessed for B2 in R3. In the other three brands, the time elapsed since last promotion has a significant impact on the price of a brand in retailer R3. All significant estimates of δ_1 are positive and those of δ_2 are negative. Thus I find that, in general, when the time elapsed since last promotion affects retail prices, its effect tends to be concave. The absolute magnitude of δ_1 is much larger than that of δ_2 in all cases, indicating that the total effect of TLP is positive initially. That is, retail prices are likely to be higher when the last promotion was made a long time ago than when it was made recently. The concavity indicated by the negativity of δ_2 implies such effect decays as time elapses further.

The signs of δ in this study might look contradictory to the results in Pesendorfer (2002) who finds that the probability of a sale, an event that a brand is priced below certain threshold, is increasing but concave in TLP. However, note that two major differences exist between two studies in the definition of the variables. First, any feature or display event is recorded as promotion in my study while a price discount or a sale is recorded as promotion in Pesendorfer (2002). Second, the dependent variable is the retail price itself in my study while Pesendorfer (2002) studies the probability of a sale. That is, I investigate the impact of time since last promotion on the continuous variation in prices without assuming a particular level of price threshold to define a sale event. In order to identify sale events, one needs to define baseline level price and sales volumes as done in Blattberg, Kim, and Ye (1996). Note that my study does not need to define sale events, which is indeed an advantage over studies that require identification of sales events separately. Figure 1 depicts the retail prices and the promotion timings of brand B1 in retailer R1. As depicted in the figure, prices of B1 in R1 tend to be lowest when they are accompanied with promotion activities. Immediately after

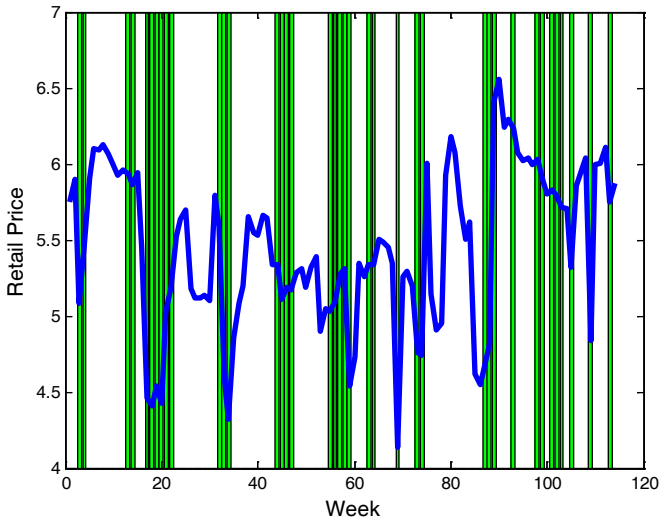

Figure 1. Retail Price and Timing of Promotion

promotions, prices tends to go up and pick later as predicted by the estimation results.

In order to assess the relative importance of the determinants of retail prices, I conduct three set of statistical tests on linear restriction on the regression coefficients. First, I test the restriction of $\beta = 0$ to check if wholesale prices indeed explain the variation in retail prices. Second, I test the restriction of $\gamma = 0$ to assess the importance of retail competition variables in explaining retail prices. Finally, I test the restriction of $\delta_1 = \delta_2 = 0$ to check if the retail price is affected by the time elapsed since last promotion. The test follows a standard Wald test procedure in which the estimated model in table 4 is used as the full model and the restriction in the null hypothesis is regarded as the deviation from the full model. The F-statistics values and their p-values are presented in table 5.

Since there is only one β in each regression equation, testing results for β in table 5 should be the same as in table 4. That is, β is not significant for B1 and B2 in R1 and for B1 and B4 in R2. As for the effect of retail competition, there are two γ's in each regression equation. In the joint test of two restrictions, it is found that, at 5% level of significance, only B3 in R2 shows insignificant impact of retail competition. As for the effect of TLP, B4 in R1 now shows significant impact of retail competition at 5% level of significance

Table 5. Testing Linear Restrictions

Null Hypothesis		No effect of wholesale price (β=0)		No effect of retail competition (γ=0)		No effect of TLP (δ=0)	
		F-stat.	P-value	F-stat.	P-value.	F-stat.	P-value
R1	B1	3.0037	0.0860	8.1245	0.0005	5.2033	0.0070
	B2	2.3817	0.1257	76.0390	0.0000	7.3454	0.0010
	B3	19.6276	0.0000	3.4502	0.0353	11.2984	0.0000
	B4	32.1160	0.0000	9.5750	0.0001	4.1336	0.0187
R2	B1	0.0240	0.8771	5.4865	0.0054	1.6085	0.2050
	B2	15.6339	0.0001	27.5138	0.0000	3.5772	0.0313
	B3	9.6140	0.0025	2.3189	0.1033	6.5425	0.0021
	B4	1.0418	0.3097	7.0116	0.0014	0.3512	0.7047
R3	B1	54.8654	0.0000	7.6541	0.0008	7.4536	0.0009
	B2[(1)]	5.4590	0.0213	147.7698	0.0000	n.a.	n.a.
	B3	35.1859	0.0000	3.5184	0.0331	7.6480	0.0008
	B4	29.6616	0.0000	7.8923	0.0006	3.4121	0.0366

(1) No promotional activity is observed for B2 at R3.

although the individual test cannot reject $\delta_1 = 0$ and $\delta_2 = 0$. This discrepancy occurs due to the possible correlation between TLP and TLP^2, which increases standard errors of δ_1 and δ_2 in the estimation. But there is a significant joint impact of TLP and TLP^2 jointly on retail price.

Overall, most of null hypotheses are rejected in table 5 indicating that all of three factors are significant in determining retail prices. Similar results are also obtained when using the test procedures based on loss of fit. So, regardless of the testing approach, the general conclusion that can be made from the formal tests of the restrictions would be that all three factors are relevant. In order to look into the gain of including additional factors, I estimate a few sub-models with reduced sets of explanatory variables. First, I estimate models with wholesale prices only. Second, models with competing retailers' prices only are estimated. Finally, models with wholesale price and retail competition but without TLP are estimated. By comparing the goodness-of-fit of the sub-models, one can get some insights on the extent to which the dependent variable is explained by each type of explanatory variable.

As presented in table 6, different variables play a major role in explaining the retail price fluctuation for different brand-retail combinations. The retail price of B1 in R1 is mostly explained by the prices at competing retail chains. R^2 of the model S1 is 0.1122 while that of model S2 is 0.2129 and that of the full model is 0.2968. This is more of the case when it comes to B2 in R1. R^2 of the model with competitors' price only is 0.7320 while that of the model with wholesale price only is 0.1380. However, when it comes to B4 in the same retailer, the wholesale price appears to perform better than competitors' price in explaining the retail prices. Obviously, the issue of which type of explanatory variable leads to a larger goodness-of-fit is brand-specific, i.e., different variables contribute to goodness-of-fit for different brands. Nevertheless, I compute the average R^2 to get an idea on relative performance of different variables. The average R^2 from the models with wholesale price only is 0.2406 while that from the models of competitors' price only 0.3511. Although I do not present in the table, I estimate a model with TLP variables only. The average R^2 from the models with TLP only is 0.1293. Thus competitors' price leads to a larger value of R^2 than wholesale price or TLP does in this data set. The average R^2 from the models with wholesale price and competitors' price is 0.4316 while the average

Table 6. Estimation Results (Restricted Models)[1]

		Model S1: Wholesale Price Only			Model S2: Competitors' Price Only					Model S3: Wholesale Price + Competitors' Price					
		a	β	R^2	a	$\gamma 1$	$\gamma 2$	$\gamma 3$	R^2	a	β	$\gamma 1$	$\gamma 2$	$\gamma 3$	R^2
R1	B1	**1.2685**	**0.2678**	0.1122	**0.9956**		**0.1722**	**0.2536**	0.2129	**0.8992**	0.1225		**0.1735**	**0.1913**	0.2284
	B2	**2.9666**	**-1.4212**	0.1380	-0.4578		**0.1345**	**1.2565**	0.7320	0.0102	-0.3873		**0.1688**	**1.1757**	0.7403
	B3	**0.8092**	**0.6974**	0.3554	**0.6744**		0.2476	0.3586	0.2815	**0.5900**	**0.5088**		0.1175	**0.1685**	0.3919
	B4	**0.3372**	**1.0346**	0.5789	**0.6704**		**0.1573**	**0.4204**	0.4881	0.1468	**0.7520**		**0.1753**	**0.1641**	0.6547
R2	B1	**1.4397**	**0.1614**	0.0243	**0.9546**	**0.3991**		0.0409	0.1086	**0.9151**	0.0588	**0.3943**		0.0125	0.1107
	B2	**1.3973**	0.0826	0.0007	**0.7245**	**0.4009**		0.1240	0.3484	-0.2863	**0.8071**	**0.4163**		0.2247	0.4095
	B3	**0.9402**	**0.5446**	0.2325	0.7548	0.3040		**0.2104**	0.2358	**0.7064**	**0.3226**	**0.1966**		0.1153	0.2805
	B4	**1.1252**	**0.3757**	0.0910	**1.0063**	0.1559		0.2106	0.2178	**1.0649**	-0.2093	**0.2453**		**0.2427**	0.2277
R3	B1	**0.4747**	**0.7085**	0.3811	**0.5272**	**0.6212**	0.0089		0.1894	-0.0597	**0.6142**	**0.3865**	0.0175		0.4500
	B2	**2.3500**	**-0.9238**	0.1425	**0.5263**	**0.5405**	0.0384		0.7574	**0.8441**	**-0.2877**	**0.5038**	0.0647		0.7690
	B3	**0.6114**	**0.7733**	0.3442	**0.4589**	**0.4969**	0.1452		0.2516	**0.3991**	**0.6000**	**0.2482**	0.0077		0.3759
	B4	-0.1268	**1.3980**	0.4857	-0.1805	**0.7625**	**0.3279**		0.3898	**-0.5884**	**1.2291**	0.0362	**0.3858**		0.5407
Average R^2				0.2406					0.3511						0.4316

(1) Estimates in bold faces are statistically significant at 5% level of significance.

R^2 from the full models is 0.4509, indicating most variations in retail prices can be explained by wholesale price and competitors' price.

SUMMARY AND DIRECTIONS FOR FUTURE RESEARCH

This study utilizes a rich data set to investigate the determinants of retail prices. From marketing literature, three important determinants of retail prices are identified: wholesale price, retail competition, time elapsed since last promotion. Since the data set used in this study contains information on retail prices from multiple retail chains competing in a regional market, I can assess directly the impact of competing retailers' price on other retailers' pricing without relying on indirect variables such as store traffic. The empirical results indicate that all three factors are significant in explaining the observed retail prices. Although all of three factors are statistically significant, they differ in the extent to which each factor explains retail price variation, i.e., contributions to goodness-of-fit. It is observed that the competing retail price explains more of variations in retail prices than wholesale price or time since last promotion does.

It is also found that a substantial variation in the pass-through of a brand exists across retailers, which cannot be explained by the brand, category, or market specific variables used in Besanko, Dube, and Gupta (2005) as those variables are common to all retail chains in the same market and the observed within-chain brand shares are similar across retailers. I also find positive cross-retail price responses, i.e., promotions such as temporary price reductions in competing retailers tend to lower the prices in a retailer. Regarding the impact of time since last promotion, the result supports the concavity of the effect of the variable. In terms of the direction, the overall effect of TLP is positive initially and then decays. This result is contrasted with Persendorfer (2002) who investigates the effect of TLP on the probability of a sales.

The outcomes of this study also produces some interesting directions for further research. First, the finding of cross-retailer variation in pass-through of a brand is new and the determinants are yet unexplored. It would be interesting what retailer-specific factors are related to such variations in pass-through. Such study would require information from many retailers in order to generate

generalizeable results Related to this issue, it is found in this study that pass-through varies across retailers but within-chain brand shares are stable across retailers. So it would be a nice venue for further study if one can address what factors and how those factors are related to such phenomena. Finally it would be interesting to check exactly what leads to the discrepancy between my study and Pesendorfer (2002) on the direction of the overall effect of time since last promotion.

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