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THE OUTPUTS OF RETAIL ACTIVITIES: CONCEPTS, MEASUREMENT, AND EVIDENCE FROM U.S. CENSUS DATA

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THE OUTPUTS OF RETAIL ACTIVITIES: CONCEPTS, MEASUREMENT AND EVIDENCE FROM U.S. CENSUS DATA

Roger R. Betancourt and David A. Gautschi*

Abstract—We develop a new economic framework for the empirical analysis of retail margins. This framework formalizes the role of distribution services as outputs of retail activities. Our main results are the following: the measures of outputs of retail activities identified in the data perform as important and robust determinants of retail margins; variables that purport to capture oligopolistic features of market structure play a limited or no role in determining retail margins; quantity setting and price setting under the assumptions of profit maximization and monopolistic competition are categorically rejected by the data. The data base is information on 49 retail sectors from the 1982 U.S. Census of Retail Trades.

I. Introduction

DISCUSSIONS of retail activities often acknowledge that services are an important aspect of these activities but do not pursue the economic implications of this idea very far. The starting point of our analysis is that these distribution services are *outputs* of retail firms and *fixed inputs* into the household production functions of consumers. Among the economic consequences of this view is a simple but powerful theoretical framework for the empirical analysis of retail margins. Here we develop this framework and apply it to the analysis of U.S. 1982 Census data.

Retail firms provide consumers with a variety of distribution services which can be classified into five broad categories: accessibility of location, assortment, assurance of product delivery in the desired form and at the desired time, information, and ambiance. In their economic role as outputs of retail firms, higher levels of these services cost the firms more; in their economic role as fixed inputs of the households, higher levels of these services reduce costs for consumers. Each of these categories can have several dimensions. Some of these services, or aspects of them, are provided for all items in an assortment (thus we label them "common"); some of these services are provided for selected items in an assortment (thus we label them "specific"). Undoubtedly, it is difficult to capture all the dimensions of these concepts in our empirical measurements; nevertheless, we have developed a data base that contains empirical counterparts to these concepts comparable to what exists for other purposes at a similar level of aggregation (roughly the three digit level of the SIC).

While our specific approach is new, several strands of literature overlap with some part of our formulation. Our insistence on viewing a set of distribution services as outputs of retail firms is paralleled in the work of Oi (1990), who presents a list of these services under the heading of output of a retail firm. His list can be easily reconciled with the five broad categories identified above. Other writers tend to select one of these broad categories, or an aspect of them, and explore their economic implications at the theoretical or empirical level, e.g., Mathewson and Winter (1986) or Smith and Hitchens (1985), respectively. One contribution in this vein that is close to our work in its integration of theoretical and empirical considerations is Ratchford and Stoops (1988, 1992), who adapt to the analysis of retail activities a model developed by Ehrlich and Fisher (1982) for the analysis of the demand for advertising.

One strand of the literature on retail markets focuses on the analysis of price behavior, in particular explanations of price dispersion. For in-

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stance, Borenstein (1989) and Shepard (1989) appeal to price discrimination to explain price dispersion in retail gasoline markets. By contrast, Pashigian (1988) appeals to the increased uncertainty generated by an increased demand for fashion goods in order to explain the increased price dispersion generated by more frequent markdowns and higher percentage markups. Finally, Reinsdorf (1992) finds evidence from the consumer price index that there is substitution toward lower priced outlets after allowing for variations on some distribution services. These studies suggest consideration of the hedonic approach. A by-product of our analysis is to show that the data are inconsistent with the hedonic formulation.

Surprisingly enough, there is a paucity of studies seeking to explain retail margins with interindustry data. What makes this scarcity remarkable is the abundance of studies seeking to explain profit margins with the same type of data, e.g., Schmalensee (1988). The existing body of literature on the empirical explanation of variations in retail margins across retail sectors is primarily due to Nooteboom (1985) and his coworkers, for example, Nooteboom, Kleijweg and Thurik (1988). This literature is based on assuming a mark-up model in which different variables are added to capture empirically the role of other factors. A recent collection of sophisticated econometric studies from this perspective is available in Bode (1990). Our conceptual framework provides an alternative to this one.

Our argument proceeds in the following manner. Section II contains the main implications of the conceptual framework for the analysis of retail margins. Imposing quantity setting or price setting behavior under monopolistic competition allows additional implications for empirical analysis to be derived. These issues are presented in section III. The choice of functional form, measurement issues, the link between theory and data and estimation procedures constitute the subject of section IV. Results are presented in section V. Finally, a brief conclusion highlights our main findings.

II. Conceptual Framework

Consider the following definition of the retail margin (R), which follows from manipulating the definition of profits (π)[1]

$$R \equiv \pi/p^*X_1 + VQ/p^*X_1, \tag{1}$$

where p^* can be interpreted as a vector of retail prices or as a single retail price. Similarly, X_1 can be interpreted as a vector of quantities of items sold at retail or as the quantity of a single item. This identity simply states that the retail margin equals the ratio of profits to sales plus the ratio of the costs of retailing to sales.

By assuming cost minimizing behavior by retailers and by treating distribution services as outputs of retail firms, we can replace the numerator of the second term in (1) with a joint cost function (Betancourt and Gautschi (1988)) that is increasing in outputs, including $\underline{X}$ which represents a vector of distribution services. Similarly, assuming utility maximizing behavior by consumers and treating distribution services as fixed inputs into the production functions of consumers, we can replace the denominator in the ratio of the costs of retailing to sales by an inverse demand function (to analyze quantity-setting behavior) (Betancourt and Gautschi (1988)), or by a standard demand function (to analyze price-setting behavior) (Betancourt and Gautschi (1990, 1992)). These demand specifications imply $\partial p^*/\partial X_j > 0$ or $\partial X_1/\partial X_j > 0$, where X_j represents the jth distribution service.

At this point we have a theory for the second term in (1). It can be specified for empirical purposes as follows:

$$\begin{aligned} C(X_1, \underline{X}; V)/p^*(X_1, \underline{X}; r)X_1 &= f(X_1, \underline{X}; V, r) + \mu \\ &= C(X_1(p^*, \underline{X}; r), \underline{X}; V) \\ &\quad /p^*X_1(p^*, \underline{X}; r), \end{aligned} \tag{2}$$

where μ is a disturbance term with the usual properties and r is a vector of other variables that affect the household demand function. The interpretation of (2) will depend on whether one assumes quantity-setting or price-setting behavior. This topic is addressed in the next section.

To complete the specification in (1), we need a theory to explain the ratio of profits to sales.

[1] That is, $\pi \equiv p^*X_1 - pX_1 - VQ$, where p represents suppliers' prices, V is a vector of input prices, Q is a vector of input quantities and the other variables are defined in the text.

2

Fortunately, the voluminous literature on the empirical analysis of profit margins provides us with a well-established approach.[2] An excellent guide through the main issues is Waterson (1984, ch. 10) whose views, as modified by Mueller (1986, ch. 4), lead to the following specification:

$$\pi/p_1^* X_1 = k(c, \theta(b)) + \epsilon, \tag{3}$$

where c stands for concentration, b stands for barriers to entry, θ is the elasticity of demand and ϵ is a disturbance term.

This specification is consistent with a variety of market structures. If oligopolistic structures prevail, we would expect k to be positive. If the market structure is that of monopolistic competition or perfect competition, we would expect k to be zero. Since we don't expect markets to be observed in long-run equilibrium, even if k is zero firms could be experiencing nonzero profits under either perfect or monopolistic competition, in which case $E\epsilon = \beta_0 > 0$. This specification provides a convenient but weak test of whether competitive or noncompetitive market structures prevail in retail markets. That is, if concentration and barriers to entry are not "statistically significant" determinants of retail markets, we cannot reject the hypothesis that retail markets are characterized by either perfect or monopolistically competitive market structures.

To sum up, our conceptual framework leads to the following equation for the retail margin;

$$R = k(c, \theta(b)) + f(X_1, \underline{X}; r, V) + \epsilon^*, \tag{4}$$

where $\epsilon^* = \epsilon + \mu$.

III. Quantity-Setting vs. Price-Setting Behavior

By coupling the framework developed in the previous section with the assumptions of short-run profit maximization and monopolistic competition, it is possible to discriminate between price-setting behavior and quantity-setting behavior.

If we assume price-setting behavior we have from the second equality in (2) and from the use of the first-order conditions for short-run profit maximization under monopolistic competition[3]

$$\partial R/\partial X_j = [(p^* - p)X_1 - C]p^*(\partial X_1/\partial X_j)/(p^* X_1)^2 = f_j \tag{5a}$$

and

$$\partial R/\partial X_1 = a[C_1 X_1/C - 1]Cp^*/(p^* X_1)^2 = af_1, \tag{5b}$$

where $C_i = \partial C/\partial X_i$, $f_j = \partial f/\partial X_j$, and $a = 1/[\partial X_1/\partial \alpha]$[4] will be assumed positive.

The sign of (5a) will be positive (negative) when net revenues from retailing exceed the costs of retailing, i.e., when the retailing activity generates profits (losses). While the effect of a distribution service on the retail margin may be positive or negative, it must be of the same sign for all distribution services. This implication provides an exacting test of the price-setting hypothesis. From (5b) we conclude that the effect of explicit outputs on the retail margin is in general ambiguous but likely to be negative. If there is only a single output and the representative firm is in long-run equilibrium, it must operate on the increasing returns portion of the average cost schedule. Hence, $f_1 < 0$. If there are many outputs, then the proportionate contribution to total marginal costs of any one of them is likely to be less than total costs and $f_1 < 0$. Nonetheless, circumstances can be constructed in which $f_1 > 0$, for example, a single output case where the representative firm is not in long-run equilibrium and it operates on the rising portion of the average cost curve.

If we assume quantity-setting behavior (the first term in (2)), we have that the first-order conditions for profit maximization under monopolistic competition imply[5]

$$\partial R/\partial X_j = [p^* X_1 - C](\partial p^*/\partial X_j)X_1 = f_j > 0 \tag{6a}$$

and

$$\partial R/\partial X_1 = [C_1[p^* X_1 - C] - pC]/(p^* X_1)^2. \tag{6b}$$

[2] The ratio of profits to sales is used in this literature as an approximation to the price-cost margin, which is not directly observable because it depends on marginal costs.

[3] For any distribution service, profit maximization under price setting implies $(p^* - p)\partial X_1/\partial X_j = C_j + C_1 \partial X_1/\partial X_j$, Betancourt and Gautschi (1993).

[4] α is a demand shifter. This notation is necessary because X_1 is not a control variable under price-setting behavior.

[5] Profit maximization under quantity-setting behavior implies $C_j = (\partial p^*/\partial X_j)X_1$ and $C_1 = (p^* - p) + (\partial p^*/\partial X_1)X_1$ (Betancourt and Gautschi (1988, p. 133)).

From (6a) one can conclude that the effect of distribution services on the retail margin must always be positive and use this result as the basis for an exacting test of the quantity-setting hypothesis. Note that C includes only the costs of retailing and not the costs of goods sold; however, p^*X_1 is the total revenues from the product, including what must be used to cover the costs of goods sold. From (6b) we conclude that the effect of explicit output on the retail margin is ambiguous.

IV. Empirical Implementation

While economic theory does not normally provide much guidance in the specification of functional form, in this instance some features of the previous discussion suggest a characteristic of the functional form. In particular, equation (2) implies a functional form general enough to allow the marginal response of the retail margin to retail output and distribution services to be a function of these same variables. Thus, an additive linear specification of the second term in (4) is unacceptable on a priori grounds. We selected a logistic functional form for two reasons: parsimony and tractability. Regarding the specification of the determinants of the ratio of profits to sales, we follow Mueller (1986) in adopting a nonlinear specification of the first term on the right hand side of (4).

For estimation purposes, equation (4) becomes

$$R = \beta_0 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_8 X_9 + \beta_{11}(X_8)^2 + \beta_{12} X_8^2 + e^{\beta' X}/(1 + e^{\beta' X}) + \epsilon^* \qquad (4')$$

where $X = [X_0^*, X_1, \underline{X}]$ and β is a 1×8 vector of parameters that determines the sign of the response of the retail margin to output (β_1), common distribution services ($\beta_2 - \beta_6$) and specific distribution services (β_7).[6] The logistic in (4') allows us to capture the intrinsic nonlinearity implied by (2) with a minimum of 8 parameters. The quadratic specification in (4') is a standard one where X_8 is concentration (c) and X_9 is barriers to entry (b).

Our data source is the 1982 U.S. Census of Retail Trades: more specifically, the three Industry Series Reports (RC82 I-1, I-2, I-3).[7] These reports provide a wide variety of information for 49 retail sectors classified at the three digit level of the SIC code and in some instances (14 out of 49) at the four digit level.

Two common distribution services are especially well measured in our data. Accessibility of location (X_2) is one of them. It is measured as the number of establishments. Breadth of product assortment (X_3) is the other one. We develop two alternative measures for this output of a retail sector, a quantity based one and a value based one. The first one indicates for each sector the number of establishments carrying a product line (out of a universe of thirty product lines) relative to the total number of establishments; the second one measures breadth of assortment as the entropy in the distribution of sales across product lines in a sector. These variables and the one for accessibility of location are particularly good measures in terms of the correspondence between the empirical construct and the theoretical one.

Two other common distribution services are measured adequately in our data. Assurance of product delivery (X_4) is measured as the average of inventory holdings at the beginning and at the end of the year per establishment. Information is measured as advertising expenditures per establishment (X_5). While these empirical measures capture relevant aspects of the theoretical constructs, they also leave other aspects out. Ambiance (X_6) is difficult to measure. In our data it can be proxied by the gross value of assets in building and structures per establishment. Different sectors provide different levels of specific distribution services, i.e., those associated with a particular item or sets of items in the assortment. Since these services usually require labor resources, sometimes specialized ones, payroll per establishment (X_7) provides a reasonably good measure of these services. Concentration (X_8) will be measured by the four firm concentration

[6] X_0^* is a vector of ones with associated coefficient β_0^*. This intercept permits the right hand side of (2) to take a value other than 1/2 when the coefficients of all explanatory variables are zero. That is, if $\beta_1 = \beta_2 = \cdots = \beta_7 = 0$, the ratio of the costs of retailing to sales will equal $e^{\beta_0^*}/(1 + e^{\beta_0^*})$; otherwise, this ratio would be forced arbitrarily to equal 1/2, i.e., $e^0/(1 + e^0) = 1/2$.

[7] We are especially grateful to Mr. Howard Hamilton who provided a special tabulation with the information on the second of these three reports at a lower level of aggregation than what existed in the published series.

ratio and barriers to entry (X_9) will be measured by the ratio of multi-establishment firms to single establishment firms in a sector. Finally, the value of building rentals per establishment (X_1B) was used as an instrumental variable in some specifications.

The last measurement issue leads us into a discussion of estimation procedures. The output of the retail sector will be measured as sales per establishment X_1. Since the definition of the retail margin (R) is the following $(X_1 - CG)/X_1$, where CG is cost of goods sold per establishment, we encounter the possibility of an error in the variables problem. We address this issue by estimating (4') by nonlinear least squares as well as by nonlinear two stage least squares (Amemiya (1985), ch. 4, 8). In addition, we considered the following rewrite of (4'):

$$R = (X_1 - CG)/X_1 = h(X_1, \bar{X}) + \epsilon^*, \quad (7)$$

where $\bar{X}$ is the vector of all other explanatory variables. (7) implies

$$CG = X_1\left[h^*(X_1, \bar{X}) - \epsilon^*\right], \quad (8)$$

which has X_1 on only one side of the equation ($h^* \equiv 1 - h$). If (8) is corrected for heteroskedasticity using the predicted value for sales per establishment,[8] we have

$$\frac{CG}{\hat{X}_1} = \frac{X_1}{\hat{X}_1}\left[h^*(X_1, \bar{X}) - \epsilon^*\right]. \quad (9)$$

This issue thus leads to four versions of the model for estimation, (7) estimated by NLLS and by NL2S, (8) and (9).

An assumption imposed on the data is that the cost and demand function parameters are the same in each of the 49 sectors.[9] The data point for each sector represents a specific equilibrium in the retail market. An interpretation of this assumption is that the cost function embodies the range of techniques available for operating and the representative firm selects in each sector the levels of distribution services and items to provide to satisfy the demands of the representative consumer. In turn, the demand function embodies the range of options desired by the representative consumer *at different times* during a given calendar period, let us say a year. The representative consumer operates different consumption and purchase activities at nonzero levels at different times within the calendar period. Different equilibria result for the sectors as a consequence of the interaction between the representative consumer's demand at a particular time and the representative firm's ability to meet that demand in a cost minimizing framework. A second standard assumption imposed on the data is that the parameters which capture the effect of concentration and barriers to entry are the same across retail sectors.

V. Results

Because the nonlinearity of the functional form is a unique prediction of our theory, it is useful to consider first a test of functional form. A simple linear regression of the predicted value from the nonlinear estimation of (7) on the retail margin yields an R^2 of 0.9105; the R^2 in the corresponding linear regression with the same explanatory variables is 0.5403. To supplement this descriptive information on our choice of functional form, we performed a nonnested hypothesis test. While these tests are often inconclusive, the results were clear-cut in our case. If one uses the linear model as the null hypothesis, the artificial embedding procedure known as the J-test (McKinnon, White and Davidson (1983)), leads to a rejection of the hypothesis that the nonlinear model contains no additional information for explaining the retail margin at the 1% level of significance. Conversely, if one uses the nonlinear model as the null hypothesis, one must accept the hypothesis that the linear model contains no additional information for explaining the retail margin at the 1% level of significance.[10]

For the three models estimated by nonlinear least squares (NLLS), three classical joint tests of hypotheses were performed (these tests are based on equation (4.3) in Amemiya) and are presented in table 1.[11] Based on the first column of table 1

[8] The predicted value of sales per establishment was obtained in a regression using all other exogenous variables and the value of building rentals per establishment as explanatory variables.

[9] We should note that we are not seeking to identify separately the cost and demand parameters with our data.

[10] All results reported here are based on the quantity index of assortment. The results for the entropy index of assortment are almost identical and they are available in an earlier version of the paper.

[11] These F-tests are not valid for the model estimated by nonlinear two stage least squares.

5

TABLE 1.—MODEL COMPARISON STATISTICS

Model[a]	Classical Test Statistics		
	F^b	F^c	F^d
R	27.43	4.79	42.99
C	6,083	0.36	25.19
CC	171	4.95	43.30
Critical Values of F at 0.01	3.18	4.23	3.58

[a] R corresponds to estimates of (7); C corresponds to estimates of (8); and CC corresponds to estimates of (9).
[b] Observed value of the F-statistic when all coefficients, except for β_0, are set to zero ($\beta_0^* = \beta_1 = \cdots = \beta_{12} = 0$).
[c] Observed value of the F-statistic when the five coefficients of the determinants of the ratio of profits to sales are set to zero ($\beta_8 = \cdots = \beta_{12} = 0$).
[d] Observed value of the F-statistic when the eight coefficients of the determinants of the ratio of the costs of retailing to sales are set to zero ($\beta_0^* = \beta_1 = \cdots = \beta_7 = 0$).

(F^b), we reject the null hypothesis that the variables identified as determinants of the ratio of the costs of retailing to sales and of the ratio of profits to sales have no effect on retail margins at the 1% level of significance. Similarly, based on the third column (F^d) we reject the null hypothesis that the variables identified as determinants of the ratio of the cost of retailing to sales have no effect on the retail margins at the 1% level of significance. The last result in particular is a powerful endorsement of the analysis of retail activities underlying our empirical work. It implies that the outputs of retail activities identified and measured here need to be incorporated into the analysis of this service sector. Our remaining classical hypothesis test reported in the second column (F^c) yields mixed results. Moreover, the value of the F-statistic is considerably lower than in the other two tests.

Turning to the individual results presented in table 2, just as one would expect from the joint hypotheses tests, most of the variables identified as distribution services or outputs of retail activities have statistically significant coefficients using 2 as the critical value. This is true to some extent with all four econometric specifications, especially if we consider the restricted models where only these variables are included. One would also expect from the joint tests that variables identified as determinants of profit margins would not have statistically significant coefficients using 2 as the critical value. This is indeed the case. In no specification do we find more than one coefficient

TABLE 2.—INDIVIDUAL COEFFICIENT ESTIMATES

	β_0	β_0^*	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}	β_{11}	β_{12}
R[a]	0.188[e]	1269.	−11.79[e]	−0.663[e]	0.273[e]	−9.54[e]	118.24[e]	−8.35	40.02[e]	0.003	0.400	0.013	−0.000	−0.455
	(0.026)	(0.921)	(2.00)	(0.225)	(0.080)	(2.12)	(23.34)	(5.88)	(7.49)	(0.002)	(0.261)	(0.020)	(0.000)	(0.367)
	0.245[e]	0.000	−9.22[e]	−0.941[e]	0.120	−5.55[e]	82.81[e]	−5.66	36.41[e]					
	(0.016)	(0.000)	(1.67)	(0.238)	(0.106)	(1.98)	(20.59)	(7.01)	(8.70)					
	0.389[e]									0.003	−0.503	0.018	−0.000	−0.145
	(0.064)									(0.006)	(0.678)	(0.053)	(0.000)	(0.971)
R[b]	0.181[e]	−263.	−2.43	−0.881[e]	−0.111	−3.66	36.48	10.62	7.64	0.002	−0.145	−0.004	−0.000	−0.102
	(0.069)	(1536)	(1.45)	(0.388)	(0.108)	(2.77)	(22.39)	(8.96)	(11.45)	(0.004)	(0.508)	(0.035)	(0.000)	(0.616)
	0.190[e]	−709.0	−3.41[e]	−0.932[e]	0.001	−3.96[e]	32.97[e]	4.02	14.75					
	(0.027)	(995)	(1.52)	(0.274)	(0.034)	(1.92)	(15.04)	(4.64)	(8.19)					
C[c]	0.140[e]	−713.71	−10.41[e]	−0.933	0.262	−9.88[e]	89.66[e]	−15.02	46.72[e]	0.006[e]	0.548	0.013	−0.000	−0.523
	(0.015)	(2343)	(3.51)	(0.593)	(0.151)	(3.66)	(34.81)	(11.38)	(16.48)	(0.002)	(0.286)	(0.025)	(0.000)	(0.439)
	−0.170[e]	−272.	−3.15[e]	−1.22[e]	−0.001	−1.36	23.12[e]	−7.49	21.75[e]					
	(0.004)	(900.)	(0.439)	(0.163)	(0.019)	(1.33)	(6.08)	(3.83)	(5.33)					
	0.121[e]									0.012[e]	0.878	−0.029	−0.000	0.173
	(0.031)									(0.004)	(0.541)	(0.042)	(0.000)	(0.804)
C[d]	0.173[e]	−757.20	−8.60[e]	−0.793[e]	0.244[e]	−9.75[e]	76.99[e]	−6.76	35.24[e]	0.001	0.173	0.038	−0.000	−0.863[e]
	(0.029)	(890)	(1.56)	(0.225)	(0.072)	(2.53)	(17.63)	(6.17)	(8.79)	(0.003)	(0.332)	(0.022)	(0.000)	(0.379)
	−0.206[e]	−471.05	−7.84[e]	−0.752[e]	0.095[e]	−5.30[e]	59.34[e]	−4.82	34.90[e]					
	(0.016)	(863)	(1.55)	(0.204)	(0.046)	(2.19)	(15.54)	(7.33)	(9.68)					
	0.331[e]									0.004	−0.597	0.053	−0.000	−0.875
	(0.065)									(0.006)	(0.766)	(0.051)	(0.000)	(0.905)

Note: Standard errors are given in parentheses.
[a] NLLS estimates of equation (7).
[b] NL2S estimates of equation (7), all exogenous variables, the squares of distribution services ($X_2 - X_5$) and $X_1 B$ were used as instruments.
[c] NLLS estimates of equation (8).
[d] NLLS estimates of equation (9).
[e] t-ratios greater than or equal to 2.

with a t-ratio greater than 2 and in only three out of seven cases do we find even one coefficient with a t-ratio greater than 2.

To sum up, these individual results support the earlier conclusion on the importance of the role of distribution services as outputs of retail activities and they strengthen the conclusion that the determinants of profit margins measured here play no role or a very limited one in determining retail margins.

Our main interest in the individual results, however, stems from what they can tell us about the relevance of quantity-setting or price-setting behavior in retail markets. In every possible specification, the hypothesis of quantity-setting behavior was rejected at the 5% level of significance. Recall from section III that this hypothesis implies all the coefficients of distribution services must be positive ($\beta_2 - \beta_7$). A quick check of table 2 shows that in every case at least one and usually more of the coefficients of distribution services are negative and statistically significant at the 5% level.[12] Similarly, the hypothesis of price-setting behavior implies that all coefficients must be of the same sign, either positive or negative, and the individual results also reject this hypothesis conclusively.

Conclusion

Our most important findings are that treating distribution services as outputs of retail firms provides a sound conceptual framework for the empirical analysis of retail margins, suggests a number of feasible empirical constructs as measures of these outputs, and generates empirical results that provide strong support for viewing distribution services as critical determinants of retail margins. This conclusion is especially supported by the results on the nonlinearity of functional forms and the stability of results across econometric specifications.

Another finding of our empirical analysis is that our measures of concentration and barriers to entry fail to affect retail margins. It would be injudicious to draw strong conclusions about the relationship between concentration, barriers to entry and profits in retail markets based on this result. That is why we called the test a weak test in section II. On statistical grounds, there is the unknown level of type II error associated with acceptance of the null hypothesis. On conceptual grounds there are the limitations of our measures of concentration and barriers to entry. They are based on nationwide data but retail markets are local in nature. Finally, barriers to entry is a complex concept with more than one dimension.[13]

Perhaps the most striking finding of our analysis is the categorical rejection of both the price-setting and the quantity-setting hypothesis by the data. How should one interpret these results? One interpretation is that monopolistic competition is not the relevant market structure and these hypotheses were derived using this assumption. Exploring this view would require introducing elements of strategic behavior in the analysis and showing how these considerations generated differences in the effects of distribution services on retail margins. Another interpretation is that profit maximization is an inappropriate assumption; instead one should use, for example, a markup model. In an appendix available upon request, we show that a standard specification of the markup model is also rejected by the data.

Finally, one can always cite data limitations. One potentially important limitation, for example, would be lack of robustness or instability. For instance, if one were to drop variables that one thought were poorly measured, for example, X_4 and X_6, evidence of robustness would be that the results on the remaining ones stay the same. This is indeed the case (these results are also reported in the previously mentioned appendix) and, together with the stability of results across econometric specifications, leads us to conclude that robustness is not an issue. Another limitation would be that the aggregate cross-section nature of the data limits the kind of questions that can be asked. In particular, the tests of quantity-setting vs. price-setting would be quite sensitive to heterogeneity across sectors whereas nonlinearity and the basic role of fundamental variables in

[12] Incidentally, a hedonic model where the retail margin is used as a proxy for price is also rejected by these results, since in that model all coefficients of distribution services would be expected to be positive.

[13] For instance, advertising expenditures, which is our measure of information, can also be interpreted as an index of barriers to entry. Indeed, it has been interpreted as such in the traditional literature on profit margins (Schmalensee (1988)) and in the more recent literature on contestable markets (Kessides (1986)).

affecting retail margins would be far less sensitive to violations of the assumption of homogeneity across sectors. We favor this explanation.

We conclude by noting that since, by definition, the variability in retail margins is substantially greater than variability in the ratio of profits to sales, i.e., it is not surprising to find empirical regularities validating fundamental characteristics of our conceptual framework even with cross-section data.

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