International Journal of the
Economics of *Business, Vol. 7, No. 3, 2000, pp. 245–261*

The Competitive Effects of Advertising in the US Automobile Industry, 1970–94

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ABSTRACT *Is advertising anticompetitive? One school of thought in industrial economics holds that advertising increases profits and reduces consumer welfare by creating spurious product differentiation and barriers to entry. Another school focuses on the informative character of advertising, claiming that advertising makes markets more competitive and reduces profits by supplying consumers with information about price and quality. We distinguish these views by examining the effect of advertising on competition in the US automobile industry. Our data include advertising, sales, profit, and market-share figures for General Motors, Ford, and Chrysler over a 25-year period from 1970 to 1994. We ask if advertising increases or decreases profitability, controlling for market structure and other factors affecting demand. We find that these firms cannot increase their profits above normal levels by increasing their advertising expenditures. This evidence supports the view that advertising serves primarily to transmit information, not to create entry barriers.*

Key words: Automobile industry; Advertising; Competition; Entry barriers; Information.

JEL classification: L10, L62, M37.

1. Introduction

Is advertising anticompetitive? As Shughart (1997: 206) observes, 'On few other subjects do the opinions of economists differ as sharply as they do on the subject of advertising.' Robinson (1933), Kaldor (1950), Bain (1956), and Comanor and Wilson (1974), among others, argue that advertising reduces consumer welfare and increases profits by creating spurious product differentiation and barriers to entry. A newer school of thought, represented by Stigler (1961), Telser (1964), Nelson (1974), and Demsetz (1979), among others, argues that advertising performs a useful social function by providing consumers with information about price,

We thank David Robinson, George Zinkhan, three anonymous referees, and the editor for helpful comments and suggestions.
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ISSN 1357-1516 print/ISSN 1466-1829 online/00/030245-17

product quality, and availability, making markets more competitive and driving down profit rates.[1]

Empirical evidence on the relationship between advertising and profitability is mixed. The pioneering study by Comanor and Wilson (1967) found a positive and statistically significant relationship between advertising and profits, as did an early study by Shephard (1972). These results were challenged by Bloch (1974), Ayanian (1975), and Demsetz (1979) because they treated advertising as an expense rather than an investment, overstating the true rates of return to advertising. More recently, Martin (1979), Ravenscraft (1983), Salinger (1984), Bothwell *et al.* (1984), and Domowitz *et al.* (1986) have found positive and statistically significant relationships between advertising and profits in US manufacturing. Imel and Helmberger (1971), Grabowski and Mueller (1978), Porter (1979), and Nagle (1981) failed to find a statistically significant effect. As is well known, however, the causal relation between advertising and profit is uncertain, and some of the early studies regressing profit rates on advertising fail to account for the possible endogeneity of advertising.

We contribute to this debate by examining the effects of advertising on competition in the US automobile industry. Our data include advertising, sales, and investment figures for General Motors, Ford, and Chrysler over the 25-year period from 1970 to 1994. We ask if advertising increases or decreases profitability, controlling for market structure and other factors affecting demand. We find that these firms cannot increase their profits above normal levels by increasing their advertising expenditures. This evidence supports the opinion that advertising serves primarily to transmit information, not to create entry barriers.[2]

The remainder of the paper is organized as follows. Section 2 sketches the background of the US auto industry, considering the role of advertising and other possible barriers to entry. Section 3 describes our data and methods. Results and discussion are presented in Section 4, and Section 5 concludes.

2. Industry Background

The US automobile sector is a huge industry producing durable consumer goods and using a nationally oriented advertising strategy to market its product. Our findings cannot, of course, be easily generalized to other kinds of industries producing different goods and using different levels of advertising. Still, the auto industry is one of the most influential segments in the US economy, providing a substantial fraction of the national employment and having a major impact on GDP. Considering all the intermediate products used in auto construction and distribution (rubber, machine tools, trucking, etc.), the total impact of the automobile industry goes far beyond the direct impact.

Automobiles are durable experience goods that sell for a fairly high price. Consequently, as the purchase of a car constitutes a large investment for the average household, the demand for cars is fairly price and income elastic and strongly affected by macroeconomic conditions, including income trends, employment, and interest rates (Adams and Brock, 1995: 68). Because we look at competitive performance within the industry, however, we do not consider the industry's overall performance and its impact on the national economy.

The US automobile industry is highly concentrated, with domestic production dominated by a tight triopoly. The top three firms, General Motors, Ford, and Chrysler (the 'Big Three'), account for 98% of domestic production. This high

concentration started mainly in the 1930s. In the first three decades after the automobile was invented in the 1890s, more than 80 firms existed in the industry, with a number of companies entering and leaving the market every year. The number of companies that managed to stay efficient and profitable, and that survived the Depression in the 1930s, shrank to eight firms in the 1940s (White, 1982: 143). Since then, the Big Three have merged with or bought the remaining domestic firms.

In the 1970s, however, US auto makers first began to face significant foreign competition. German and especially Japanese car markers, which were already established in their home markets, entered the US market with small, efficient cars that provided stiff competition for domestic producers. Today, imports account for about a quarter of the existing US market share (as opposed to 0.4% market share immediately after World War II). This trend is reflected in Figure 1, which shows the market shares of the Big Three over our sample period. This considerable gain in market share for the foreign companies resulted mainly from the oil crisis of 1979, after which US consumers began to value fuel efficiency over size and style.

The importance of barriers to entry in this industry is widely debated. In general, a long-run barrier is any cost or factor that permits market incumbents to earn supernormal returns while deterring entry. Examples include absolute (capital) costs, economies of scale, product differentiation, sunk exit costs, strategic behavior, special resources or licenses, and other legal restrictions. Because both incumbents and new entrants appears to enjoy the same benefits of economies of scale, these do not appear to constitute a major entry barrier in the US auto industry. White (1971: 38–53) estimates the minimum efficient scale of production in automobiles to be about 400,000 vehicles per year, which amounts to only an 8–10% market share. Absolute capital requirements, however, may be more important. New entrants in the automobile market must build a variety of plants, such as engine and final assembly plants, that require significant sunk costs, and establish a distribution and a dealership network to sell 400,000 units. According to the Department of Transportation this can easily cost over a billion dollars (Adams and Brock, 1990: 110). This large investment for the new entrant, along with the uncertainty of future success, provides a relatively high barrier to entry.

Does automobile advertising function as a barrier to entry? Advertising can be an important source of first-mover advantages (Schmalensee, 1982; Leffler, 1981). In some markets, firms must achieve a certain level of brand recognition to enter; for incumbents, these expenditures are sunk, creating an 'advertising cost wedge' between incumbents and potential entrants (Albion and Farris, 1981; Kessides, 1986). However, advertising also facilitates entry by providing information to consumers about potential entrants (Telser, 1964; Brozen, 1974, 1975) and by reducing the risk that a new entrant will fail (Kessides, 1986). Product differentiation may be an entry barrier, though advertising does not appear to be a major source of product differentiation in the auto industry. Automobiles tend to be differentiated by rapidly changing styles and body types, not by advertising. This forces rivals to develop new styles and models to remain competitive. Thus, the actual barrier to entry is another financial one, because producers must be able to finance the development and production of new product types and styles.

We examine the importance of advertising as a barrier to entry indirectly, by focusing on the relationship between advertising and profitability. We find that advertising does not, on average, increase profits. We interpret this finding as evidence that advertising is not a significant entry barrier in this industry.

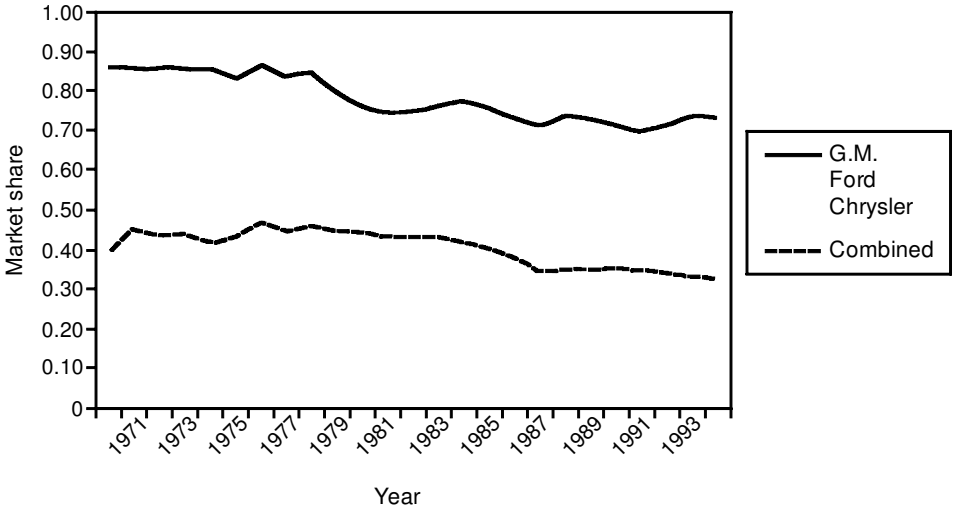

Figure 1

3. Data and Methods

Many well-known studies of the economic impact of advertising are cross-sectional (Telser, 1964; Backman, 1967; Comanor and Wilson, 1969; Sutton, 1974). Our approach focuses on one industry, using a 25-year time series. We regress profitability on advertising expenditures, market structure, and other controls for each of the three largest firms in the industry.

We measure profit as return on sales, defined as net income divided by total US sales. Of course, as Fisher (1987) points out, accounting rates of return are not necessarily measures of monopoly power. Moreover, profits, however measured, may result from superior efficiency (Demsetz, 1973) or entrepreneurial foresight (Kirzner, 1973) rather than market power. Following the standard approach in this literature, however, we ask whether advertising increases market power, and whether market power in turn increases profitability. McAuliffe (1987: 53–55) shows that market share affects profitability only if the firm has market power. Similarly, advertising affects profitability only if the firm has market power. Therefore we can look at the relationship between advertising and profitability to see if advertising makes markets more or less competitive.

Our data are annual figures from 1970 to 1994. (Reliable data before 1970 were unavailable.) Collecting sales data for the US market alone proved difficult because the firms usually report only worldwide sales figures, not sales per country. Trade journals such as *Ward's Automotive Yearbook*, *Automotive News Market Data Book*, and *AAMA Motor Vehicle Facts & Figures* provide US sales in numbers of units, but not dollar amounts. *Moody's Industrial Manual* provides segmented sales figures for the US market only for General Motors for 6 years; annual reports from G.M. and Ford provide similar data for 10 of our 25 years. To estimate US sales figures for our entire period (1970–94), we adjust each firm's total sales by a proxy for the proportion of total sales going to the US. The proxy is calculated by dividing each firm's sales by the total number of cars sold worldwide and multiplying the result by the total number of cars sold in the US. This gives a dollar value that estimates

closely the actual sales figure for the US market. The difference between the calculated and the actual value adjusted over the 10-year period provided a correction factor that is used to approximate the US market sales figures for the remaining years of the time series.

The difference between calculated and actual sales figures in the sample is the result of the price difference for cars in the markets outside the US and by diminished per-car revenues in foreign markets due to tariffs and other trade barriers. A similar correction factor is used to estimate cost figures for the US market. The correction factor leads to higher actual total cost in the US market than originally calculated. This discrepancy is explained by higher labor costs in the US and higher fixed costs due to the larger number of manufacturing plants in the US versus overseas.

The *LNA $ Advertising Summary*[3] provides annual advertising data for the 100 largest advertisers in the US. Each of the Big Three is among the 10 largest advertisers in absolute dollar values. The *LNA $ Summary* provides some information on advertising expenditures by different media, but because auto advertising is similar across competitors, we use only the aggregate amounts per firm.

Proponents of the view that advertising increases competition argue that the treatment of advertising as an expense, rather than an investment, is partly responsible for findings that advertising decreases competition. Lambin (1976: 231–51), for example, finds that the problems in determining the relation between advertising and profitability arise partly because advertising is treated as an expense, whereas advertising has long-term effects on sales and thus should be treated as an investment. Advertising, looked at as an expense, overstates firms' profit rates because it understates firms' assets by omitting the company's stock of advertising capital. Weiss (1969: 421–30), Bloch (1974: 267–86), and Ayanian (1975) calculate a depreciation rate for advertising to augment their advertising figures, adjusting the rate of return accordingly.[4] This increases 'true' industry rates of return, making it more difficult to show a positive significant relationship between advertising and profitability.

We do not make a depreciation rate adjustment because our primary data consist of three time series, analyzed independently, rather than a panel. The adjustments made in the previously cited studies were designed to correct errors in industry-wide data relating to consumer behavior as well as the competition–advertising relationship. Because it is difficult to construct a proper depreciation rate for each firm, we use the unadjusted advertising figures.

As additional control variables, we include an index of US retail gasoline prices to account for other factors affecting the demand for automobiles, and a measure of market share, to address the argument made by Kwoka and Ravenscraft (1986) that profitability is explained by market share, not by industry concentration.[5] Of course, the inclusion of market share as an explanatory variable raises further questions about endogeneity, so we perform all our major tests both with and without it. We retrieved the gasoline price index from the American Petroleum Institute. *Automotive News Market Data Book* provides information on market shares. Market share for firm i is calculated by dividing the total number of cars sold by firm i in the US by the total number of cars sold in the US by all manufacturers, including foreign producers.

Table 1 contains descriptive statistics on the sample, and Table 2 provides simple correlations between the main variables of interest. The dataset itself is reproduced

Table 1. Descriptive statistics

	G.M.	Ford	Chrysler
ADV	512.450	338.337	293.845
	(378.239)	(202.528)	(160.507)
SALES	68,224.308	40,692.700	22,652.125
	(19,138.614)	(11,883.445)	(7,963.776)
PROFIT	−0.011	0.030	−0.008
	(0.072)	(0.030)	(0.053)
MKTSHR	0.406	0.238	0.140
	(0.045)	(0.023)	(0.018)
GASOLINE	90.736	90.736	90.736
	(34.076)	(34.076)	(34.076)

Means of primary variables with standard deviations in parentheses. *ADV* is defined as US advertising expenditures in millions of 1992 dollars. *SALES* is total US sales in millions of 1992 dollars. *PROFIT* is defined as net US income divided by total US sales. *MKTSHR* is US market share. *GASOLINE* is an index of US retail gasoline prices. Twenty-five observations per firm, 1970–94.

as Appendix A. As seen in Table 2, G.M. is by far the largest advertiser of the three, spending over one-and-a-half times as much on average as Ford and Chrysler over this period. Because we use income and sales figures for the US market only, our values for income are generally lower than what the firms would have reported on their consolidated financial statements. Consequently, our measured profit rates (defined as US return on US sales) appear unusually low, with means of −0.0109 for G.M., 0.0296 for Ford, and −0.0082 for Chrysler. As explained above, we calculate net income by subtracting total US costs from total US revenues. Because the three firms incur most of their R&D and production costs in the US, this procedure overstates the true domestic cost of production. However, we have no reason to suspect systematic differences between the firms in the proportion of domestic versus overseas R&D and production costs, so we do not think our procedure introduces any biases.[6]

Originally, we hoped to include the major foreign competitors, Toyota, Honda, and Nissan. Unfortunately, the necessary segmented sales, cost, and capital data are unavailable for these firms. Finding a meaningful correction factor is extremely difficult due to large differences in exchange rates if the annual average or the rate at the end of the fiscal year is used. Including Toyota, Honda, and Nissan would also have generated difficulties because they cannot be assumed to have been operating in a profit-maximizing manner due to voluntary export restrictions. Because of these difficulties we omit them from the investigation. Kwoka (1993) similarly uses only US data in his study of the 1960–82 period. His OLS estimation does not analyze profitability but focuses on the competitive effects of advertising (which he finds to be short-lived) and styling (which he finds to have a much longer impact).

Unfortunately, we are unable to control for all the competitive and regulatory changes that took place during this 25-year period. However, two additional controls deserve mention. First, a reader suggested including a dummy variable for 1979 and later years to account for the 'gas-guzzler' tax that was imposed beginning with the 1980 model year. We re-ran our primary regressions with this dummy and the results were virtually identical to those described below (the dummy itself was

Table 2. Correlation matrix

	G.M.				
	ADV	*SALES*	*PROFIT*	*MKTSHR*	*GASOLINE*
ADV	—	0.85642	−0.32437	−0.88874	0.21204
		(0.0001)	(0.1137)	(0.0001)	(0.3089)
SALES		—	−0.23714	−0.75532	0.40756
			(0.2537)	(0.0001)	(0.0432)
PROFIT				0.36540	−0.25465
				(0.0725)	(0.2193)
MKTSHR				—	−0.04443
					(0.8330)
GASOLINE					—

	Ford				
	ADV	*SALES*	*PROFIT*	*MKTSHR*	*GASOLINE*
ADV	—	0.92692	0.06248	−0.12560	0.31156
	(0.0001)	(0.7667)	(0.5497)	(0.1295)	
SALES		—	0.24879	0.05364	0.10389
			(0.2304)	(0.7990)	(0.6212)
PROFIT			—	0.35364	−0.49081
				(0.0829)	(0.0127)
MKTSHR				—	−0.87394
					(0.0001)
GASOLINE					—

	Chrysler				
	ADV	*SALES*	*PROFIT*	*MKTSHR*	*GASOLINE*
ADV	—	0.95823	0.24514	−0.26423	0.24716
		(0.0001)	(0.2376)	(0.2018)	(0.2336)
SALES		—	0.32067	−0.16968	0.15708
			(0.1181)	(0.4175)	(0.4533)
PROFIT			—	0.30995	−0.21825
				(0.1316)	(0.2946)
MKTSHR				—	−0.81154
					(0.0001)
GASOLINE					—

Pearson correlation coefficients for advertising measured in constant dollars (*ADV*), sales measured in constant dollars (*SALES*), return on sales (*PROFIT*), market share (*MKTSHR*), and the retail price of gasoline (*GASOLINE*). Significance probabilities in parentheses. Twenty-five observations per firm, 1970–94.

never significant). Second, our market-share variable does control partially for the presence of foreign competitors, because the market is defined as all vehicles sold in the US, foreign and domestic.

4. Empirical Results

4.1. Basic Results

We begin with OLS estimation of the following regression, estimated separately for each of the three firms:

$$PROFIT_t = \beta_0 + \beta_1 ADV_t + \beta_2 GASOLINE_t + \beta_3 MKTSHR_t + u_t \qquad (1)$$

PROFIT is return on sales, *ADV* is advertising expenditures, measured in constant (1992) dollars, *MKTSHR* is market share, and *GASOLINE* is the retail gasoline price index.[7] Because we have time-series data, we include a correction for first-order serial correlation. Results are presented in Table 3, both with and without market share as an explanatory variable. Advertising is statistically significant in none of the six regressions. Market share is significant (and positive) only in the G.M. regression. As expected, the coefficient on gasoline prices is negative, though significant in only one regression. In this simple specification, then, increases in advertising do not increase profitability, controlling for market share and other demand characteristics.

Ideally, as pointed out by Schmalensee (1972), advertising should be measured as a quantity, not an expenditure (which reflects both quantity and the price of advertising). An increase in the price of advertising, for example, can increase advertising expenditures without increasing the number of advertising messages broadcast to consumers. Hence our findings in Table 3, like other findings in this literature, could be driven by incorrect measurement of advertising.

To account for this possibility, we augmented our analysis using advertising price index data from the Economic Research Service of the US Department of Agriculture. This series contains indexes of cost per 1 000 targeted viewers or readers for eight categories of advertising (network, spot TV, network radio, spot radio, magazines, supplements, newspaper, and outdoor). Lacking information on the distribution of automobile advertising across these categories, we averaged them into a single index. We then divided advertising expenditures by this index to derive a measure of advertising 'messages' and re-ran the regressions in Table 3 using messages as the advertising measure. Unfortunately, reliable data on advertising prices are available only since 1982, so we could not perform this experiment with our complete time series. With so few observations per firm we pooled the three time series into a single panel and estimated the regressions with firm- and year-fixed effects.

Results are presented in Table 4. The coefficient on advertising messages is not significant, either with or without the market share variable. (Market share itself is positive and significant at the 10% level.) Thus even when we control for the price of advertising, and with a shorter time series, advertising does not have a significant effect on profitability, controlling for gasoline prices and market share. This supports the basic results presented in Table 2.

4.2. Endogeneity

Because advertising affects sales, and sales revenues also fund advertising expenditures, a simultaneous-equations framework may be more appropriate than simple OLS for studying the advertising–sales relationship (Quandt, 1964; Bass and

Table 3. Effects of advertising expenditures on profitability

	G.M.		Ford		Chrysler	
Constant	0.0626	−0.3725	0.0920***	0.1029	0.0213	−0.1133
	(0.0565)	(0.3316)	(0.0285)	(0.1375)	(0.0545)	(0.1983)
ADV	−0.0454	0.0643	0.0465	0.0437	0.1487	0.1415
	(0.0434)	(0.0910)	(0.0384)	(0.0351)	(0.0918)	(0.0856)
GASOLINE	−0.0004	−0.0006	−0.0007***	−0.0006*	−0.0006	0.0003
	(0.0004)	(0.0005)	(0.0002)	(0.0003)	(0.0004)	(0.0005)
MKTSHR	—	0.9991	—	−0.0634	—	0.6987
		(0.7444)		(0.4509)		(1.0198)
p	−0.1189	−0.1648	−0.5838***	−0.4414**	−0.4595**	−0.3615*
	(0.2166)	(0.2205)	(0.1771)	(0.2006)	(0.1938)	(0.2084)
p^2	0.1565	0.2262	0.5508	0.5274	0.3374	0.3388

OLS regressions of return on sales on advertising measured in constant dollars (*ADV*), the retail price of gasoline (*GASOLINE*), and market share (*MKTSHR*). Twenty-five observations per firm, 1970–94. Standard errors in parentheses; p is the estimated first-order autocorrelation coefficient. ***,**, and * designate statistical significance at the 1, 5, and 10% levels, respectively.

Parson, 1969). For example, letting S_t be the number of units sold in year t, ADV_t be advertising, P_t be price, a,b,c,d,e,f, be coefficients, and u_t and u_t be error terms, the appropriate system is:

$$S_t = a + bADV_t + cP_t + u_t \tag{2}$$

$$ADV_t = d + eS_t + fP_t + u_t \tag{3}$$

If both advertising and sales are endogenous, then ADV_t in (1) is positively correlated with the error term u_t, and S_t in (2) is positively correlated with u_t. Consequently, OLS estimates are biased and inconsistent (Schmalensee, 1972: 98–100).

We accounted for the possible endogeneity of advertising in three ways. First, we experimented with lagged independent variables in our OLS regressions of profitability on advertising. We re-estimated the basic regressions reported in Table 3 using various combinations of lagged advertising instead of current-year advertising; we also included gasoline prices, and market share in half the specifications. The results were generally the same as those reported in Table 3. None of the coefficients on the lagged advertising terms were significant and positive. (Lagged advertising was significant, but negative, in a few of the G.M. regressions.) In short, exploiting the additional information provided by lagged values of advertising leaves our basic findings intact.

Second, we used Granger causality testing (see, e.g., Berndt, 1991) to examine the causal relation between advertising (*ADV*) and profitability (*PROFIT*). We began by regressing profitability on its own lags and four lags of advertising to see whether lagged information on advertising provides any statistically significant information on profitability in the presence of lagged profitability. We estimated the following unrestricted regression by OLS:

Table 4. Effects of advertising messages on profitability

Constant	2.3250*	1.6353
	(1.2486)	(0.12276)
MESSAGES	0.0046	0.0512
	(0.0266)	(0.0347)
GASOLINE	−0.0203*	−0.0163
	(0.0106)	(0.0101)
MKTSHR	—	1.0437*
		(0.5403)
FORD	0.0217	−0.0888
	(0.0236)	(0.0614)
GM	−0.0503	−0.3600**
	(0.0387)	(0.1644)
F	2.187[a]	2.556[a]
R^2	0.5932	0.6572

Panel regressions of return on sales on advertising messages, defined as advertising expenditures divided by an index of advertising prices (*MESSAGES*), the retail price of gasoline (*GASOLINE*), and market share (*MKTSHR*). Pooled data, 1982–93. Standard errors in parentheses. Firm- and year-fixed effects included. ***, **, and * designate statistical significance at the 1, 5, and 10% levels, respectively; [a] indicates joint significance at the 5% level.

$$PROFIT_t = a_1 + \sum_{i=1}^{n} b_i\, PROFIT_{t-i} + \sum_{i=1}^{n} c_i\, ADV_{t-i} + v_t \tag{4}$$

Assuming v_t is a white noise, we can conclude that advertising does Granger-cause profitability if the advertising coefficients c_i are jointly significantly different from zero. To test the null hypothesis that $c_1 = c_2 = \ldots = c_n = 0$, we conducted an *F*-test by estimating the following restricted equation, also by OLS:

$$PROFIT_t = a_0 + \sum_{i=1}^{n} d_i\, PROFIT_{t-i} + \eta_t \tag{5}$$

We used the respective sum of squared residuals to compute the *F*-statistic in the standard way. If the *F*-statistic is greater than the specified critical value, we can reject the null hypothesis that advertising does not Granger-cause profitability. Next, using the same procedure, we regressed advertising on its own lags and the lags of profitability to see if profitability Granger-causes advertising. By performing the second regression in the same manner, this time with advertising as the left-hand-side variable, we can determine if there is a one-directional causation between advertising and profitability or if the causation works in both directions.[8]

Regressing profitability on its own lags and lagged advertising, and using four lags of each variable,[9] we found that the coefficients on lagged advertising are jointly significantly different from zero only for G.M. (The *F*-statistic is 6.109, significantly different from zero at the 1% level.) For Ford and Chrysler, the *F*-statistics are below their critical values, and we cannot reject the null hypothesis that the coefficients on lagged advertising are jointly equal to zero.

For G.M., then, advertising may be said to Granger-cause profitability. For the other two firms, lagged values of advertising provide little information on profitability. The reverse test suggests that advertising may be taken as exogenous in all our specifications. For all three firms, the *F*-statistics are below their critical values. Lagged values of profitability provide no additional information on current values of advertising in the presence of lagged values of advertising.

However, our sample is limited to 25 annual observations per firm, so the Granger causality tests are relatively low-powered. With four lags of both variables, we are left with only 12 degrees of freedom. Thus we cannot rule out the possibility that advertising is endogenous. To address this concern, we re-estimated the relation between advertising and profit for all three firms using two-stage least squares, with gasoline prices and lagged advertising as instruments for advertising. In the first stage we regressed advertising on lagged advertising and gasoline prices, then used the fitted values of advertising as regressors in the second-stage regressions. For the regressions including market share in the second stage, we added market share as an instrument in the first-stage regression.

Results are reported in Table 5. As seen in the table, none of the coefficients on advertising are significant and positive. (For G.M., when only the fitted values of advertising and gasoline prices are used as second-stage regressors, the coefficient on advertising is significant, but negative.) In short, even accounting for possible endogeneity with lagged right-hand-side variables and instrumental-variables estimation, we find no evidence that advertising increases profits above normal levels throughout this period.

Conceivably, these regressions could be biased due to omitted variables. When examining advertising and profitability for a causal relationship, we must consider if variables affecting, or affected by, profitability are omitted. Economies of scale, for example, could be correlated with advertising. Increases in advertising could increase output, which in turn can lead to economies of scale, and this could reduce the rate of return on sales even if advertising did increase market power. However, this scenario takes place only under the assumption that a firm must lower its price to increase output. When a firm advertises, it incurs a demand-increasing cost that allows it to increase output without lowering the price. Therefore, the rate of return on sales does not necessarily have to fall when advertising increases and economies of scale become more important. Furthermore, the longer the period under investigation, the less likely the correlation between advertising and economies of scale. Looking at shorter periods increases the likelihood of possible correlation, which could suggest bias in previous cross-sectional studies on the causal relation between advertising and profit. Our time-series approach makes the problem of omitted variables less likely.

4.3. Rivalry

Our results are consistent with the view that advertising makes markets more competitive by providing consumers with information about prices and products. We find no evidence that US automobile advertising increased manufacturers' profits beyond normal levels during the 1970s, 1980s, and early 1990s. This suggests that the three firms have maintained an active rivalry during this period, competing aggressively for customers on price, quality, and product variety.

Table 5. Two-stage least squares estimates of profitability

	G.M.		Ford		Chrysler	
Constant	0.0828	0.4598	0.0752***	0.3196*	0.0216	−0.2827
	(0.0554)	(0.5293)	(0.0207)	(0.1749)	(0.0419)	(0.1992)
ADV	−0.0903**	−0.1878	0.0383	0.0573	0.0819	0.0914
	(0.0420)	(0.1484)	(0.0305)	(0.0333)	(0.0742)	(0.0718)
GASOLINE	−0.0004	−0.0002	−0.0005***	−0.0010**	−0.0004	0.0001
	(0.0004)	(0.0005)	(0.0001)	(0.0003)	(0.0003)	(0.0005)
MKTSHR	—	−0.8337	—	−0.8307	—	1.6419
		(1.1586)		(0.5912)		(1.054)
R^2	0.2288	0.2116	0.2975	0.3566	0.1122	0.2120

Two-stage least squares regressions of return on sales on advertising measured in constant dollars (*ADV*), the retail price of gasoline (*GASOLINE*), and market share (*MKTSHR*). Lagged advertising and gasoline prices used as instruments in the first-stage regressions in the first, third, and fifth columns; market share used as an additional instrument in the second, fourth, and sixth columns. Twenty-four observations per firm, 1971–94. Standard errors in parentheses. ***, **, and * designate statistical significance at the 1, 5, and 10% levels, respectively.

Indeed, the advertising-as-information perspective assumes active competition among advertising firms. By informing consumers about its own products and prices, signalling the quality of its brand name, and so on, each firm makes its rivals' demand curves more elastic. Of course, if only one firm were to advertise, while its competitors did not, the advertising firm could presumably steer customers to itself. The degree to which a firm's profits respond to its rivals actions can thus be interpreted as a measure of the strength of among-brand competition.

Our data allow us to explore this notion of rivalry directly by including cross-advertising terms in regressions of profitability on advertising. To examine this issue, we re-estimated our regressions of profitability on advertising, this time controlling for the advertising of each firm's rivals. For example, we regressed G.M.'s profits on its own advertising expenditures, Ford's advertising expenditures, and Chrysler's advertising expenditures, along with the gasoline price index and G.M.'s market share. Combined with the results reported above, these regressions can be interpreted as measures of rivalry. That is, adding firm *j*'s advertising to a regression of firm *i*'s profitability on firm *i*'s advertising looks at the effect of firm *i*'s decision to advertise, controlling for its rival's decision to advertise. If advertising increases a firm's profitability when its rival's advertising is held constant, but not otherwise, then the firm and the rival are competing for the same customers. Of course, if the firms' advertising levels covary over time, then these regressions will suffer from multicollinearity.[10] The results must thus be interpreted cautiously.

Table 6 presents results of the regressions including the cross-advertising terms. For Chrysler, the results suggest strong inter-brand competition. The coefficient on own advertising is significant and positive. That is, controlling for G.M.'s and Ford's advertising, Chrysler can increase its profits by increasing its advertising expenditures, providing new information about its own products and prices while its rivals do not. Without controlling for rivals' advertising, as in Table 3, we found that the

Table 6. Effects of rivals' actions on profitability

	G.M.		Ford		Chrysler	
Constant	0.1341**	−0.1680	0.0784***	0.1175	−0.0012	−0.1187
	(0.0631)	(0.3298)	(0.0273)	(0.1437)	(0.0549)	(0.2085)
ADV-OWN	−0.0478	0.0095	0.0191	0.0129	0.5709*	0.5802*
	(0.1079)	(0.1235)	(0.1311)	(0.1444)	(0.3079)	(0.3244)
ADV-GM	—	—	−0.0463	−0.0518	−0.0389	−0.0332
			(0.0427)	(0.0427)	(0.0879)	(0.0910)
ADV-FORD	0.9662**	0.9122**	—	—	−0.2916	−0.3089
	(0.4005)	(0.3979)			(0.2799)	(0.2954)
ADV-CHRY	−1.1955**	−1.0910**	0.1293	0.1495	—	—
	(0.4525)	(0.4658)	(0.1432)	(0.1595)		
GASOLINE	−0.0008	−0.0009	−0.0006**	−0.0006*	−0.0004	−0.0002
	(0.0005)	(0.0005)	(0.0002)	(0.0003)	(0.0004)	(0.0006)
MKTSHR	—	0.6747	—	−0.1492	—	0.6051
	(0.7217)		(0.4791)		(1.0687)	
ρ	−0.2340	−0.2488	−0.4804***	−0.3708**	−0.4324***	−0.3599*
	(0.2230)	(0.2282)	(0.2012)	(0.2188)	(0.2068)	(0.2199)
R^2	0.3830	0.4124	0.5792	0.5664	0.4054	0.4070

OLS regressions of return on sales on each firm's own advertising measured in constant dollars (*ADV-OWN*), the retail price of gasoline (*GASOLINE*), market share (*MKTSHR*), and the advertising of each firm's rivals. Twenty-five observations per firm, 1970–94. Standard errors in parentheses; ρ is the estimated first-order autocorrelation coefficient. ***, **, and * designate statistical significance at the 1, 5, and 10% levels, respectively.

coefficient on Chrysler's advertising was not significant. This implies that the presence of its rivals constrains Chrysler's ability to increase its profits above normal levels by providing information about its own products.

The results for G.M. and Ford are more difficult to interpret, however. In neither case is the coefficient on the firm's own advertising significant, controlling for the advertising of its rivals. Neither firm can generate supranormal profits by increasing its advertising expenditures, even if its rivals do not adjust their own advertising expenditures. One plausible interpretation is that given their already high levels of advertising expenditures, further increases do not attract substantial numbers of additional customers, even if the other firms maintain their current advertising levels.

The coefficients on the remaining cross-advertising terms shed additional light on the competitive relationships among the three firms. Chrysler and G.M. appear to compete for the same customers: the cross-advertising terms between G.M. and Chrysler are negative (but significant only in the G.M. regressions). Increases in Chrysler's advertising reduce G.M.'s profits, controlling for G.M.'s own advertising. On the other hand, the coefficient on Ford's advertising in the G.M. regressions is positive and significant. This suggests that at least part of Ford's advertising over this period is less product-specific, allowing G.M. to free-ride on the information provided by Ford. However, our data cover a 25-year period, and it is doubtful that specific competitive relationships among the three remained stable over that many years. For that reason, these cross-advertising results should be taken as suggestive, not conclusive.

5. Summary

We examined the effects of advertising on profitability in the US auto industry in the 1970s, 1980s, and early 1990s. Our results support the view that advertising makes markets more competitive, not less competitive. We find no evidence that advertising operates as a barrier to entry. Our methods and data were carefully chosen to correct for problems that biased the results of previous studies. We use firm-specific data over a 25-year period to conduct separate time-series analyses on each of the three major firms in the industry. We are careful to deal with the potential endogeneity of advertising. The results are fairly robust to model specification and choice of performance variables. On the whole, our findings strongly suggest that automobile advertising provides a social benefit.

Notes

1. For surveys of the literature published through the late 1970s, see Comanor and Wilson (1979), Bloch (1980), and Simon (1980). For a survey emphasizing the newer point of view, see Ekelund and Saurman (1988).
2. We do not address the question of whether advertising is designed to provide general information about availability and quality, or to signal high quality to relatively uninformed consumers. Nichols (1998) shows that automobile industry advertising is positively and significantly correlated with product quality, where quality is unobservable before purchase but becomes available after the product's release. This finding lends further credence to the advertising-as-information perspective.
3. Prior to 1980, the *LNA National Advertising Investment*.
4. See also Ekelund and Saurman (1988: 106–09).
5. Das *et al.* (1993) show a positive and statistically significant *ceteris paribus* relationship between advertising intensity and market share instability, supporting the view that advertising in procompetitive. However, they do not model profitability as we do. We view our and their results as complementary.
6. To verify the robustness of our results to this assumption, we re-estimated all the major regressions in the paper using unadjusted (consolidated) income data; all the basic results remained the same.
7. Many of the early studies in this area, such as Comanor and Wilson (1967), Bloch (1974), and Ayanian (1975), use a size-adjusted measure of advertising, such as the advertising-to-sales ratio. All our basic results hold when we use this measure instead of advertising expenditures.
8. See Ashley *et al.* (1980) for a similar causality test using aggregate data on advertising and consumption.
9. We repeated the tests using two and three lags, with similar results.
10. Changes in advertising levels could be correlated under tacit collusion, in which case firms could jointly raise or lower advertising expenditures based on expectations of future market conditions. Borenstein and Shepard (1996) show that profit margins increase with expected future profits in retail gasoline markets, supporting the existence of tacit collusion in that industry. The high absolute advertising expenditure levels in our sample make the presence of tacit collusion on advertising doubtful.

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Appendix A. Primary dataset

Year	G.M.				Ford				Chrysler				*GASOLINE*
	ADV	*SALES*	*PROFIT*	*MKTSHR*	*ADV*	*SALES*	*PROFIT*	*MKTSHR*	*ADV*	*SALES*	*PROFIT*	*MKTSHR*	
1970	136.385	28773.112	−0.00297	0.39800	108.662	26963.343	0.03758	0.28365	112.720	12469.004	−0.02072	0.17850	35.7
1971	180.601	37237.255	0.03436	0.44720	122.868	28507.660	0.04310	0.25452	118.738	13790.711	−0.00232	0.15430	36.4
1972	149.564	41089.014	0.03703	0.43630	160.198	32962.481	0.04621	0.26148	136.722	15953.532	0.01025	0.1643	36.1
1973	164.288	45635.484	0.03280	0.44010	164.216	35699.091	0.04253	0.25385	157.899	18191.129	0.01306	0.16370	38.8
1974	142.216	39286.115	−0.00542	0.41830	134.927	33563.904	0.01850	0.26709	149.125	17062.394	−0.01466	0.17200	53.2
1975	167.530	45773.262	−0.00028	0.43370	134.314	38049.255	0.01666	0.24635	166.498	18117.318	−0.03367	0.15630	56.7
1976	221.776	57455.046	0.02710	0.46880	158.544	28669.812	0.03724	0.24310	162.939	17577.076	0.00859	0.15830	60.4
1977	254.910	64862.475	0.02630	0.45120	177.469	34260.495	0.04733	0.25090	154.439	17895.600	−0.00356	0.13770	64.2
1978	277.759	72145.100	0.02090	0.46310	189.231	38776.858	0.04028	0.25500	229.187	18801.269	−0.02322	0.12970	65.2
1979	330.790	73672.539	0.00860	0.45010	219.611	36060.936	0.02935	0.23040	190.428	16866.965	−0.08061	0.11790	88.2
1980	286.116	61929.870	−0.05030	0.44520	271.806	29640.833	−0.03810	0.20290	189.085	14657.743	−0.17672	0.11320	122.1
1981	313.753	63641.627	−0.03110	0.43500	261.004	26907.670	−0.02436	0.19690	191.083	14432.287	−0.06205	0.11620	135.3
1982	394.706	66225.872	−0.02000	0.43560	294.312	27301.710	−0.01458	0.20210	242.092	16335.475	−0.01144	0.11740	128.1
1983	429.371	74285.690	0.01520	0.43530	390.723	32861.457	0.04509	0.20770	293.087	19307.467	0.02120	0.12300	122.5
1984	284.999	83332.905	0.01920	0.42030	256.114	39101.326	0.05860	0.21760	248.280	25675.285	0.08999	0.13710	119.8
1985	453.744	86263.043	0.00640	0.40790	424.180	40708.267	0.05078	0.21360	387.226	28305.977	0.04772	0.14000	119.6
1986	515.684	96030.568	−0.00690	0.38740	449.703	47891.737	0.05842	0.21180	372.887	29384.327	0.03830	0.13590	93.1
1987	626.520	85356.901	−0.00050	0.34970	403.668	52836.064	0.07199	0.23210	390.523	29562.688	0.03351	0.13500	95.7
1988	963.560	87755.911	0.02200	0.35620	447.915	56412.530	0.05689	0.24250	372.070	32926.571	0.01932	0.14270	96.3
1989	988.255	84106.783	0.01566	0.35230	477.989	56499.908	0.03079	0.24250	386.948	30136.142	−0.00093	0.13830	106.0
1990	1120.406	77805.941	−0.05977	0.35530	479.824	49619.804	0.01288	0.23890	419.931	25953.700	−0.01012	0.12230	121.7
1991	1085.506	74554.002	−0.09764	0.34960	531.627	41728.967	−0.03562	0.23250	426.064	23936.176	−0.04421	0.12220	119.6
1992	947.827	79783.400	−0.31808	0.34130	601.730	51918.000	0.00990	0.24780	567.394	29784.441	0.00910	0.13290	119.0
1993	1074.178	87831.380	0.00212	0.33530	705.947	60700.487	0.04479	0.25600	572.249	37231.586	−0.07600	0.14710	117.3
1994	1300.797	90774.393	0.05100	0.33240	891.839	69674.906	0.05587	0.25300	708.506	41948.260	0.06345	0.14610	117.4

Primary data on US advertising expenditures in millions of 1992 dollars (*ADV*), total US sales in millions of 1992 dollars (*SALES*), return on sales (*PROFIT*), market share (*MKTSHR*), and an index of US retail gasoline prices (*GASOLINE*).