DEALERSHIP COMPETITION IN THE U. S. AUTOMOBILE INDUSTRY

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Abstract

This paper develops a model of dealership rivalry for the U.S. auto industry in line with the research program of Joe Bain. In Bain's research, the literature depicts the auto industry as a differentiated oligopoly with non-price competition and price collusion. It has established advertising and R&D rivalry successfully, but has focused little attention to dealership competition. Because Bain has given a dominant role to dealership competition, this paper addresses the dealership rivalry problem. We found that a competitive model allowing a firm to react to a rival's past levels of advertising, R&D outlays, and the number of dealers, represents the firms' non-price competitive behavior well for the 1970–1996 period. The hypotheses we used have captured the joint effects of advertising, R&D, and dealerships, when explicit specifications for the financial constraints facing the firms are accounted for. We are able to statistically validate the hypothesis that U.S. firms do compete in dealership systems, as Joe Bain has predicted, within the differentiated oligopoly market structure. The results also allow some inferences regarding the sequential nature of non-price competition among the firms.

1. Introduction

This paper is a sequel to several articles in this journal (Ramrattan [1991]; Ramrattan [1994]; Ramrattan [1998]) that apply Joe Bain's hypothesis to the U.S. auto industry. According to Bain, auto firms engage in dealership rivalry partly to maintain the product preferences of buyers, partly to sell a substantial part of their products through retail dealerships, and partly to promote sales, specialized maintenance, repair service, and easy access to replacement parts (Bain [1956], p. 300). This study analyzes and statistically explains how auto firms compete in their levels of dealerships. Such competition can take place over exclusive or dual franchises, with the special case of the latter entitled intercorporate duals. The method of dual dealership suggests that dealer rivalry among firms may not fall under the traditional leader-follower model found with advertising and R&D rivalry. Broadly speaking, we find that the proliferation of products has encouraged nonexclusive dealerships, (Dhebar, Neslin, and Quelch [1987], p. 338) while intercorporate duals are located mostly in rural areas where dealers tend to spread their overhead. (Bresnahan and Reiss [1985])

The domestic auto firms let their dealers carry practically all their inventory, except cars in transit, (Blanchard [1983], p. 368). An early policy of General Motors, aimed at smoothing out seasonal variations, related dealers' inventory holdings to a sales index (Kashyap and Wilcox [1993]). Today, marketing and efficiency are emphasized over sales targeting, yet stay within Bain's paradigm. To demonstrate marketing and efficiency advantages, a GM report points to the widespread use of dealers by both domestic and foreign firms (General Motors Corporation [1968], p. 9). We find that both small and large firms have symmetric power in increasing the number of their dealers (General Motors Corporation [1968], p. 82, and General Motors Corporation [1974], pp. 84–85). For example, foreign firms, such as Toyota and Volkswagen, have been known to capitalize on the dual nature of franchises, selling their brands through domestic dealers that have been established over the years.

Comparable time-series data for the foreign firms are not available to allow the study of non-price rivalry between domestic and foreign firms. In the case of price collusion among domestic firms, one study was able to source disruptive price behavior to the influence of foreign competition

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(Ramrattan [1991], pp. 63–65). However, the influence of foreign firms in that study was limited to three specific situations, viz., a cross-section point of view, anomalous behavior over only two years—1983 and 1986, and the disruptive influence of foreign competition on the collusive price behavior of domestic firms. The non-price dealership environment in this study does not display such anomalous behavior among the domestic firms. This might be because a sub-market of American buyers remains loyal to domestic brands, while foreign competition continues to disrupt the pricing policies of domestic firms.

The logical structure of dealership competition has taken the form of many "if-then" statements. If a firm's cashflow and pricing strategies are successful, then it may want to strengthen competition in the areas of R&D, Advertising, and Dealership rivalry. If its pricing strategy yields an optimal outcome or even prevents price wars, then it may seek to maximize the return from its R&D endeavor in the areas of basic research, new model year design, or the diffusion of innovation. If its sequence of price and R&D strategies are working successfully, then it will look to Advertising outlays and dealership systems to sell its product. The final outcome will be optimal because a firm will most likely follow optimal policies at each stage regarding decisions on price collusion, reaction functions for advertising, research and development, and dealership franchise. In such a dynamic scenario, a firm will not only follow a stabilizing policy by varying its stock of dealers in a smooth fashion, or a destabilizing policy by synchronizing desired and actual stock of dealers, but can react to its rivals' past level of franchise holdings, as well. The empirical section below specifies a single equation model to explain such a dealership reaction. We will also examine that equation within a system of equations model, which was validated in the literature.

2. Specification

We have some *a priori* information about relationships among variables and about the magnitude and signs of parameters to help our specification of dealership rivalry. Bain has identified the volume of sales as an important determinant of the number and geographical density of dealer-service representatives of a manufacturer. Sales are dependent on the number of dealers with either exclusive or dual franchises. Regarding price, we will adopt Bain's collusive prediction as validated in a recent study (Ramrattan [1991]) and also in some subtle ways in the broader literature. For instance, Bresnahan and Reiss [1985] have emphasized the traditional idea that sales are also dependent on price formation, which is developed within a market power struggle between manufacturers and dealers, who both determine prices. From the psychological standpoint, we repeat the brand loyalty argument that a high level of product differentiation, which can be enhanced by non-price competition and territorial restraints, may sustain a high price without allowing buyers to switch to other brands. On the structural end, Crandall ([1968], p. 222) has pointed out that the vertical integrated nature of the auto market may allow sufficient consumer surplus to be extracted from the parts market to deform prices to a low level represented by incremental costs. He suggested a value-added measure of price level, defined as the sum of payroll, net income before tax, depreciation, and interest divided by sales (Crandall [1968], p. 214).

Regarding advertising, we find arguments for positive reactions among firms at both the manufacturer and dealer levels. Simon [1970], p. 38 has argued that "if advertising 'presells' the customer there is less room for selling-promotion by retailers." One implication of this statement is that rivalry in advertising is anchored at the firm level, as corroborated in two previous studies (Ramrattan [1986] and Ramrattan [1994]). Another implication is that even when retailers advertise, either because they have unadvertised brands, excess inventory, or dual brands, rival dealers may not react, particularly those in the immediate neighborhood. The reasons cited are that dealers' territories are fairly well-defined and large, that collusion among dealers may take place, or that one dealer's advertising may sufficiently increase traffic in the neighborhood so as to minimize or cause no retaliation (Dhebar, Neslin, and Quelch ([1987], p. 341).

On the R&D end, a recent study found that financial variables modeled in a simultaneous equation framework to account for feedbacks, is necessary to bring out significant relationships. The most significant single equation R&D specification is of the Grabowski and Baxter [1973] type. But its performance in the auto industry needed enhancement to account for the background financial relationship

of the firm. We found that the best method and the one adopted in this paper was obtained from embedding the single equation model into the Dhrymes and Kurtz system of equation model for the firm. (Ramrattan [1998])

We find the above background information necessary and sufficient to specify a set of equations in order to test the dealership hypothesis. These equations are grouped below, followed by a list of the variables and discussions of their estimation.

$$LnNF_{i,t} = Ln\tau + \upsilon LnNF_{t-1,j} + \phi LnP_{t-1,i} + \varphi LnVC \quad (1)$$

$$LnA_{i,t} = Ln\alpha + \beta LnA_{t-1,j} + \gamma LnP_{t-1,i} + \lambda Opec \quad (2)$$

$$\frac{Div}{S_{i,t}} = a_0 + a_1\frac{P}{K_{i,t}} + a_2\frac{N}{K_{i,t}} + a_3\frac{Inv}{S_{i,t}} + a_4\frac{F}{S_{i,t}} \quad (3)$$

$$\frac{Inv}{S_{i,t}} = b_0 + b_1\left(\frac{P}{K}\right)_{i,t-1} + b_2\frac{N}{K_{i,t}} + b_3 S_i^* + b_4\frac{Div}{S_{i,j}} + b_5\frac{F}{S_{i,t}} \quad (4)$$

$$\frac{F}{S_{i,t}} = g_0 + g_1\frac{LTD}{K\text{–}LTD_{i,t}} + g_2 r_{i,t} + g_3\frac{Dep}{K_{i,t}} + g_4\frac{NI}{K_{i,t}} + g_5\frac{Div}{S_{i,t}} + g_6\frac{Inv}{S_{i,t}} \quad (5)$$

$$\Delta R_{i,t} = c_1\Delta D_{i,t} + c_2\Delta R_{j,t-1} + c_3\Delta P_{i,t} + c_4\Delta V_{i,t} + c_5\Delta R_{i,t-1} \quad (6)$$

$$Inv_{i,t} \equiv F_{i,t} + NI_{i,t} - Div_{i,t} - R_{i,t} - A_{i,t} + Dep_{i,t} \quad (7)$$

Where:

NF = Net Franchise.
VC = Index of Vertical Integration.
A = Advertising Expenditure.
P = Cashflow (NI + Depreciation).
NI = Net Income.
i,j = i^{th} and j^{th} firm.
Coefficients = α, β, γ, λ, τ, υ, ϕ, φ, a, b, c, g are estimates.
t = Time.
$Opec$ = Dummy (Zero for 1970–74, one otherwise).
Δ = Change.
$\Delta D_{i,t}$ = Cyclical Dummy: one when both sales and cashflow fall and zero otherwise.
Ln = log_e
Inv = Investment in Plant and Equipment.
Div = Common Stock Dividend Disbursements.
S = Sales.
S^* = Capacity Accelerator = $\frac{(Sales_t - Sales_{t-3})}{Sales_{t-3}}$.
K = Total Invested Capital.
N = Short-term position: Excess of inventories, cash, short-term securities, and accounts receivable over accounts payable and other short term liabilities.
V = Firm's outstanding debt and money value of common and preferred stock.
R = A firm's R&D outlays.
F = External Bond Financing: First Difference of LTD.
LTD = Long-Term Debt outstanding.
r = An interest rate appropriate to LTD.

Equation 1 is our specification for rivalry in net franchise dealership. We expect a firm to react to its rival's past level of dealers in a Cournot fashion, given its cashflow and its degree of vertical integration. The first two variables are standard in the advertising and R&D specifications for rivalrous behavior. The latter variable captures a firm's market power in sequential stages of production and distribution, where it can discriminate between price and non-price weapons (Blair [1972], pp. 26–27). Also, a firm may want to be vertically integrated to allow for efficient use of any excess capacity of plants and equipment (Menge [1959]). Recently, vertical integration has been rediscovered in the post-Keynesian literature as an important factor affecting a firm's growth (Scazzieri, et. al. [1990]). While its importance is undeniable, its predicted effect on dealership formation will be determined empirically.

Equations 2–6 are adopted from Ramrattan [1998], where they demonstrated significant rivalry between General Motors, Ford and Chrysler in the areas of Advertising and R&D. Financial equations

3, 4, and 5 were specified by Dhrymes and Kurtz [1974], [1967], and the R&D equation 6 by Grabowski and Baxter [1973]. Advertising equation 2 is a specification for Bain's hypothesis that was corroborated in two studies (Ramrattan [1986], [1994]). Equation 7 is an identity for the firm's budget constraint.

The data to test these specifications are taken from various sources. The observation period is 1970–1996. The sources for Advertising, R&D, and the financial variables are the same as listed in Ramrattan's study [1998]. The Advertising variable is from *Advertising Age's Leading National Advertisers.* S&P's Compustat tapes, Moody's Industrial Manual, and firms' Annual Reports are the sources for the firms' financial variables. The R&D data in particular is from the firms' 10K reports. The vertical integration variable is defined as in Crandall [1968]. Firms' payroll data is taken from their Annual Reports. Moody's Industrial Manual is another reliable source, but it did not report payroll data for Chrysler from 1975 onwards. The dealership data is from various issues of the *Automotive News' Market Data Book.*

3. Results

Like Dhrymes and Kurtz [1967], we got our best results using a 3-stage-least-square estimation technique. The set of instrumental variables we used excludes the dependent variables. The results are represented in Tables 1 to 3R. Table 1 shows a significant response by the Ford Corporation to a change in the dealership levels of General Motors. The index of vertical integration has a small negative but statistically significant influence on net dealership formation. It suggests that as the firm's degree of integration improves, it may need fewer dealer outlets. The cashflow coefficient is at about the same level in the dealership model as in the R&D model, approximately 0.04 vs. 0.06, respectively. It is significant at the 99% confidence level across advertising, R&D, and net franchise. The dealership coefficient is highly significant. Its high level indicates a corroboration of Bain's hypothesis that dealership rivalry is strong. The estimated dealership coefficient, which is close to one, shows that Ford reacts almost perfectly to General Motors' previous level of Net Franchise, implying a head-to-head competition.

Table 1R shows General Motors' response to Ford, testing for the reverse relationship that is identified in Table 1. The index of vertical integration is not significant. The cashflow variable across Advertising, R&D and Net Franchise holds its ground, with two instances of significance, one at the 95% level and one at the 99% level. Again, the Net Franchise variable repeated its significant performance that is established in Table 1. The major difference from Table 1 is that General Motors does not seem to worry about its level of vertical integration. Compared to an earlier study (Ramrattan [1998]), the advertising and R&D equations in this study indicate improved performance. All the advertising coefficients remain significant, though at varying levels. Overall, we now have four significant R&D coefficients against only two in the earlier study.

The financial equations compare better with the earlier study. While the dividend equation continues its non-performance, five of the investment coefficients are now significant vs. four in the earlier study. Six finance equations are now significant vs. four in the earlier study (Ramrattan [1998]).

We turn now to the results of Chrysler vs. General Motors. Table 2 shows a significant index of vertical integration, which is similar to Ford's reaction to General Motors. The cashflow variable is as significant in this relationship as in the Ford and General Motors relationship. The significant coefficients are located in the first three equations. The network reaction coefficient is significant, but indicates about 60 percent (not 100 percent) of Chrysler to Ford's change in dealership. R&D performance is greatly improved from the earlier study. All five coefficients are now significant, while the previous study indicated that only the Chrysler cashflow coefficient was significant (Ramrattan [1998]). The advertising results are fairly stable-only the constant term did not hold up. The financial model has the same amount of significant influence as in the earlier study (Ramrattan [1998]).

The results of Table 2R show that General Motors does not react to Chrysler's previous level of dealership holdings. These results stand up even though the other equations do not perform any worse than those found in a previous study (Ram-

TABLE 1
The Determinants of Annual Change in Dealership
Ford Corporation vs. General Motors Corporation
Annual Data: 1970–1996
System of Equation Results

Description	Net Dealership Systems	Advertising in Log Form	R and D in 1st Diff. Form	Dividend Per Unit of Sales	Investment Per Unit of Sales	Finance Per Unit of Sales
Constant	–2.82	–2.09		0.02	0.29	0.30
	(–3.42)***	(–1.64)*		(3.13)***	(18.74)***	(1.72)*
$LGMNET_{t-1}$	1.19					
	(14.04)***					
LFDVC	–0.10					
	(–2.12)**					
$LGMAD_{t-1}$		1.17				
		(4.85)***				
$LFDCF_{t-1}$	0.04	0.79				
	(6.20)***	(6.02)***				
OPECDUM		1.29				
		(3.56)***				
ΔFDD_t			244.11			
			(2.14)**			
$\Delta GMRD_{t-1}$			0.20			
			(1.97)**			
$\Delta FDCF$			0.06			
			(3.27)***			
$\Delta FDRD_{t-1}$			0.68			
			(4.89)***			
ΔFDV_t			–0.001			
			(–0.41)			
$(\frac{FDNI}{FDK})_t$				0.004		–0.94
				(0.37)		(–3.94)***
$(\frac{FDN}{FDK})_t$				–0.01	–0.09	
				(–1.57)	(–2.68)**	
$(\frac{FDInv}{FDS})_t$				–0 05		–3.01
				(–1.52)		(–4.15)***
$(\frac{FDF}{FDS})_t$				0.0001	–.04	
				(0.02)	(–1.07)	
$(\frac{FDNI}{FDK})_{t-1}$					0.15	
					(2 70)**	
$FDSALES_{t-2}$					–0.11	
					(–6.96)***	
$(\frac{FDDiv}{FDS})_t$					3.15	12.72
					(2 72)**	(2.23)**
$(\frac{FDLTD}{FDK-FDLTD})_t$						0.06
						(3.84)***
$(\frac{FDr}{FDLTD})_t$						–0.01
						(–0.23)
$(\frac{FDDep}{FDK})_t$						2.22
						(3.84)***
ADJ. R^2	.96	.90	.17	.08	.66	.20

*** = Significant at the 1 percent level. ** = Significant at the 5 percent level, and * = Significant at the 10 percent level. LGM, LFD, and LCH abbreviated names for the four firms. Source: Estimate by author.

TABLE 1R
The Determinants of Annual Change in Dealership
General Motors vs. Ford Motor Company
Annual Data: 1970–1996
System of Equation Results

Description	Net Dealership Systems	Advertising in Log Form	R and D in 1st Diff. Form	Dividend Per Unit of Sales	Investment Per Unit of Sales	Finance Per Unit of Sales
Constant	–1.23	–3.21		0.07	0.41	0.09
	(–1.48)	(–3.79)*		(8.39)***	(24.53)***	(1.27)
$LFDNET_{t-1}$	1.18					
	(14.35)***					
LGMVC	0.06					
	(0.83)					
$LFDAD_{t-1}$		0.71				
		(8.26)***				
$LGMCF_{t-1}$	0.03	1.01				
	(2.44)**	(10.29)***				
OPECDUM		0.48				
		(1.87)*				
ΔGMD_t			–103.63			
			(–0.88)			
$\Delta FDRD_{t-1}$			0.35			
			(2.19)**			
$\Delta GMCF$			0.04			
			(1.97)**			
$\Delta GMRD_{t-1}$			0.37			
			(2.88)***			
ΔGMV_t			0.02			
			(3.46)***			
$(\frac{GMNI}{GMK})_t$				0.001		0.25
				(0.07)		(2.28)**
$(\frac{GMN}{GMK})_t$				–0.08	–0.41	
				(–4.80)***	(–6.10)***	
$(\frac{GMInv}{GMS})_t$				–0.17		0.28
				(–6.72)***		(2.05)**
$(\frac{GME}{GMS})_t$				–0.03	–.004	
				(–0.77)*	(–0.02)	
$(\frac{GMNI}{GMK})_{t-1}$					0.11	
					(1.64)*	
$GMSALES_{t-2}$					–0.01	
					(–0.36)	
$(\frac{GMDiv}{GMS})_t$					–4.73	–1.62
					(–8.22)***	(–1.71)*
$(\frac{GMLTD}{GMK-GMLTD})_t$						–0.02
						(–3.92)***
$(\frac{GMr}{GMLTD})_t$						–0.23
						(–4.51)***
$(\frac{GMDep}{GMK})_t$						–0.43
						(–2.84)***
ADJ. R^2	.95	.86	.37	.59	.66	.42

*** = Significant at the 1 percent level. ** = Significant at the 5 percent level, and * = Significant at the 10 percent level. LGM, LFD, and LCH abbreviated names for the four firms. Source: Estimate by author.

TABLE 2
The Determinants of Annual Change in Dealership
Chrysler Corporation vs. General Motors Corporation
Annual Data: 1970–1996
System of Equation Results

Description	Net Dealership Systems	Advertising in Log Form	R and D in 1st Diff. Form	Dividend Per Unit of Sales	Investment Per Unit of Sales	Finance Per Unit of Sales
Constant	2.37	0.29		0.03	0.01	0.43
	(0.82)	(1.21)		(2.20)**	(0.16)	(3.11)***
$LGMNET_{t-1}$	0.59					
	(2.10)**					
LCHVC	–0.34					
	(–2.22)**					
$LGMAD_{t-1}$		0.98				
		(10.70)***				
$LCHCF_{t-1}$	0.04	0.74				
	(1.89)*	(21.56)***				
OPECDUM		–.10				
		(–.75)				
ΔCHD_t			–67.54			
			(–4.19)***			
$\Delta GMRD_{t-1}$			0.11			
			(5.75)***			
$\Delta CHCF$			0.04			
			(4.64)***			
$\Delta CHRD_{t-1}$			0.30			
			(2.57)***			
ΔCHV_t			0.002			
			(1.82)*			
$\left(\frac{CHNI}{CHK}\right)_t$				0.01		0.13
				(2.23)**		(0.92)
$\left(\frac{CHN}{CHK}\right)_t$				–0.01	0.65	
				(–0.99)	(3.44)	
$\left(\frac{CHInv}{CHS}\right)_t$				0.01		–0.26
				(2.22)**		(–0.62)
$\left(\frac{CHF}{CHS}\right)_t$				0.001	0.36	
				(0.12)	(2.18)**	
$\left(\frac{CHNI}{CHK}\right)_{t-1}$					.12	
					(–0.57)	
$CHSALES_{t-2}$					–0.26	
					(–4.73)***	
$\left(\frac{CHDiv}{CHS}\right)_t$					37.07	–19.56
					(5.38)**	(–1.77)**
$\left(\frac{CHLTD}{CHK-CHLTD}\right)_t$						–0.01
						(–0.15)
$\left(\frac{CHr}{CHLTD}\right)_t$						2.26
						(0.76)
$\left(\frac{CHDep}{CHK}\right)_t$						–3.15
						(–2.98)***
ADJ. R^2	.54	.93	.60	.14	.33	.35

*** = Significant at the 1 percent level. ** = Significant at the 5 percent level, and * = Significant at the 10 percent level. LGM, LFD, and LCH abbreviated names for the four firms. Source: Estimate by author.

TABLE 2R
The Determinants of Annual Change in Dealership
General Motors vs. Chrysler Corporation
Annual Data: 1970–1996
System of Equation Results

Description	Net Dealership Systems	Advertising in Log Form	R and D in 1st Diff. Form	Dividend Per Unit of Sales	Investment Per Unit of Sales	Finance Per Unit of Sales
Constant	11.87	–3.89		0.07	0.40	0.06
	(11.85)***	(–7.86)***		(8.52)***	(23.71)***	(0.80)
$LCHNET_{t-1}$	–0.13					
	(–1.17)					
LCHVC	0.87					
	(5.64)***					
$LCHAD_{t-1}$		0.89				
		(15.49)***				
$LGMCF_{t-1}$	–0.09	1.11				
	(–3.20)***	(19.30)***				
OPECDUM		0.26				
		(1.66)*				
ΔGMD_t			–74.90			
			(–0.44)			
$\Delta CHRD_{t-1}$			2.11			
			(1.76)*			
$\Delta GMCF$			0.05			
			(2.08)***			
$\Delta GMRD_{t-1}$			0.29			
			(1.16)			
ΔGMV_t			0.01			
			(1.73)*			
$(\frac{GMNI}{GMK})_t$				–0.01		0.23
				(–0.27)		(2.05)**
$(\frac{GMN}{GGM})_t$				–0.07	–0.35	
				(–4.21)***	(–5.27)***	
$(\frac{GMInv}{GMS})_t$				–0.18		0.34
				(–7.06)***		(2.44)***
$(\frac{GME}{GMS})_t$				–0.01	0.15	
				(–0.17)	(0.79)	
$(\frac{GMNI}{GMK})_{t-1}$					–0.09	
					(–1.26)	
$GMSALES_{t-2}$					–0.01	
					(–0.69)	
$(\frac{GMDiv}{GMS})_t$					–4.37	–1.28
					(7.64)***	(–1.35)
$(\frac{GMLTD}{GMK-GMLTD})_t$						–0.01
						(–3.69)***
$(\frac{GMr}{GMLTD})_t$						–0.21
						(–3.99)***
$(\frac{GMDep}{GMK})_t$						–0.37
						(–2.39)***
ADJ. R^2	.68	.96	.12	.57	.76	.41

*** = Significant at the 1 percent level. ** = Significant at the 5 percent level, and * = Significant at the 10 percent level. LGM, LFD, and LCH abbreviated names for the four firms. Source: Estimate by author.

TABLE 3
The Determinants of Annual Change in Dealership
Chrysler Corporation vs. Ford Motor Company
Annual Data: 1970–1996
System of Equation Results

Description	Net Dealership Systems	Advertising in Log Form	R and D in 1st Diff. Form	Dividend Per Unit of Sales	Investment Per Unit of Sales	Finance Per Unit of Sales
Constant		0.01		0.01	0.05	–.01
		(0.04)		(1.86)**	(0.96)	(–0.04)
$LFDNET_{t-1}$	0.88					
	(56.74)***					
$LCHVC$	–0.40					
	(–4.76)***					
$LFDAD_{t-1}$		0.79				
		(7.97)***				
$LCHCF_{t-1}$	0.06	0.73				
	(5.77)***	(17.65)***				
OPECDUM		0.26				
		(1.62)*				
ΔCHD_t			–66.18			
			(–2.62)***			
$\Delta FDRD_{t-1}$			0.03			
			(–0.87)			
$\Delta CHCF$			0.01			
			(1.12)			
$\Delta CHRD_{t-1}$			0.95			
			(5.30)***			
ΔCHV_t			0.002			
			(1.19)			
$\left(\frac{CHNI}{CHK}\right)_t$				0.01		–0.06
				(2.16)***		(–0.30)
$\left(\frac{CHN}{CHK}\right)_t$				–0.01	0.50	
				(–1.05)	(2.62)***	
$\left(\frac{CHInv}{CHS}\right)_t$				0.01		–0.46
				(2.67)***		(–0.81)
$\left(\frac{CHF}{CHS}\right)_t$				0.002	0.19	
				(0.34)	(1.15)	
$\left(\frac{CHNI}{CHK}\right)_{t-1}$					–.02	
					(–0.08)	
$CHSALES_{t-2}$					–0.24	
					(–4.30)***	
$\left(\frac{CHDiv}{CHS}\right)_t$					32.37	5.35
					(4.75)***	(0.45)
$\left(\frac{CHLTD}{CHK-CHLTD}\right)_t$						0.08
						(1.31)
$\left(\frac{CHr}{CHLTD}\right)_t$						–0.07
						(–0.19)
$\left(\frac{CHDep}{CHK}\right)_t$						0.52
						(0.51)
ADJ. R^2	.42	.91	.08	.12	.34	.13

*** = Significant at the 1 percent level. ** = Significant at the 5 percent level, and * = Significant at the 10 percent level. LGM, LFD, and LCH abbreviated names for the four firms. Source: Estimate by author.

TABLE 3R
The Determinants of Annual Change in Dealership
Ford Motors Corporation vs. Chrysler Corporation
Annual Data: 1970–1996
System of Equation Results

Description	Net Dealership Systems	Advertising in Log Form	R and D in 1st Diff. Form	Dividend Per Unit of Sales	Investment Per Unit of Sales	Finance Per Unit of Sales
Constant	7.88	–0.98		0.02	0.28	0.28
	(6.91)***	(–1.57)		(2.99)***	(19.20)***	(1.57)
$LCFNET_{t-1}$	0.15					
	(3.10)***					
LFDVC	–0.05					
	(–0.90)					
$LCHAD_{t-1}$		0.87				
		(5.53)***				
$LFDCF_{t-1}$	0.03	0.72				
	(3.87)***	(8.70)***				
OPECDUM		0.77				
		(1.97)*				
ΔFDD_t			187.84			
			(1.61)			
$\Delta FDRD_{t-1}$			0.13			
			(1.32)			
ΔFDCF			0.12			
			(2.58)***			
$\Delta FDRD_{t-1}$			0.77			
			(5.56)***			
ΔFDV_t			–0.001			
			(–0.19)			
$(\frac{FDNI}{FDK})_t$				0.002		–0.94
				(0.21)		(–3.94)***
$(\frac{FDN}{FDK})_t$				–0.01	–0.09	
				(–1.62)*	(–2.87)***	
$(\frac{FDInv}{FDS})_t$				–0.05		–2.99
				(–1.41)		(–4.14)***
$(\frac{FDF}{FDS})_t$				0.001	–0.04	
				(0.14)	(–1.02)	
$(\frac{FDNI}{FDK})_{t-1}$					0.15	
					(2.99)***	
$CHSALES_{t-2}$					–0.10	
					(–7.00)***	
$(\frac{FDDiv}{FDS})_t$					–3.11	13.28
					(2.76)***	(2.41)***
$(\frac{FDLTD}{FDK-FDLTD})_t$						0.06
						(3.96)***
$(\frac{FDr}{FDLTD})_t$						–0.01
						(–0.21)
$(\frac{FDDep}{FDK})_t$						2.31
						(4.03)***
ADJ. R^2	.92	.85	.11	.11	.67	.20

*** = Significant at the 1 percent level. ** = Significant at the 5 percent level, and * = Significant at the 10 percent level. LGM, LFD, and LCH abbreviated names for the four firms. Source: Estimate by author.

rattan [1998]). All advertising estimates perform significantly in both studies. The R&D model shows that the Cashflow, Vertical Integration, and R&D variables are now significant, while the earlier study indicated only the latter was significant. The Dividend, Investment, and Finance equations show the same number of significant variables as in the previous study. Based on this study, therefore, we are likely to accept the results that the largest firms' franchise operations do not imitate the smallest firms' franchise operations.

Table 3 indicates Chrysler's strong reaction (88 percent) to Ford Motor Company's dealership level. The vertical integration and the cashflow coefficients show the appropriate signs and are highly significant. The previous advertising study (Ramrattan [1998]) indicated an insignificant OPEC influence, which is improved in this study. However, we now have an insignificant constant instead. The R&D equation still does not show that Chrysler reacts to Ford's previous R&D outlay. On the financial end, the Dividend and Investment equations performed about the same, but the Finance equation now shows no significant relation, whereas the previous study had one.

Table 3R examines Ford's reaction to the Chrysler dealership system. The dealership equation indicates a significant reaction, albeit only about 15 percent, supported by a significant cashflow coefficient and a significant intercept. Compared to the earlier study (Ramrattan [1998]), the advertising results are similar, indicating strong competition. However, the R&D coefficient is still insignificant. The financial model here has done better, particularly in the finance equation, where five coefficients are significant vs. only the constant and the interest rate variables in the previous study (Ramrattan [1998]). The investment equation shows five significant coefficients vs. only three previously and the dividend equation holds its ground.

4. Preferred Nonprice Strategy

We will now draw some implications for the preordering of strategies. We use the term preorder to characterize whether a firm has a preference to play one particular nonprice weapon-Advertising, R&D, or Dealership system over another. This interpretation pivots on whether the estimated coefficients are close to one, which, according to Schnabel, may be taken as a sign of full competition (Schnabel [1974], p. 34). The average level of significant coefficients for all the results of Tables 1 to 3R are 0.90 for Advertising, 0.80 for Dealership, and 0.70 for R&D. Looking only at General Motors and Ford, the coefficients are rounded to one in dealership competition and slightly less than one (.94) for advertising. The preorder does not change if all coefficients are averaged.

The statistical view gives a mixed result of the preordering of strategies. The main concern is whether the 10 percent observed difference between the coefficients is significant. A t-test on the pairwise differences of the coefficients between Advertising, R&D and Dealership competition did not turn up significant statistics. The ρ values are 0.32, 0.76, and 0.27 for Net Franchise vs. Advertising, Net Franchise vs. R&D, and Advertising vs. R&D, respectively, indicating that we cannot reject the null hypothesis of no difference between the coefficient levels. However, a Bartlett test for the equality of variances, taking advantage of the normality assumption behind the distribution of the coefficients, yields a probability value of zero, rejecting the hypothesis of the equality of variances (Judge, Griffiths, Hill, Lutkepohl and Tsoung-Chao [1985], p. 447).

Because of the mixed results, we may view the results for preordering competition of the non-price variables in two ways. On the one hand, we may consider the coefficients for dealerships equal to one between the two-way rivalry of General Motors and the Ford Motor Company to imply that the greatest competition resides with dealerships. A coefficient for advertising is equal to one only in the one-way reaction of Ford Motor Company to General Motors. On the other hand, while the average significant statistics for the coefficients are 0.90 for Advertising, and 0.80 for Dealership, and 0.70 for R&D, the 10 percent difference poses a mixed statistical result, being significant for the variances and not for the means. From the level of the coefficients and the variances approaches, it is therefore probable that dealership rivalry does about the same as advertising, but better than R&D.

5. Conclusion

The paper successfully expanded the empirical work on Bain's paradigm to include dealership rivalry. It found five out of six significant dealership reaction coefficients for the permutations of rivalry between Ford Motor Company, General Motors and Chrysler Corporation. Except for the General Motors and Chrysler relationship, the reaction patterns fail to falsify Bain's prediction of franchise dealership. General Motors' reaction to Chrysler Corporation may be a result of the smallest firm choosing to follow the largest. The reaction patterns of the second-largest firm to the smallest firm and vice versa show significant but substantially less than a full level of adjustment, viz., about 15 percent vs. only one percent.

As in earlier studies, the performance of the advertising and R&D variables are as expected, with six and four coefficients significant, respectively. For preordering, the average level of reaction coefficients appears in favor of 0.90 for Advertising and 0.80 for Dealership, and 0.70 for R&D, with statistical support of significance for difference in the variances, but not in the mean values of the results. Overall, however, the results do lend greater empirical support for Bain's differentiated oligopoly hypothesis of the auto industry.

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