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Research Note: On Storekeepers' Pricing Behavior

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This research note deals with a quantitative analysis of differences in percentage gross margin between individual stores in the retail trade. A number of hypotheses on pricing behavior of storekeepers are tested using Dutch survey data from nine different types of retail stores. We define percentage gross margin as a percentage mark-up on costs and make a distinction between out-of-pocket and remaining costs. It appears that the remaining costs are not always passed on completely into the percentage gross margin. This result can be explained in two ways: competition is possibly so heavy that storekeepers are not always in a position to pass on completely their remaining costs, or storekeepers are not very careful about passing on this type of cost to customers. Another finding is that percentage gross margin is inversely related to sales size due to the fact that a higher sales size requires a lower percentage of sales to achieve a given basic reward for storekeepers' labor. Percentage gross margin is of course affected by the competitive strength of a store. This influence is approximated by a store's sales

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growth. There seems to be a lag with respect to the effect of sales growth on the percentage gross margin. Furthermore, it appears that the percentage gross margin is, in general, higher for stores located in high population areas.

This note is a quantitative analysis of pricing behavior of storekeepers in the retail trade. A number of hypotheses concerning this behavior are tested and a quantitative relationship to explain the variation in percentage gross margin among individual stores is developed.

In economics literature "mark-up rule" or average cost pricing often appears as a basis for pricing behavior. It can be shown that mark-up pricing practices are compatible with a number of hypotheses professing to explain the behavior of the firm (Koutsoyiannis 1975). A mark-up relationship is useful in describing pricing behavior and is widely accepted. The "mark-up rule" will be a maintained hypothesis throughout this note. It is important to realize that we are interested in the percentage gross margin of an individual store rather than the average price of the products sold by a store. The percentage gross margin is defined as sales revenue minus purchase expenses expressed as a percentage of sales revenue.

Nooteboom (1985) developed a mark-up relationship which explains differences in average percentage gross margin among different types of stores. The focus of this note is on explaining the pricing behavior of individual stores within a retail category. We shall use some of the ideas developed by Nooteboom. Furthermore, we shall introduce specific microaspects.

PRICING BEHAVIOR OF INDIVIDUAL STOREKEEPERS

In order to understand the framework of a mark-up relationship for individual storekeepers, we must consider several aspects of Nooteboom's relationship, namely, operating costs, reward for storekeeper's labor and competitive strength.

Operating costs. Constructing a mark-up relationship on a microlevel, we are faced with the following question: What costs should be taken as the basis for the mark-up? It seems reasonable to take the percentage operating costs of an individual store excluding the reward for the storekeeper's labor as the basis.

On a microlevel, however, it is questionable whether all parts of the operating costs are treated equally by all storekeepers. For example, it is possible that storekeepers who own their establishment do not pass on their ratable value completely, especially when a strong competition

exists. Similarly, family labor, when valued at normal wage rates, is not passed on completely. In our study, therefore, we make a distinction between out-of-pocket costs and other costs. These same factors may also explain why stores with a negative net profit, when calculated on the basis of total operating costs, sometimes continue to exist.

Reward for storekeeper's labor. Following Nooteboom we assume that the mark-up is a function of the reward for a storekeeper's labor. We start with the idea of a basic reward, equal in value for all stores within a type of stores. This implies that the percentage mark-up is inversely related to sales size.

Strength of competition. Clearly, the competitive strength of a store is an important factor affecting the level of the percentage gross margin. Many variables determine competitive strength, such as, number of relevant competitors, distance to relevant competitors, store space as compared to that of competitors, market share of the store in a certain area, and so forth. All these variables were not sufficiently and consistently available in our samples. Therefore, we took another variable into consideration, namely, the sales growth of the store. This variable can be used to describe the store's competitive strength. A growing sales size is taken as evidence of a high competitive strength, which warrants a higher margin level.

Population size. Among the other variables that affect a store's percentage gross margin, the environment may be of particular importance. In this study we take only one additional variable into consideration—the size of the population within the store's market area. We expect a higher margin level when the population size in the store's market area is large, due to a high potential demand.

SOME HYPOTHESES CONCERNING PRICING BEHAVIOR

The above considerations lead to the formation of the following formal hypotheses.

Hypothesis 1

Storekeepers make a distinction between out-of-pocket operating costs and remaining operating costs in their pricing behavior. The out-of-pocket costs are passed on completely, whereas the remaining costs are not always passed on completely into the percentage gross margin. Remaining costs include ratable value, family labor costs, depreciations, and calculated interest.

Hypothesis 2

The percentage mark-up on operating costs is inversely related to the value of annual sales (Q) of a store. The coefficient of the variable $1/Q$ is an estimate of the basic reward for a storekeeper's labor.

Hypothesis 3a

The relative change in the value of annual sales of a store has a positive effect on the percentage mark-up on operating costs.

Hypothesis 3b

There exists a lag structure with respect to the effect of sales growth on the percentage gross margin of a store. (See equation 1.)

Hypothesis 4

Stores located in high population areas put a higher percentage mark-up on their operating costs than those located in low population areas.

THE DATA

Dutch survey data from the Research Institute for Small and Medium-Sized Business (E.I.M.) in Zoetermeer, The Netherlands, were used. We had at our disposal cross-section data from nine different types of retail (and handicraft) stores. A type of stores is defined as a group of establishments which has a certain homogeneity regarding assortment composition, service level, extent of own production, and so forth. The year of collection varies from 1979 to 1982, and the number of observations per type of stores varies from 60 to 170. More information on the data set is given in the appendix.

TESTS AND RESULTS

The hypotheses were tested simultaneously using one specification. Before presenting this specification, we must comment with respect to the variables sales growth and population size. We approximated the sales growth by the relative change in the value of annual sales of a store with respect to the previous year. The lag structure with respect to the effect of this sales growth variable is specified as follows:

$$\gamma\{\delta R_{it} + (1 - \delta)R_{it-1}\} \tag{1}$$

where $R_{it} = \dfrac{Q_{it} - Q_{it-1}}{Q_{it-1}}$, the relative change in the value of annual sales of store i in the year of collection (t)

γ = coefficient measuring the size of the effect of sales growth

δ = coefficient expressing the lag ($0 < \delta < 1$).

The above equation allows for the possibility that storekeepers do not react instantly to changes in the value of annual sales, the maximum lag being one year ($\delta = 0$).

With reference to the population size in the store's market area, we are faced with two shortcomings: first, only the population size in the township of the store is available, which does not necessarily correspond to its market area. Secondly, the population size is not continuously measured, but divided into eight classes. In spite of these shortcomings, we take this variable as a proxy for the population size in the store's market area. In our analysis we dichotomize the variable instead of considering eight classes.

The following equation is used to test the various hypotheses:

$$M_t = \alpha_1 COUP_t + \alpha_2 CREM_t + \frac{\alpha_3}{Q_t} + \alpha_4 \Delta R_{it} + \alpha_5 R_{it-1} + \alpha_6 DPOP_t + u_t, \quad (2)$$

where
i = index of the store
t = index of the year of collection
M = percentage gross margin
$COUP$ = percentage out-of-pocket operating costs
$CREM$ = percentage remaining operating costs excluding the reward for a storekeeper's labor
Q = value of annual sales at current prices
$\Delta R_t = R_t - R_{t-1}$
$\alpha_4 = \gamma\delta$ (See equation 1 for the definition of R, γ, and δ)
$\alpha_5 = \gamma$
$DPOP$ = 1 if the population size in the township of the store exceeds 20,000 persons
= 0 elsewhere
u = stochastic disturbance term
α_1 through α_6: coefficients to be estimated

If our hypotheses are correct, the empirical estimates should satisfy the following conditions:

* $\hat{\alpha}_1$ does not significantly differ from one (H_1). (3)
* $\hat{\alpha}_2 \leqslant \hat{\alpha}_1$ (H_1)
* $\hat{\alpha}_5 > 0$ (H_{3a})

* $0 < \frac{\hat{\alpha}_4}{\hat{\alpha}_5} < 1$, where $\frac{\hat{\alpha}_4}{\hat{\alpha}_5} = \hat{\delta}$ (H_{3b})

* $\hat{\alpha}_6 > 0$ (H_4)

Moreover, $\hat{\alpha}_3$ is an estimate of the basic reward for a storekeeper's labor in the year of collection (see H_2).

The estimation results are given in Table 1. The following conclusions can be drawn regarding the hypotheses formulated:

H_1: $\hat{\alpha}_1$ (out-of-pocket operating costs) does not differ significantly from one in six out of nine cases. Additionally, $\hat{\alpha}_2$

TABLE 1

Estimates of Coefficients of Relationship (2)

Type of Stores	Out-of-Pocket Operating Costs ($\hat{\alpha}_1$)	Remaining Operating Costs ($\hat{\alpha}_2$)	Reward for Storekeeper's Labor ($\hat{\alpha}_3$)	Sales Growth ($\hat{\alpha}_4$)	Sales Growth ($\hat{\alpha}_5$)	Population Size ($\hat{\alpha}_6$)
Textiles stores	.861	1 262	18520	.217	.245	.035
	(.057)	(.130)	(9060)	(.072)	(080)	(.013)
Supermarkets	1.129	.880	− 130	.035	078	.004
	(.053)	(202)	(18520)*	(027)*	(.029)	(.006)*
Superettes	1.134	569	18450	171	.193	017
	(.071)	(127)	(8120)	(.054)	(.052)	(007)
Electro-technical	955	.881	20570	.105	138	026
retailers	(047)	(.135)	(8260)	(.035)	(058)	(010)
Stationer's stores	916	.919	35010	.170	219	039
	(.060)	(.117)	(6030)	(.062)	(.062)	(012)
Furnishing firms	1 022	.673	37010	.027	148	—
	(036)	(.094)	(6250)	(.038)*	(.051)	
Shoe repair stores	1 082	.682	33260	.116	.614	167
	(.193)	(.193)	(5830)	(.239)*	(350)	(.059)
Record stores	990	.814	5098	.104	109	.033
	(.080)	(.146)	(5989)*	(.080)*	(105)*	(017)
Decoration stores	.942	1.019	31850	.117	.273	026
	(071)	(.138)	(8660)	(.092)*	(.185)*	(.020)*

The estimates were obtained by ordinary least squares We assumed that the disturbances u_t were independently and normally distributed with zero mean and constant variance Estimated standard errors ($\hat{\sigma}$) are printed beneath the estimated coefficients An asterisk (*) is printed next to the standard error of coefficient $\hat{\eta}$ if $|\hat{\eta}| < 1\ 645\ \hat{\sigma}(\hat{\eta})$, that is, if $\hat{\eta}$ is not significantly different from zero at a 10% level of significance.

(remaining operating costs) is less than $\hat{\alpha}_1$ in six cases, and significantly so in two. Only for textiles stores is $\hat{\alpha}_2$ significantly greater than $\hat{\alpha}_1$. This result is somewhat puzzling. Considering the overall results, we conclude that the hypothesis that storekeepers make a distinction between out-of-pocket costs and remaining costs cannot be rejected, although more research is required to obtain stronger results.

H_2: $\hat{\alpha}_3$ (reward for storekeeper's labor) is found to be positive in eight out of nine cases, and significantly so in seven of them. With respect to the seven cases where $\hat{\alpha}_3$ is significantly positive, the estimates vary from about 18,000 to about 37,000 Dutch guilders. (In the period considered, one U.S. dollar was about 2.50 Dutch guilders.) The standard errors of $\hat{\alpha}_3$ are considerably large: none of the estimates differ significantly from 30,000 Dutch guilders. The overall results are quite reasonable. The estimates for $\hat{\alpha}_3$ can be viewed as basic rewards for storekeeper's labor in the specific type of stores. The low values for supermarkets and record stores may indicate that storekeeper's income is indeed very low in these types of stores. We conclude that the hypothesis that the percentage gross margin is inversely related to sales size, the proportionality coefficient measuring the basic reward for storekeeper's labor, is supported by the data.

H_{3a}: $\hat{\alpha}_5$ (sales growth) is in excess of zero in all nine cases, and significantly so in seven. The parameter estimates vary from .078 to .273, except for shoe repair stores where $\hat{\alpha}_5 = .614$. It must, however, be noted that in this case the standard error is also relatively high (.350). The overall results indicate that the sales growth of a store has a positive effect on the percentage gross margin indeed. We find support for our hypothesis 3a.

H_{3b}: $0 < \hat{\alpha}_4/\hat{\alpha}_5 < 1$ in all nine cases. As mentioned above, we assumed that $\hat{\alpha}_4/\hat{\alpha}_5$ is an estimate of the lag with respect to the effect of sales growth. In some types of stores, storekeepers seem to react more instantly to changes in the value of annual sales than in other types of stores. Because of the fact that we used a linear estimation procedure to estimate the parameters, we were not able to estimate the standard errors of $\hat{\alpha}_4/\hat{\alpha}_5$. Nevertheless, we

conclude that the hypothesis that there exists a lag structure with respect to the effect of the variable sales growth is supported by the data.

H_4: $\hat{\alpha}_6$ (population size) is found to be positive in all eight cases where the population size in the township of the store was available, and significantly so in six. The parameter estimates that differ significantly from zero vary from .017 to .039, and in one case $\hat{\alpha}_6$ equals .167 (shoe repair stores). It is worth noting that $DPOP_i$ is a dummy variable. This means that the dimension of $\hat{\alpha}_6$ is percentage gross margin. Hence a coefficient of .039 (see stationer's stores) implies that stores which are located in high population areas have, in general, a four percent higher percentage gross margin than those which are located in low population areas. We conclude that the hypothesis that the population size positively affects the percentage gross margin of a store is supported by the data.

We also tested for the possibility of multicollinearity in the data. We did this by calculating the matrix of correlations between the independent variables per type of stores. (The precise results can be obtained from the authors.) Apart from the (low) correlation between the variables ΔR_t and R_{t-1} (due to the fact that $\Delta R_t = R_t - R_{t-1}$), the maximum absolute value of the correlation coefficients is .67, namely, between *COUP* and *CREM* for decoration stores. Often, squared correlation coefficients are used in literature. Here, the maximum squared correlation coefficient is about $.67^2 = .45$. From this we conclude that the danger that the results are influenced by multicollinearity is limited.

POOLING THE TYPES OF STORES

It may be interesting to see whether stronger results can be obtained when all observations are pooled. This seems possible in view of the estimation results—the variation in the parameter estimates over the types of stores is limited. Since the data for the different types of stores come from different time periods, we must correct the sales value figures for inflation. We decided to express the sales value figures in prices of 1982. If we assume that both the percentage variables (M_t, $COUP_t$, $CREM_t$, ΔR_{it}, and R_{it-1}) and the population size variable ($DPOP_t$) are more or less stable in the period 1979–1982, we can pool the data. Table 2 gives the estimation results with pooled data.

First of all, relationship (2) is estimated for the total sample (925 obser-

TABLE 2

Estimates of Coefficients of Relationship (2) with Pooled Data

		1	2
Number of observations		925	758
Out-of-pocket operating costs	$\hat{\alpha}_1$	1.003	.923
		(.019)	(.028)
Remaining operating costs	$\hat{\alpha}_2$	.782	.791
		(.046)	(.053)
Reward for storekeeper's labor	$\hat{\alpha}_3$	44190	43000
		(1630)	(1760)
Sales growth	$\hat{\alpha}_4$	.121	.130
		(.023)	(.031)
Sales growth	$\hat{\alpha}_5$	.209	.205
		(.028)	(.035)
Population size	$\hat{\alpha}_6$	—	.031
			(.006)

See note Table 1.

vations). In this relationship the variable $DPOP_t$ has been left out of consideration, since this variable was not available for furnishing firms. The estimation results are given in column 1 of Table 2. It appears that $\hat{\alpha}_1$ (out-of-pocket operating costs) and $\hat{\alpha}_2$ (remaining operating costs) differ significantly from each other: $\hat{\alpha}_1$ equals 1.00, which is exactly what we hypothesized, whereas $\hat{\alpha}_2$ equals .78, which is also in accordance with our hypotheses. It appears that the effect of sales growth is significantly positive ($\hat{\alpha}_5 = .21$), whereas the lag coefficient ($\hat{\alpha}_4/\hat{\alpha}_5$) is about .57, which means that storekeepers react to this year's sales growth to the same extent as to previous year's sales growth. Finally, it appears that the basic reward for storekeeper's labor is about 44,000 Dutch guilders (of 1982). This is quite reasonable in view of the Dutch wage rates in 1982.

If we leave the furnishing firms out of consideration, we can estimate the complete relationship (2) including the variable $DPOP_t$ for the remaining observations (758). These estimates are given in column 2 of Table 2. It appears that the variable $DPOP_t$ (population size in the township of the store) has a significantly positive effect on the percentage gross margin. Due to the presence of this variable (and the absence of the furnishing firms) the value of the coefficient $\hat{\alpha}_1$ (out-of-pocket operating costs) has slightly declined to .923. The remaining coefficients are about

the same. We conclude from the parameter estimates in columns 1 and 2 that the pooling of the data yields results such that all our hypotheses are supported.

CONCLUSION

In this research note we take a first step towards the development of a pricing relationship for individual stores. We use the mark-up rule as a maintained hypothesis. Several hypotheses were formulated concerning the storekeeper's pricing behavior, most of which were supported by the empirical analysis. We do not claim that the results in this note can be viewed as a complete description of storekeepers' pricing behavior, but we believe that the results support our basic hypotheses. The model can be extended toward a more complete relationship explaining the differences in percentage gross margin among individual stores. Further research should introduce more environmental as well as competitive variables into the relationship in order to increase the goodness-of-fit, as well as the degree of reality.

APPENDIX: DATA

In this appendix we give a description of the data set used in this study. First of all, we present a table which gives a general description of the samples used. Table

TABLE A_1

Description of the Samples Used

Type of stores	Number of Observations	Year of Collection
Textiles store	170	1979
Supermarket	89	1979
Superette	100	1979
Electro-technical retailer	89	1980
Stationer's store	109	1980
Furnishing firm	167	1981
Shoe repair store	60	1982
Record store	70	1982
Decoration store	71	1982

Some storekeepers did not report their sales values in previous years, which values were necessary to construct the variables ΔR_{it} and R_{it-1}. We left these storekeepers out of consideration in our study, and they are not part of the data set mentioned in Table A_1.

TABLE A_2

Further Description of the Samples

Code	$\frac{\min M_t}{\overline{M}}$ / $\max M_t$	$\frac{\min COUP_t}{\overline{COUP}}$ / $\max COUP_t$	$\frac{\min CREM_t}{\overline{CREM}}$ / $\max CREM_t$	$\frac{\min Q_t}{\overline{Q}}$ / $\max Q_t$	$\frac{\min \Delta R_{it}}{\overline{\Delta R}_t}$ / $\max \Delta R_{it}$	$\frac{\min R_{it-1}}{\overline{R}_{t-1}}$ / $\max R_{it-1}$	$\% DPOP_t = 1$
Textiles stores	.235	.032	.009	278,432	−.807	−.177	
	.358	.224	.076	1,052,015	−.072	.097	71
	.492	.474	.205	4,951,820	.303	.770	
Supermarkets	.158	.077	.007	1,342,980	−.857	−.102	
	.204	.150	.026	3,213,271	−.050	.133	42
	.252	.198	.078	6,792,372	.488	1.043	
Superettes	.131	.043	.008	475,039	−.319	−.171	
	.190	.104	.055	1,095,906	−.021	.075	43
	.246	.158	.148	3,448,162	.181	.352	
Electro-technical retailers	.170	.044	.009	289,242	−.334	−.197	
	.279	.172	.073	1,298,668	.089	−.002	54
	.435	.363	.233	4,681,605	.717	.293	

Stationer's stores	.227	.051	.010	229,522	−.335	−.112	
	.338	.187	.080	1,183,780	−.042	.113	69
	.496	.333	.228	5,645,540	.308	.483	
Furnishing firms	.277	.060	.009	189,390	−.685	−.295	
	.393	.255	.104	1,239,523	−.129	.064	—
	.538	.488	.279	4,200,736	.836	.575	
Shoe repair stores	.646	.058	.015	55,233	−.313	−.279	
	.795	.222	.174	173,388	.041	.028	82
	.847	.534	.668	481,589	.681	.373	
Record stores	.203	.040	.008	148,187	−.499	−.269	
	.291	.179	.082	784,731	.000	.012	69
	.461	.368	.332	2,340,832	.583	.523	
Decoration stores	.276	.043	.005	183,021	−.205	−.190	
	.398	.209	.100	531,918	.073	−.036	72
	.527	.451	.252	1,243,610	.509	.111	

M_t is percentage gross margin, $COUP_t$ is percentage out-of-pocket operating costs, $CREM_t$ is percentage remaining operating costs excluding the reward for storekeeper's labor; Q_t is value of annual sales; ΔR_{it} is defined as R_{it} minus $R_{it\text{-}1}$, where R_{it} is percentage change in the value of annual sales in the year of collection (t) with respect to the year before, and $R_{it\text{-}1}$ is analogously defined with t replaced by t-1, $DPOP_t$ equals one if the population size in the township of the store exceeds 20,000 persons, zero elsewhere. The percentage variables are divided by 100 Sales are expressed in Dutch guilders of the year of collection.

A_1 contains the type of stores, the number of observations, and the year of collection. These Dutch data were gathered by the field force of the Research Institute for Small and Medium-Sized Business in Zoetermeer, The Netherlands. In Table A_2 we give a further description of the samples. This table gives the minimum, the maximum, and the mean of several variables used in the study.

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