THE JOURNAL OF INDUSTRIAL ECONOMICS
Volume XXVIII June 1980 No. 4

THE 1958 AUTOMOBILE INFORMATION DISCLOSURE ACT: A STUDY OF THE IMPACT OF REGULATION

RICHARD L. SMITH, II*

IN recent years there has been an emerging trend toward empirical examination of the effects of regulation. A variety of techniques have been applied to the study of regulation with varying degrees of success. Not infrequently, however, the use of different econometric tools can lead different researchers to reach opposite conclusions as to the impact of the same regulation. This is not surprising since the leap from theory to empirical hypothesis is a tenuous one.

This paper focuses on one particular regulation, the 1958 Automobile Information Disclosure Act (AIDA), which required 'sticker prices' and equipment lists to be posted on new cars. The analysis of a previous study is extended to incorporate additional data and alternative econometric techniques. The primary finding is that the conclusions of the earlier study are not supported.

In a recent study Stanley Boyle and Thomas Hogarty (BH) present an analysis of pricing behavior among the top three United States automobile producers over the period 1957–71 [2]. Their purpose was to test the impact of the AIDA on the competitiveness of industry pricing. Based on their analysis the authors conclude:

> The overall results suggest that the three largest manufacturers in this industry collude in terms of quality adjusted prices and that such collusion became successful as a result of the October 1958 Automobile Information Disclosure Act.

Their remedy is straightforward:

> [T]his Act should be repealed or, if that action is undesirable, be supplemented with action designed to reduce the firms' ability to collude.

This paper calls attention to some deficiencies of the characteristic pricing model as an instrument for testing for the presence of collusion, and presents new evidence that does not support the BH conclusion.

* Financial support was provided by the Research Program in Competition and Business Policy, University of California, Los Angeles, J. Fred Weston, Director. Thanks to Professor Weston as well as Stanley I. Ornstein, Ronald Bibb, Kwang Chung, and David Levy for reading and commenting on earlier drafts of this paper.

Review of the BH Analysis

The approach employed by BH is to construct an empirical model explaining automobile list prices in terms of objectively measurable characteristics, the theoretical reasoning being that these characteristics are really what the consumer buys, and therefore products comprising different bundles of characteristics can be analyzed in terms of a set of common dimensions.

The characteristic pricing approach is well known, and has been successfully used in many empirical studies [9] [11]. However, the application by BH is unique in that the authors attempt to employ the model as an instrument for detecting collusion on product price arising from regulation [2] [10].

The premise of the BH analysis is that AIDA mandated disclosure of list price and product characteristics facilitates collusive pricing and lowers the cost of policing cartel members. BH argue that the success of such a cartel would be revealed by uniformity of quality adjusted product list prices. Hence they employ characteristic pricing to control for product differences and then use an F-test to evaluate the homogeneity of implicit characteristic prices over the three leading firms. If the homogeneity hypothesis is accepted, the authors interpret this to mean that the individual firms are employing identical mechanisms for list price determination, from which they infer that prices are being set collusively.

There are two problems with this approach: the first is a theoretical point concerning the linkage between homogeneity of prices and collusion, and the second is a statistical one with respect to acceptance of the price homogeneity hypothesis. A brief comment is in order on both.

Limitations of the Characteristic Pricing Model

The reasoning behind the characteristic pricing model (CPM) is that market goods are composed of characteristics which provide utility to consumers. The demand for the market good is actually a derived demand based on the demands for the characteristics. Under the rather strict assumptions of completeness and divisibility with costless information and costless trading, separability in characteristics obtains. The price of any market good is determined by the underlying characteristics, and is enforced by the trading behavior of market participants. In other words, there is competition in the market for characteristics, and this carries over into the goods market.

A number of studies have attempted to determine whether the automobile market approximates the idealized market sufficiently that the technique of characteristic pricing can be applied. The answer must be that it depends on the purpose of the researcher. There are enough different vehicle models that it may be regarded as complete if one is willing to restrict himself to looking at general and basic characteristics such as horsepower. If one

considers the availability of rental vehicles the divisibility problem is reduced, and it is also true that the cost of trading is relatively small compared to the price of the product. Since the differences between the theoretical model and the actual automobile market are not great, use of the CPM is probably appropriate for studies like that of BH.

However, the essential problem with using the CPM to look at collusion is that, in terms of the tests of homogeneity, improved competition and increased collusion are observationally identical. Both would be evidenced by increasingly homogeneous sets of market prices over firms. Thus, when BH find homogeneity of list prices over General Motors, Ford, and Chrysler in all but two years it is impossible to say whether this represents collusion or reduced information cost to consumers due to the AIDA, and hence improved competition.

As an empirical proposition homogeneity is not only consistent with competitive pricing—it is the only result consistent with it. Heterogeneity can mean one of two things. Either some seller has market power or else prices are in disequilibrium and will be corrected either by price adjustments or by the failure of those sellers whose prices are too high.

BH concede that in competition transaction prices would be homogeneous, but they argue that only with collusion would list prices be homogeneous. This distinction is artificial. Since all sellers face more or less similar costs and markets and sell similar products, it is difficult to see why different sellers should not independently arrive at approximately the same list price for the same product. The possibility that transaction and list prices are not closely related to each other is also difficult to accept for the same reasons. List price is, after all, little more than a proxy for actual transaction price. It would behove any seller to make sure his list price was at least competitive with others in the industry.

In summary, homogeneity is consistent with either collusion or competition. To say more than that heterogeneity indicates either disequilibrium or market advantage is theoretically indefensible.

Statistical Testing and Econometric Problems with the CPM

Another point with respect to the BH study is that the significance test applied to the data is misleading. The policy conclusion of the authors is based on the existence of collusion. Supposing, initially, as they do, that homogeneity does evidence collusion, care should be taken not to accept the hypothesized homogeneity too easily. That is, one does not want to accept the null hypothesis, price homogeneity, unless he is reasonably certain of its validity. For the purpose of this analysis whether or not the test used by BH is significant at $\alpha = 0{\cdot}05$, the criterion they use, is irrelevant. One needs to know how powerful the test is.

The critical F-test values in BH Table II, which is reproduced as Table I in Appendix A of this paper, can be used to infer the number of vehicles

included in the study each year. Using this information we can determine the probability that the observed F-value could have been generated by nonhomogeneous pricing practices (column 5 in Table II of the Appendix). From this, it is evident that the probability of BH incorrectly accepting the homogeneity or collusion hypothesis exceeded 10% in all but two of the 13 years in which they accepted it, and exceeded 50% in ten cases. The last column in Table II shows the maximum F-value consistent with a probability of less than 0·5 of accepting the homogeneity hypothesis incorrectly.

This is not sufficiently strong evidence on which to base the conclusion that the auto industry colludes on price. On the other hand, neither does it support the hypothesis that the industry is competitive.

The frequency with which BH fail to reject the homogeneity hypothesis is most likely a two-fold problem: weak data and an incorrectly specified model. A point that the authors fail to note in their paper (but which is covered by Hogarty [10]) is that multicollinearity was a major problem in arriving at the model, and is still prevalent in the final specification. Simple correlation coefficients between variables were frequently in excess of 0·90, making it difficult to arrive at the right variables list and making it difficult to reject the null hypothesis due to large standard errors associated with the implicit prices in the model.

In another paper by Dhrymes [6] principal components analysis is used in a study of the automobile industry to reduce multicollinearity and leads to the result that homogeneity is consistently rejected. The study covers various years from 1953 to 1964. These findings overlap the BH period and are difficult to reconcile with their results.

Evidence on Product Prices

There is one way that the CPM might be used to detect collusion. That would be to demonstrate that an abnormal price increase took place concurrent with the increased homogeneity of prices over firms.

This does not appear to have occurred in the case of the AIDA. From the 1957 pre-AIDA price, to 1971, the end of the BH study, the total price increase for new cars was 15·6%. This is based in an hedonic price index computed by Hogarty [10]. There were no particularly large jumps in his price index in any year, the largest being 4·9% for 1957–58, which is prior to the period when the Act could have had an impact. The estimated total price increase is roughly equivalent to the 13·8% increase in new car prices reported by Bureau of Labor Statistics in the Consumer Price Index, and contrasts with a 42·4% increase both in used car prices and in overall consumer transportation prices, and a 43·9% increase in the overall Consumer Price Index [17]. The apparent decline in the real price of new cars over the period studied by BH would seem to be inconsistent with the hypothesized strengthening of a producer cartel. In light of this

it does not appear that increased homogeneity can be correctly interpreted as evidence of collusion.

Analysis of Stock Returns: An Alternative Approach

The fundamental problem with the characteristic pricing approach as employed by BH is that it cannot distinguish between intense competition and collusion since product prices would be uniform in either case. An alternative approach focuses on security prices rather than product prices. If the AIDA did, as BH allege, facilitate collusion in the industry, the result should have been an increase in the expected profits of firms in the industry. As BH state: '. . . Stockholders will reap the benefits of (more successful) cartelization to the extent that the monopoly profits are recognized as permanent' (p. 92). If the Act had not been fully anticipated prior to its introduction into the Congress, then the expected change in earnings resulting from the AIDA would have been new information, not previously capitalized into security prices. The prices of securities of industry members would then have increased in response to passage of the Act [8].

Several recent studies have employed analysis of residuals to test the impact of regulations such as the AIDA [7] [3]. This is the approach employed here.

On the basis of the rational expectations/efficient market hypothesis it is argued that securities markets will fully capitalize the value of all information as soon as it is available. The implication is that one cannot correctly anticipate earning anything but a normal risk-adjusted return on any security investment. As a result, the full impact of the value of new information should be concentrated in a short time period, and would be evidenced by the existence of abnormally high or low returns during the period.

The expected return on any security j at any time t, $\bar{R}_{jt}$, can be expressed as a function of the expected return on the market portfolio at that time, $\bar{R}_{Mt}$, and the risk-free rate R_{Ft} [14]. The basic expression of the security market line is given by

$$\bar{R}_{jt} = R_{Ft} + \beta_j(\bar{R}_{Mt} - R_{Ft}) \tag{1}$$

where β_j is the covariance of firm returns with the excess of market returns over the risk free rate, divided by the variance of market returns minus the risk free rate.

$$\beta_j = \frac{\text{cov}\,[R_{jt},\,(R_{Mt} - R_{Ft})]}{\text{var}\,(R_{Mt} - R_{Ft})} \tag{2}$$

If R_{Ft} can be assumed constant over all time periods, then the model can be written as

$$\bar{R}_{jt} = (1 - \beta_j)R_F + \beta_j\bar{R}_{Mt} \tag{3}$$

where $(1-\beta_j)R_F$ is the intercept term in a linear regression of R_{jt} on R_{Mt}, and $\bar{R}_{jt}$ equals the sum of the actual return, R_{jt}, plus a residual, ϵ_t which is assumed to be normally distributed with mean zero. Thus, the model can be estimated using ordinary least squares as

$$R_{jt}=\alpha_j+\beta_j R_{Mt}+\epsilon_{jt}. \tag{4}$$

Results of the Residual Analysis

In the residual analysis approach the above model is estimated for observations of returns surrounding, but not including, the period when the event actually occurred. The model thus determined can be solved for the values of the prediction errors during the event period and tests of significance can be applied to these prediction errors.

Often it is difficult to determine the exact period of an event since it depends on when the information first became available to market participants. In the case under study, the Act would first have affected product prices in October 1958; however, the Senate Report on the legislation was dated May 13th, 1958 and, most likely, existence of the intended legislation was known several months earlier, though the exact scope of the legislation may not have been known until October [16].

To allow for what must have been a gradual arrival of information on the likelihood of passage, the full 12-month period from December 1957 through November 1958 was excluded for the purpose of estimating the model for each security. The danger in this approach is that the period under examination is so long that other events might occur which could incorrectly confirm or refute the test hypothesis. In the figures to follow, May 1958 is defined as $t=0$, making December 1957 $t=-5$, and November 1958 $t=+6$. The actual estimations were made using data for the 18 months before and after the excluded period, a total of 36 months. This is a relatively short period on which to base the estimation of β_j, but was chosen because earlier market price data was not available for Ford. A separate model was estimated for each of the four leading motor vehicle manufacturers using individual monthly stock returns provided by the Center for Research on Security Prices and market returns prepared by Myron Scholes [4].

BH argued for the existence of a cartel of the three leading firms. Smaller firms were excluded from their study for lack of data, based on the assumption that 'such firms were never members of the cartel'.[1] In order to test the BH three-firm collusion hypothesis, the residuals for each of the three firms were standardized by the mean square errors. That is

$$\mathrm{SR}_{jt}=\epsilon_{jt}/\hat{\sigma}^2_{\epsilon j} \tag{5}$$

[1] This assumption by BH is difficult to reconcile with the diminishing market share of smaller domestic firms. If the cartel was charging above competitive prices, then non-member firms should have benefited disproportionately by their ability to sell at below the cartel price.

where SR_{jt} is the standardized residual for firm j in period t, and $\hat{\sigma}^2_{tj}$ is the mean square error. Summing (5) over t gives the standardized cumulative residual for firm j at any time T,

$$SCR_{jt} = \sum_{t=-5}^{T} SR_{jt} \quad (T = -5, \ldots, 6) \tag{6}$$

By the BH collusion hypothesis the top three firms should earn a positive abnormal return over the event period. GM and Ford do exhibit a positive SCR as of $T=6$, implying positive abnormal returns over the period (Figure 1). Chrysler exhibits slightly negative abnormal returns. In subsequent analysis the study will be extended to bring in the number four firm, American Motors.

To provide a precise test of the collusion hypothesis the variance of standardized residuals was estimated for the event period. Assuming the standardized variances for all firms to be equal, we have,

$$V_{SR} = \left[\sum_{t=-5}^{6} \sum_{j=1}^{n} (SR_{jt})^2 \right] / (12n - 1) \tag{7}$$

From (7) we can determine the standard deviation of the standardized cumulative residuals at any time T, on the assumption of non-autoregressive errors over time, as

$$SD_{SCR_T} = [(T+6)V_{SR}]^{1/2}. \tag{8}$$

Typically these estimates are greater than one, since the data spanning the event period is not used in the least squares step.

The two standard deviation values, both positive and negative, are shown in Figure 1, and in subsequent figures. It is evident from the figure that none of the SCRs as of the $t=+6$ month exceeds the normal return by two standard deviations, the magnitude necessary to reject the null hypothesis at the 0·05 level in a one-tail t-test. A one-tail test of significance is what would be implied by the BH collusion hypothesis since firms should not collude to earn negative abnormal returns for their shareholders.

To examine the cartel hypothesis explicitly, a portfolio of the securities of the three leading firms was constructed using weights such that the residual dollar returns to each security had equal variance for the 36 months over which the models were estimated (henceforth, a variance weighted portfolio). A standardized average residual at time t (SAR_{nt}) was computed for the n firm portfolio.

$$SAR_{nt} = \left(\sum_{j=1}^{n} SR_{jt} \right) / n \tag{9}$$

The standardized cumulative average residual for the n firm portfolio at any time T ($SCAR_{nT}$) is given by

$$(10) \qquad \mathrm{SCAR}_{nT} = \sum_{t=-5}^{T} \mathrm{SAR}_{nt} \quad (T = -5, \ldots, 6)$$

Following (7) the variance of the standardized average residuals is

$$(11) \qquad V_{\mathrm{SAR}} = \left[\sum_{t=-5}^{6} (\mathrm{SAR}_{nt})^2 \right] / 11$$

and the standard deviation of standardized cumulative average residuals under the non-autoregression assumption is

$$(12) \qquad \mathrm{SD}_{\mathrm{SCAR}_{nT}} = [(T+6) V_{\mathrm{SAR}}]^{1/2}$$

In Figure 2 a positive SCAR_3 of 2·20 was needed to reject the null hypothesis

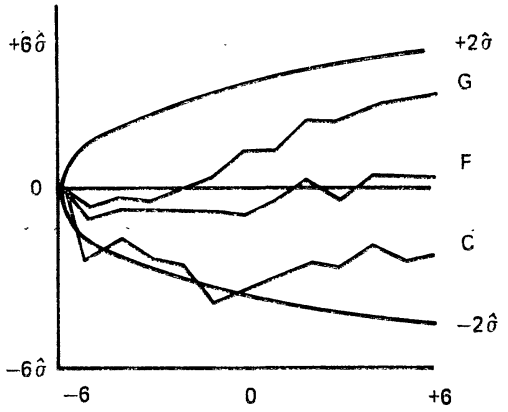
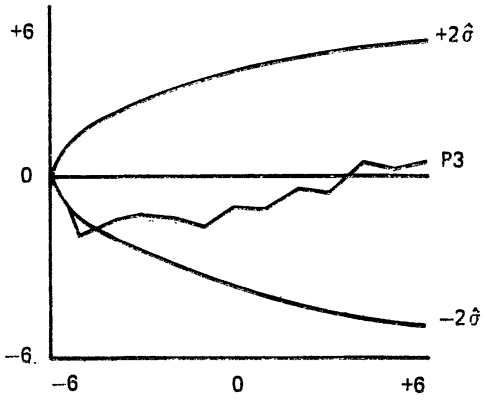


FIGURE 1. Standardized Cumulative Residuals, Three Firms, 12 Months



C = Chrysler, F = Ford, G = General Motors, P3 = Three Firm Portfolio

FIGURE 2. Standardized Cumulative Average Residuals, Three Firm Portfolio, 12 Months

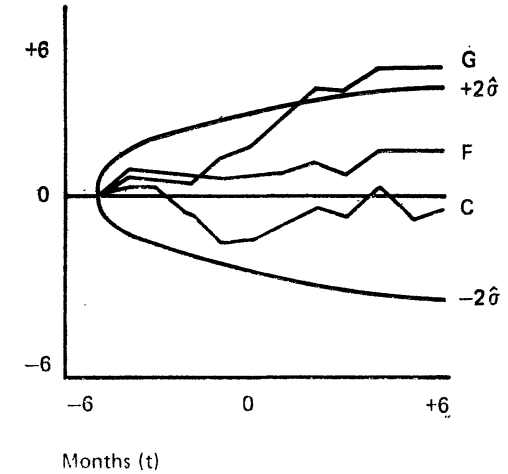


FIGURE 3. Standardized Cumulative Residuals, Three Firms, 11 Months

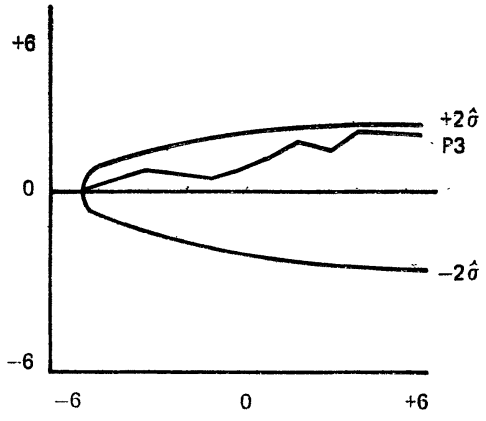


FIGURE 4. Standardized Cumulative Average Residuals, Three Firm Portfolio, 11 Months

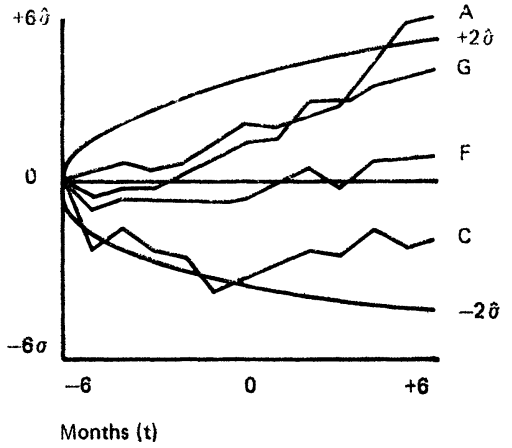
at the 0·05 level in month $t = +6$. Clearly the summed abnormal returns of the portfolio do not support the BH hypothesis.

Although the selection of the test period was arbitrarily chosen as the six months before and after the Senate Report date, the analysis might be criticized on the basis that the residuals for month $t = -5$ are sharply negative, possibly suggesting an incorrectly chosen event period. If the test period began too early the negative residuals in the beginning month would impart a bias toward accepting the null or non-collusion hypothesis in subsequent periods. To accommodate this potential criticism Figure 3 eliminates month $t = -5$. Likewise, expressions (5) through (12) were recomputed for that 11-month period. As a result, GM does exhibit a positive residual, which is significant at the 0·05 level; the other two firms do not. Neither does the variance weighted portfolio in Figure 4 for the 11-month period deviate significantly from zero, although it clearly has a positive drift and actually would be significant at about the 0·15 level. It should be noted, however, that to eliminate the first period after observing the prediction errors imparts a positive bias to the summed residuals, a bias in favor of rejecting the null hypothesis which is not reflected in the test statistic. Also, since the first month was one of unusually large residuals, elimination of that month substantially reduced the estimated variances in Figures 3 and 4 from those in Figures 1 and 2.

BH specifically exclude American Motors from their study, citing the lack of data. At the same time, they assert that American Motors and other small firms were probably not cartel members. For the market model approach employed here, data on American Motors is not a problem. Figures 5 through 8 correspond to Figures 1 through 4 with the inclusion of American Motors. From Figure 5 it is evident that American Motors is the only firm with a significant positive cumulative abnormal return by month $t = +6$. In Figure 6 the four firm variance weighted portfolio is still not significantly different from zero by month $t = +6$. In Figure 7, with the first month eliminated, both GM and American Motors are significantly positive. Finally, in Figure 8 the four firm portfolio is significantly positive in month $t = +6$, but only due to the inclusion of American Motors in the portfolio. The inclusion of American Motors both raises the value of the summed residual and reduces the residual portfolio variance.

Orderings and Magnitudes of Summed Residuals

Evidence to this point suggests positive abnormal returns over the test period, but generally not strong enough to accept the three firm collusion hypothesis at an acceptable confidence level. A further piece of evidence which is inconsistent with the collusion hypothesis is the ordering of cumulative residuals (non-standardized) over firms. Ignoring the first month, over the remaining 11 months GM securities earned abnormal returns of 48%, Ford earned 22% and Chrysler earned −6% based on average



A = American Motors, C = Chrysler, F = Ford, G = General Motors, P_4 = Four Firm Portfolio

FIGURE 5. Standardized Cumulative Residuals, Four Firms, 12 Months

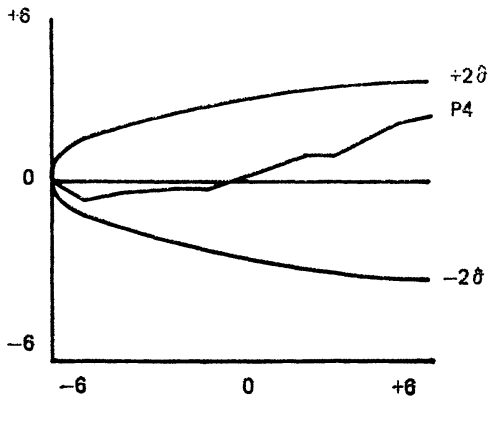


FIGURE 6. Standardized Cumulative Average Residuals, Four Firm Portfolio, 12 Months

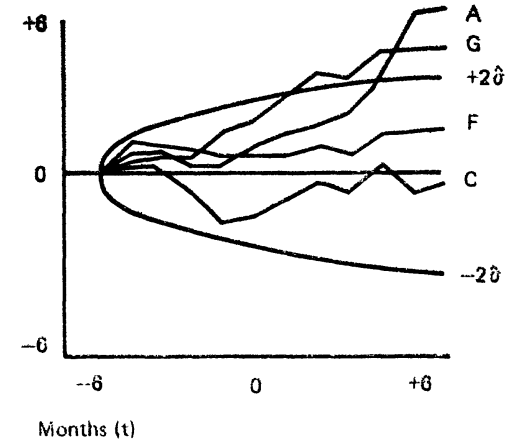


FIGURE 7. Standardized Cumulative Residuals, Four Firms, 11 Months

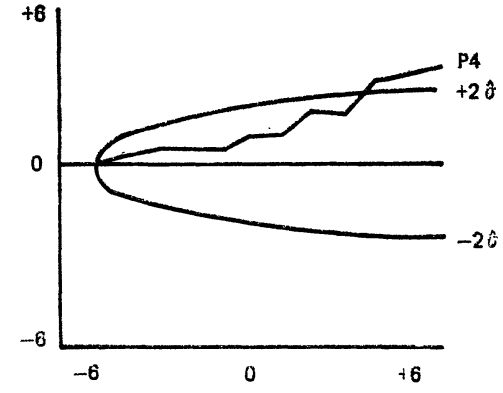


FIGURE 8. Standardized Cumulative Average Residuals, Four Firm Portfolio, 11 Months

monthly returns. This is exactly the reverse ordering that one would expect from a cartel that enabled all firms to raise vehicle prices by similar amounts, as a cartel would tend to do.

To illustrate by example, for the five preceding years from 1953 through 1957 the average net income to sales ratio was 7·85% for GM, 5·75% for Ford and 2·02% for Chrysler [12].[2] If the cartel had enabled all firms to raise prices by 1% or about 31 dollars per average vehicle, and quantity sales had not changed, the increase would represent a 49·5% increase in net income for Chrysler, a 17·4% increase for Ford and a 12·7% increase for GM [12]. If these increased returns had been anticipated to last forever,

[2] The criticism might be raised that in competition returns should be equal over firms. Such criticism would not hold if the differential returns represented rents on entreprenurial capacity which was bounded.

the security values should have risen by similar magnitude. Chrysler, the firm that should have benefited most from such a cartel, actually exhibited a negative cumulative abnormal return for the period. GM, which should have benefited least, actually had the largest percentage abnormal return of the three leaders.[3] In fact, the pattern of abnormal returns, including those for American Motors, was positively related to changes in market share in unit sales from 1957 to 1958. A simple regression of abnormal returns on change in total volume of units sold explains 66% of the variance of abnormal returns.[4] On a more tangible level, it may be noted that the 1958–59 period corresponds to the first small car wave. This, in turn, explains the rise in market share of American Motors, which was aggressively involved in small car production; and the fall in market share for big car producers, Chrysler in particular.

Extending the comparison of orderings of summed residuals to include American Motors, the average return on sales for the previous five years was −0·79%. It is sufficient to recognize that only a slight increase in the earnings potential of American Motors should have affected the value of the security very sharply. This was, in fact, the case; the abnormal return to American Motors was 149%, the largest of any of the four.

With respect to the magnitudes of the summed abnormal returns it was noted above that a 1% increase in sales price forever should have increased security prices by from 12·7 to 49·5% depending on the firm. The actual abnormal returns were from −6 to 48%, or to 149% if American Motors is included. This is an order of magnitude only about the size that would result from a 1% price increase forever. It suggests that the price increase would have been small, or would have lasted for a shorter period, or that the demand for automobiles is relatively elastic.

A specific point should also be made with respect to Chrysler, the only firm to consistently show a non-positive SCR. BH refer to Chrysler as a cheater on the cartel in 1958–59, the two years when homogeneity was rejected in their study. This appears to be a misinterpretation of the empirical result. Chrysler experienced net losses in both years as well as a 40% drop in sales, whereas the rest of the industry experienced only a 20% drop. Various issues of the *Wall Street Journal* during April 1958 reveal that the auto manufacturers, and particularly Chrysler, were blaming the sluggish economy for sales declines, and that one result of Chrysler's losses was a management housecleaning. These are not the results one would expect from cheating on a cartel. It appears, instead, that Chrysler incorrectly anticipated the market demand for 1958–59 by failing to recognize the

[3] This is based on the presumption that all firms had similar quality adjusted prices initially. If, on the other hand, Chrysler had been overcharging relative to Ford and GM, the observed pattern of residuals might result, observed, but then it would be difficult to explain why Chrysler would agree to participate in the cartel.

[4] The mere fact of such shifts in market share, it should be noted, is also atypical of cartel behavior, which generally tends to stabilize market shares.

emerging demand for small cars, and that this was reflected in the BH characteristic pricing equations for those two years.

Summary of Findings

To summarize the essential findings of this section, using residual analysis, a positive abnormal return is observed for the three firm portfolio consisting of General Motors, Ford and Chrysler, but the abnormal return is not sufficient to accept the collusion hypothesis based on either the original 12-month analysis, or the modified 11-month analysis. Individual firms, in particular General Motors and American Motors, do earn significantly positive abnormal returns in the modified 11-month analysis (based on biased significance tests) though for the 12-month analysis GM does not. These mixed results are not, in my opinion, persuasive enough to reject either the collusion or the competition hypothesis.

However, additional findings do argue, and I believe convincingly, that the collusion hypothesis should be rejected. Specifically, it was determined that the ordering of summed abnormal returns of the three leading firms was exactly the reverse of what would be anticipated from a cartel enabling all firms to raise price by the same amount. The actual ordering of abnormal returns was found to be explained quite well by changes in market shares during the period. Also, it was noted that the magnitudes of abnormal returns suggested that if they were due to the presence of a cartel, its impact on product prices was expected to be either slight or short-lived or both. Finally, Chrysler's results in 1958–59 are inconsistent with cheating on a cartel.

Conclusions and Suggested Extensions

On the basis of these findings it would appear that an appropriate area for future research would be to explore some alternative theories of regulation as to possible explanations for the existance of the AIDA.

The theory implicit in the BH article is the capture theory of regulation. The principle is that the regulatory authority, regardless of its original charge, becomes excessively responsive to the interest group being regulated. In general this is held to result from the regulated interest group being in good position to reward regulators (the Congress in this case) with either votes, campaign expenses, or future employment [15] [13]. In the case that BH consider, the AIDA is interpreted as legislation that could enable the industry to collude.

A central assumption of the capture theory is that interest groups compete with each other for the benefits that regulators can provide. Typically these benefits consist of transfers of wealth between interest groups. The regulatory body is generally presumed to be unable to either increase total production or to reduce the amount that is consumed as transactions costs, broadly defined. The AIDA allegedly resulted in a transfer from

automobile purchasers to producers by enabling the industry to cartelize, and more easily detect cartel cheating.

As evidence in support of this theoretical proposition, BH observe that in the House of Representatives hearing a spokesperson of the Ford Motor Company testified in favor of the legislation, whereas the Department of Justice (DOJ) opposed it.

The basis for the position of the DOJ was that existing antitrust legislation could be used to effectively control the alleged practice of 'price packing' in the auto industry,[5] making the AIDA unnecessary special legislation pertaining only to the automobile industry. The DOJ also argued that the legislation would facilitate resale price maintenance and endorsed an opposition argument advanced by the National Independent Automobile Dealers Association [16].

The opposition of the NIADA was based on the requirement that disclosure under the Act include the name of the retailer to whom the vehicle was originally shipped by the producer. This, the NIADA argued, would enable producers to determine which of their franchised dealers were reselling to independent automobile dealers [16].

One possibility that has not been fully tested in this paper is that producers and consumers could both benefit from the legislation. It may be the case that the legislation would enable the motor vehicle industry to cope with a free-rider problem. The franchise dealer system of the US motor vehicle industry grants each new dealer a more or less exclusive territory for a particular automobile make. The assurance of such a primary market area is necessary to encourage the dealer to provide the efficient level of information about the product prior to purchase and to maintain sufficient service facilities. Without exclusive territories customers could shop at franchised dealerships which carried large inventories, and then buy from independents who saved costs by providing no presale information or service and could thus sell at lower prices. In the absence of the disclosure requirement franchised dealers could easily circumvent the exclusive territory arrangement by anonymously selling to independent in other geographic areas.

This tendency is reinforced by the predominant method of price cutting by manufacturers. To increase volume a stepped incentive structure is used for sales in excess of the dealer's weekly quota, viz.:

Basic quota five vehicles per week	
Bonus for sale of sixth vehicle	$50
Bonus for sale of seventh vehicle	$75
Bonus for sale of eighth vehicle	$100
Bonus for sales of over eight vehicles	$150 per vehicle

[5] Price packing is a general term referring to the inclusion of unwanted optional equipment in order to inflate the price, or to the practice of trading new autos for used ones at artificial prices to confuse the customer.

Thus, a retailer may share a substantial portion of his bonus on sales with independents in areas where sales would not impact on the potential of his own area. It is possible that the disclosure requirement could be used by producers or other franchised retailers to restrict such practices and strengthen exclusive territories, thus eliminating an obvious free-rider problem [18].

Viewed in this way, the reason for opposition by the NIADA is clear. That the Justice Department would strongly support the position of the NIADA is no longer evident, since in recent antitrust decisions recognition of the free-rider problem as a justification for exclusive territories has increased [5]. If the Automobile Information Disclosure Act increased market efficiency by eliminating a free-rider problem, both producers and consumers may have benefited. Consequently, even the existence of significant abnormal positive returns for the automobile industry would not be inconsistent with consumers being made better off. A useful extension of this paper would be to examine the free-rider problem explicitly.

CASE WESTERN RESERVE UNIVERSITY ACCEPTED OCTOBER 1979

APPENDIX A

The test of homogeneity used by Boyle and Hogarty, as given by their equation (3) is

$$F_t = \frac{(S_{dt}^2 - \sum_t S_{it}^2)/[(\tau - 1)(K+1)]}{\sum_t S_{it}^2/[N_t - \tau(K+1)]} \tag{13}$$

where

S_{dt}^2 is the residual sum of squares from the combined sample in year t
S_{it}^2 is the residual sum of squares from one firm
τ is the number of groups
K is the number of independent variables, and
N_t is the total number of vehicle models in year t.

Using the critical F-values from Table II of Boyle and Hogarty's paper (Table I in this Appendix), and allowing for 8 degrees of freedom in the numerator of their F-test (based on three groups and three independent variables in the F-test), it is possible to infer the degrees of freedom in the denominator using significance tables for the test, which in this case is equal to the sample size minus 12. This procedure was used to estimate the sample size by year in Table II of this Appendix.

Some errors are unavoidable, since the procedure involves a great deal of interpolation. But as a cross check it was learned from the paper by Hogarty [10] that the authors' total sample size, including more than the three largest firms, was 992 and that the minimum in any one year was 41 and the maximum was 112. Assuming these to be the first and last years, respectively, I inferred the number of models

produced by non-big-three firms in the first and last years. Then, assuming a simple average of these two numbers for each year, it was possible to estimate total production by minor producers at 112·5 over the 15 years of their study. Adding this to the estimated total for three major firms gives a grand total of 994·5, which only misses the actual total by 2·5. Thus it appears that the estimating procedure is quite accurate, though estimates for given years may be somewhat off.

Using the implied sample sizes the appropriate F-values for rejecting the null hypothesis at the 0·50 and 0·10 level were determined and compared to the observed F-values. Also, the P-values, or probabilities that the observed F-values could be generated by homogeneous groups were determined. From this, the probability that homogeneous data could not have generated the observed F-values was found, as shown in Table II.

TABLE I
(Boyle and Hogarty Table II)

HOMOGENEITY TESTS (F-VALUES) FOR REGRESSION OF LIST PRICE ON INDEXES OF COMFORT AND PERFORMANCE, AND A DUMMY VARIABLE FOR POWER STEERING (BRAKES), THREE LARGEST AUTOMOBILE MANUFACTURERS, 1957–71

Year	*F-value*	*Critical value (0·05 level)*
1957	1·311	2·51
1958	2·593* (1·794)[a]	2·32 (2·90)[a]
1959	3·781* (2·281)	2·40 (2·96)
1960	2·000	2·26
1961	1·286	2·30
1962	1·978	2·20
1963	1·600	2·18
1964	1·169	2·17
1965	1·066	2·15
1966	1·264	2·14
1967	0·871	2·10
1968	0·294	2·10
1969	0·331	2·05
1970	0·571	2·04
1971	0·655	2·04

[a] The entries in parentheses are actual and critical F-values, respectively, for (sub)samples consisting of General Motors and Ford alone. Thus, these two firms employed the same price-quality relation in all 15 years.

TABLE II

RE-EVALUATION OF HOMOGENEITY TEST RESULTS

Year	*Critical* ($f_2=8$)	*Implied sample size* (N)	*Observed F-value*	*P* (β *error) if* H_0 *accepted*[a]	*Appropriate F for* ($\beta=0\cdot5$; N)[b]
57	2·51	30	1·31	0·67	1·10
58	2·32	38	2·59	0·99	1·08
59	2·40	34	3·78	0·99	1·09
60	2·26	43	2·00	0·99	1·07
61	2·30	39	1·29	0·70	1·08
62	2·20	50	1·08	0·54	1·05
63	2·18	52	1·60	0·91	1·05
64	2·17	54	1·17	0·63	1·04
65	2·15	58	1·07	0·53	1·03
66	2·14	60	1·26	0·74	1·03
67	2·10	72	0·87*	0·35[a]	1·02
68	2·10	72	0·29**	0·10[a]	1·02
69	2·05	100	0·33**	0·10[a]	0·98
70	2·04	108	0·57*	0·22[a]	0·96
71	2·04	108	0·66*	0·28[a]	0·96
		882			

[a] = these values approximated by extrapolation of power curves.

[b] *Source: Biometrika Tables for Statisticians*, Vol. II, E. S. Pearson, (ed.).

*→$P(\beta$ error$)=0\cdot50$, **→$P(\beta$ error$)=0\cdot10$.

Critical F-value for ($\beta=0\cdot50$)$=0\cdot35$.

Minimum observations$=41$, maximum$=112$. If one assumes these are first and last years, respectively, the table implies that other manufacturers produced 11 and four types in those years. A simple average of $7\cdot5$ per year implies a total sample of $994\cdot5$. The actual sample was 992. Thus the estimated values of N appear to be quite accurate.

REFERENCES

[1] BOYLE, S. E., 'A Blueprint for Competition: Restructuring the Motor Vehicle Industry', *Journal of Economic Issues*, **2** (June 1975), pp. 251–69.

[2] BOYLE, S. E. and HOGARTY, T. F., 'Pricing Behavior in the American Automobile Industry, 1957–71', *Journal of Industrial Economics*, **24** (December 1975), pp. 81–95.

[3] BURNS, MALCOLM R., 'The Competitive Effects of Trust-Busting: A Portfolio Analysis', *Journal of Political Economy*, **84** (August 1977), pp. 717–39.

[4] Center for Research in Security Prices (sponsored by Merrill, Lynch, Pierce, Fenner and Smith, Inc.), Graduate School of Business, University of Chicago.

[5] *Continental T.V. Inc. v. GTE Sylvania Inc.*, 433 US 36 (1977).

[6] DHRYMES, PHOEBUS J., 'Price and Quality Changes in Consumer Capital Goods: An Empirical Study', in *Price Indexes and Quality Change*, Z. Griliches (ed.) (Harvard University Press, Cambridge, 1971).

[7] ELLERT, JAMES C., 'Mergers, Antitrust Law Enforcement and Stockholder Returns', *Journal of Finance*, **31** (May 1976), pp. 715–51.

[8] FAMA, EUGENE F., FISHER, LAWRENCE, JENSEN, MICHAEL and ROLL, RICHARD, 'The Adjustment of Stock Prices to New Information', *International Economic Review*, **10** (February 1969), pp. 1–21.

[9] GRILICHES, ZVI, 'Hedonic Price Indexes for Automobiles: An Econometric Analysis of Quality Change', in *Price Indexes and Quality Change*, Z. Griliches (ed.) (Harvard University Press, Cambridge, 1971).

[10] HOGARTY, THOMAS F., 'Price–Quality Relations for Automobiles: A New Approach', *Applied Economics*, **7** (1975), pp. 41—51.

[11] LANCASTER, KELVIN, 'A New Approach to Consumer Theory', *Journal of Political Economy*, **74** (April 1966), pp. 132–57.
[12] *Moody's Industrial Manual*, various years.
[13] PELTZMAN, SAM, 'Toward a More General Theory of Regulation', *Journal of Law and Economics*, **19** (August 1976), pp. 211–40.
[14] SCHWERT, G. WILLIAM, 'Using Financial Data to Measure Effects of Regulation', unpublished working paper series No. GPB 78-7 (Center for Research in Government Policy and Business, Graduate School of Management, University of Rochester).
[15] STIGLER, GEORGE J., 'The Theory of Economic Regulation', *Bell Journal of Economics and Management Science*, **2** (1971), pp. 3–21.
[16] *United States Code, Congressional and Administrative News*, **15** (1958), p. 2902.
[17] United States Department of Labor, Bureau of Labor Statistics, *Handbook of Labor Statistics 1973*.
[18] WARREN, R., 'Economics of Closed-Territory Distribution', *Antitrust Law and Economics Review* (Winter 1968–69).