# Public regulation of national securities exchanges: a test of the capture hypothesis

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*This paper tests the hypothesis that members of national securities exchanges have received net benefits from the regulatory activities of the Securities and Exchange Commission. The prices of stock exchange seats are analyzed in time periods of major changes in the regulation of the securities industry during the 1926–1972 period. Time series regression models are used to identify changes in seat prices which are unrelated to changes in stock prices or share trading volume. Empirical analysis of the unexpected changes in seat prices indicates that the most important regulatory change occurred in March, 1934, when the Securities and Exchange Act was first considered by Congress; both New York and American Stock Exchange seat prices fell unexpectedly by about 50 percent in one month. There is no evidence that this capital loss was ever recouped after March, 1934. There is also evidence that recent changes in the fixed commission rate structure of the brokerage industry have had a negative impact on seat prices. Thus, there is evidence which contradicts the hypothesis that securities brokers have benefited by capturing control of the regulators of the securities industry.*

## 1. Introduction

■ The controversy about the effect of public regulation on the functioning of economic markets has concentrated on two hypotheses: (1) the "public interest" hypothesis, which posits that government regulation benefits consumers of goods and services, and (2) the "capture" hypothesis, which posits that producers of goods and services receive net benefits from government regulation. These propositions do not exhaust the possible combinations of interest groups which might be served by government regulation, but because of their simplicity, they have been the focus of most of the empirical studies of the effects of public regulation.[1]

The author received financial support from the Earhart and Walgreen Foundations, from the University of Chicago Graduate School of Business, and from the Center for Research in Government Policy and Business at the University of Rochester. Many people made helpful comments on earlier drafts, including Charles Nelson, Eugene Fama, Peter Pashigian, Merton Miller, Sam Peltzman, Harry Roberts, Myron Scholes, Nicholas Gonedes, John Gould, the Finance Workshops at the Universities of Chicago and Rochester, and the Industrial Organization Workshop at the University of Chicago; however, I retain the responsibility for remaining errors.

[1] Stigler (1971) proposes the idea that regulation is initiated and enforced in response to the demands of affected groups, with powerful groups and the most affected

Many previous analyses of the effects of public regulation on the securities industry have concentrated on testing the public interest hypothesis (cf. Stigler, 1964; Officer, 1973; Benston, 1969, 1973; and Jaffe 1974) and no supporting evidence has been found. This paper provides a test of the capture hypothesis by determining whether important changes in public regulation have had significant effects on securities brokers' profits.

In Section 2 the relationship between brokers' profitability and the prices of "seats" (memberships) on organized securities exchanges is analyzed. A model for the dynamic behavior of seat prices as a function of new information about future levels of stock prices and share trading volume is estimated, and the econometric methodology used for subsequent tests of regulatory effects is presented. In Section 3 several important changes in the public regulation of the securities industry are analyzed in the context of the model for the behavior of seat prices. Evidence is presented which discloses that seat prices have been adversely affected by regulation. If public regulation by the Securities and Exchange Commission has conferred net benefits on the members of the New York and American Stock Exchanges, these evidently have been of an indirect kind. The concluding section summarizes the empirical findings of this paper and puts them in perspective with other studies of regulatory effects.

## 2. Testing the capture hypothesis

■ Securities brokers who are members of organized national securities exchanges, in particular the New York (NYSE) and American (ASE)[2] Stock Exchanges, dominate the securities brokerage industry. They handle about 90 percent of the dollar trading volume of exchange-listed common stocks and determine the pricing policies for brokerage services. If securities brokers are able to capture the government agency which regulates them, the Securities and Exchange Commission (SEC), NYSE and ASE brokers' profits should be higher with regulation than without it. This hypothesis will be tested by analyzing the behavior of stock exchange seat (membership) prices in response to changes in SEC regulatory behavior.

The prices of stock exchange seats represent the capitalized value of the expected future flow of profits which accrue to stock exchange members as a function of their brokerage activities on organized exchanges; therefore, changes in seat prices through time reflect changes in the future flow of profits which are expected by securities brokers. If SEC regulation has any significant effect on the long-run profitability of stock exchange membership, changes in regulation should be associated with changes in seat prices.

□ **The market for stock exchange seats.** An NYSE seat gives its owner access to the trading floor of the Exchange at a reduced price. The seat owner may participate in one of four types of activity on the Exchange: (1) *specialists* hold inventories and deal in specific NYSE-

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groups reaping the benefits from regulation. Posner (1974) reviews many empirical tests of the capture and public interest hypotheses in different industries.

[2] Editor's note: While the standard acronym for the American Stock Exchange is AMEX, as a conservation measure Schwert's acronym, ASE, has been retained.

listed securities; (2) *commission brokers* handle the transactions of nonmembers which are brought to the NYSE by the branch offices of their brokerage firms; (3) *floor brokers* handle the trades of other members for a floor brokerage fee (which is less than the commission charged to nonmembers); and (4) *floor traders* trade for their personal accounts at very reduced transactions costs.[3] The ability to trade at reduced costs makes the seats valuable to securities brokers and dealers who handle large numbers of transactions. If the NYSE were to dissolve itself, the seat-holders would receive equal portions of the net proceeds from the liquidation of the assets of the Exchange. In this sense the seats are analogous to equity in the NYSE. Most other American stock exchanges are organized in a similar fashion, so only the NYSE is described specifically.

The supply of NYSE seats has remained relatively constant over time. In 1869, three major securities exchanges merged to form the NYSE as it is now known and the 1,060 seats were first considered to be saleable property.[4] In 1879, 40 new seats were sold at $13,000 each to finance a new building for the Exchange. In 1929 a 25-percent "seat dividend" was issued to all seat-owners. All of these rights were exercised by March, 1932, bringing the total number of seats to 1,375. In March, 1953, the NYSE authorized a plan to retire some seats, and nine seats were repurchased in the market for a total of $336,000. The current number of NYSE seats remains at 1,366 today. The number of seats on the ASE has also remained reasonably constant since its initial organization in 1921.

The market for NYSE seats is an anonymous auction market which is operated by the Secretary of the NYSE. Each time a new bid or ask price is brought to the market, all interested participants are informed in an effort to consummate a transaction. While private transfers are permissible, only the prices derived from public trades are reported. There are no direct out-of-pocket transactions costs beyond the costs of applying for admission to the NYSE involved in the market for NYSE seats[5].

These characteristics of the market for NYSE seats make seat prices a good current measure of the expected long-run profitability of NYSE membership. In another paper (Schwert, 1977) I analyze in detail the efficiency of the market for NYSE and ASE seats over the 1926–1972 time period. Analogous to the behavior of the prices of stocks traded on the NYSE, the prices of NYSE and ASE seats quickly reflect new information as it becomes publicly available. Thus, changes in public regulation of the securities industry which are perceived to have an important impact on the profitability of Exchange membership should have a quick impact on seat prices.

□ **A dynamic model of seat price behavior.** To identify changes in seat prices which are associated with changes in regulation, it is useful to

[3] Leffler and Farwell (1963), pp. 105–126, provide a more detailed description of the history and institutional details of the market for NYSE seats.

[4] Doede (1967), pp. 5–20, provides a detailed history of the NYSE and its competitors since the initial organization of the NYSE in 1792.

[5] It is of interest that seats have most of the same property rights associated with other marketable assets such as common stocks. For example, if an NYSE member is prohibited from trading on the Exchange floor as a sanction for improper behavior of some kind, he may sell his seat in the market and the sanction does not affect the purchaser of the seat.

construct a model of seat price determination in order to account for variation in seat prices through time which is not due to regulatory change. A simple model of the securities brokerage industry expresses profits, $\pi$, as a function of share trading volume, $Q$, and the level of share prices, $V_s$:

$$\begin{aligned} \pi &= \{p_c(V_s) \cdot Q(p_c)\} - C(Q) \\ &= \pi(Q, V_s), \end{aligned} \tag{1}$$

where commission rates, $p_c$, are an increasing function of the level of share prices, and brokers' costs, $C(Q)$, are a function of the level of share trading volume. Variables which affect expected future profits of brokers are the expected level of share volume, $E(Q)$, and the expected level of share prices, $E(V_s)$. Thus, changes in NYSE seat prices should be related to changes in the expected future levels of share volume and share prices.

In an efficient market unexpected changes in seat prices would only be caused by *new* information about the expected future levels of $Q$ and $V_s$, assuming that the discount rate which is appropriate for the cash flows associated with seats remains constant over time. An implication of the assumption that the market for seats is rational in its use of information is that unexpected changes in seat prices should be a function of unexpected changes in share volume and stock prices, since the *new* information about the future levels of share volume and stock prices which becomes available in period $t$ is contained in these *unexpected* changes.

The data which are used to implement this model are: (1) the last-trade-in-the-month prices of NYSE and ASE seats as reported in the *Bank and Quotation Record;* (2) a monthly value-weighted index of NYSE stock prices[6]; and (3) total NYSE and ASE monthly share trading volume as obtained from the respective exchanges. To estimate this model the approximate percentage changes of these variables—the first differences of the natural logarithms—are analyzed as univariate time series.

Using the techniques of Box and Jenkins (1976), each series is decomposed into an "expected" part which is predictable, based on the past history of the series, and an "unexpected" part which is uncorrelated with the "expected" part and could not be predicted from the past history of the time series. Specifically, the percent changes of NYSE and ASE seat prices, $r_t$ and $r_{at}$, and the percent change of NYSE stock prices, $r_{mt}$, all have small autocorrelations at all lags as seen in Table 1. This implies that the "expected" parts of these variables are their marginal expectations, for example:

$$\tilde{r}_t = E(\tilde{r}_t | r_{t-1}, r_{t-2}, \ldots) + \tilde{\epsilon}_t = E(\tilde{r}_t) + \tilde{\epsilon}_t, \tag{2}$$

so that any deviation of seat price changes or stock price changes from their average values would be unexpected. However, the percent changes of NYSE and ASE share volume, $q_t$ and $q_{at}$, are serially correlated. Following the Box-Jenkins methodology, these processes are modeled as fourth-order moving average (MA(4)) processes with

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[6] The value-weighted index of NYSE common stock prices created by the Center for Research in Security Prices at the University of Chicago is the source of this data. No comparable data for ASE stock prices could be found, so the NYSE data is used as a proxy in the ASE regression models.

TABLE 1

AUTOCORRELATIONS OF RATES OF CHANGE OF SEAT AND STOCK PRICES

| VARIABLE | $\hat{\rho}_1$ | $\hat{\rho}_2$ | $\hat{\rho}_3$ | $\hat{\rho}_4$ | $\hat{\rho}_5$ | $\hat{\rho}_6$ | $\hat{\rho}_7$ | $\hat{\rho}_8$ | $\hat{\rho}_9$ | $\hat{\rho}_{10}$ | $\hat{\rho}_{11}$ | $\hat{\rho}_{12}$ | $S(\hat{\rho})^a$ | $\bar{x}$ | $\hat{S}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1926–45 | | | | | | | | | | | | | | | |
| $r_t$ | 0.04 | −0.01 | −0.12 | −0.14 | −0.02 | 0.01 | 0.11 | 0.05 | 0.04 | 0.13 | 0.07 | −0.04 | 0.06 | −0.00069 | 0.14760 |
| $r_{at}$ | 0.02 | 0.04 | −0.09 | −0.02 | 0.10 | 0.03 | 0.07 | −0.05 | 0.04 | 0.04 | 0.07 | 0.04 | 0.06 | 0.00000 | 0.23132 |
| $r_{mt}$ | 0.11 | −0.01 | −0.19 | 0.03 | 0.08 | −0.01 | 0.04 | 0.09 | 0.11 | 0.02 | −0.02 | 0.01 | 0.06 | 0.00614 | 0.08485 |
| 1946–72 | | | | | | | | | | | | | | | |
| $r_t$ | −0.07 | −0.08 | −0.07 | 0.06 | 0.08 | −0.03 | 0.01 | −0.11 | 0.05 | −0.04 | 0.05 | −0.01 | 0.06 | 0.00197 | 0.10176 |
| $r_{at}$ | −0.10 | 0.05 | 0.05 | −0.07 | 0.08 | −0.10 | 0.03 | 0.02 | −0.13 | 0.08 | −0.14 | 0.11 | 0.06 | 0.00298 | 0.13626 |
| $r_{mt}$ | 0.09 | 0.02 | −0.01 | 0.07 | 0.06 | −0.03 | −0.05 | −0.09 | 0.07 | −0.08 | 0.02 | 0.01 | 0.06 | 0.00926 | 0.03847 |

[a] $S(\hat{\rho}) = T^{-1/2}$ IS THE ASYMPTOTIC STANDARD ERROR OF $\hat{\rho}_1$ UNDER THE NULL HYPOTHESIS THAT $\rho_1 = 0$. $\bar{X}$ IS THE SAMPLE MEAN AND $\hat{S}$ IS THE SAMPLE STANDARD DEVIATION.

the third MA parameter not significantly different from zero. Estimates of these models are contained in Table 2. Based on the esti-

TABLE 2

MOVING AVERAGE MODELS FOR RATES OF CHANGE IN NYSE AND ASE SHARE VOLUME (ASYMPTOTIC STANDARD ERRORS IN PARENTHESES)

| PERIOD | CONSTANT $\hat{\alpha}$ | MOVING AVERAGE PARAMETERS $\hat{\theta}_1$ | $\hat{\theta}_2$ | $\hat{\theta}_4$ | $S(\hat{u})$ | $R^2$ | $Q^{\hat{u}}(24)^a$ | $SR(\hat{u})^b$ |
|---|---|---|---|---|---|---|---|---|
| NYSE SHARE VOLUME[c]: $q_t = \hat{\alpha} + [1 - \hat{\theta}_1 L - \hat{\theta}_2 L^2 - \hat{\theta}_4 L^4]\hat{u}_t$ | | | | | | | | |
| 1926–45 | −0.0011 (0.0071) | 0.2333 (0.0602) | 0.2840 (0.0660) | 0.1538 (0.0626) | 0.3289 | 0.116 | 22.1 | 6.09 |
| 1946–72 | 0.0068 (0.0031) | 0.3358 (0.0543) | 0.2025 (0.0553) | 0.1596 (0.0515) | 0.1821 | 0.171 | 36.8 | 5.82 |
| ASE SHARE VOLUME: $q_{at} = \hat{\alpha} + [1 - \hat{\theta}_1 L - \hat{\theta}_2 L^2 - \hat{\theta}_4 L^4]\hat{u}_{at}$ | | | | | | | | |
| 1927–45[d] | 0.0024 (0.0124) | 0.1644 (0.0640) | 0.2063 (0.0671) | 0.1485 (0.0663) | 0.3846 | 0.078 | 16.6 | 6.13 |
| 1946–72 | 0.0055 (0.0055) | 0.3159 (0.0542) | 0.1960 (0.0562) | 0.1158 (0.0521) | 0.2613 | 0.124 | 30.1 | 8.65[e] |

[a] $Q^{\hat{u}}(24) = T \cdot \sum_{i=1}^{24} \hat{\rho}_i^2$, IS THE BOX–PIERCE [1970] STATISTIC FOR 24 LAGS OF THE RESIDUAL AUTOCORRELATION FUNCTION WHERE $\hat{\rho}_i$ IS THE ESTIMATED AUTOCORRELATION COEFFICIENT AT LAG i AND T IS THE SAMPLE SIZE.

[b] S.R.($\hat{u}$) IS THE STUDENTIZED RANGE OF THE RESIDUALS: THE LARGEST RESIDUAL MINUS THE SMALLEST RESIDUAL ALL DIVIDED BY THE STANDARD DEVIATION OF THE RESIDUALS, $S(\hat{u})$.

[c] L IS THE LAG OPERATOR: $L^k x_t \equiv x_{t-k}$.

[d] ASE SHARE VOLUME DATA BEGINS IN 1927.

[e] SR EXCEEDS THE 0.99 FRACTILE OF THE SAMPLING DISTRIBUTION WHEN SAMPLING FROM A NORMAL POPULATION.

mated MA (4) models for the percent changes in share volume, the expected change in share volume is

$$\hat{q}_t = \hat{\alpha} - \hat{\theta}_1\hat{u}_{t-1} - \hat{\theta}_2\hat{u}_{t-2} - \hat{\theta}_4\hat{u}_{t-4}, \quad (3)$$

and the unexpected change is

$$\hat{u}_t = q_t - \hat{q}_t, \tag{4}$$

which is uncorrelated with $\hat{q}_t$ in large samples.

Analysis of the time series behavior of these variables is separated into two subperiods, 1926–1945 and 1946–1972, because the variability of the data is greater in the first period. Otherwise, the behavior of the variables is remarkably stable over the 1926–1972 period. For example, the magnitudes of the moving average parameters in the time series models for share volume are similar for NYSE and ASE data and across time periods. This suggests that these models may provide a useful proxy for the market's expectations of share volume for the purposes of this paper. Schwert (1977) provides further analysis of this data to show in detail the stability of the relationships among these variables.

Given this evidence on the time series behavior of percent changes in seat prices, stock prices, and share volume, the regression model,

$$r_t = \alpha + \beta r_{mt} + \gamma \hat{u}_t + \epsilon_t, \tag{5}$$

can be used to represent the relationship of unexpected changes in seat prices with unexpected changes in stock prices and share volume. The regression coefficients $\beta$ and $\gamma$ measure the association between deviations of $r_t$ from its mean (the unexpected change in seat prices) and deviations of $r_{mt}$ and $\hat{u}_t$ from their respective mean values (the unexpected changes in stock prices and share volume). Thus, the use of time series models to identify unexpected components of these variables provides a means of implementing the model of seat price behavior.[7] The residuals from equation (5) can be interpreted as estimates of the unexpected changes in seat prices which are unrelated to current information about future levels of stock prices or share volume.

Because seats are not always traded on the last day of each month, it is necessary to include lagged values of $\hat{u}_t$, $r_{mt}$ and the regression residual, $\hat{\epsilon}_t$, in the empirical model for the change in the logarithm of seat prices, $r_t$,

$$r_t = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L] r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\hat{u}_t + [1 - \hat{\theta}_1 L]\hat{\epsilon}_t, \tag{6}$$

where $L$ is the lag operator, $L^k X_t = X_{t-k}$. Perhaps the easiest way to see why these lagged effects occur is to consider the following hypothetical situation. Suppose that the last seat trade in month 1 occurred near the beginning of that month and that the last trade in month 2 occurred on the last day of that month. The measured change in seat price from month 1 to month 2 should incorporate not only the information which becomes available in month 2, but also all information which became available in month 1 after the occurrence of the seat trade. Since stock prices and share volume are measured at the end of the month, the nonsynchronous measurement of seat prices may cause the lagged coefficients in equation (6) to be significant.[8]

[7] The use of time series models as proxies for the expectational mechanisms of economic markets is gaining popularity. Nelson (1975) mentions many applications of this methodology.

[8] This type of spurious correlation due to nontrading has been referred to in the finance literature as the "Fisher" effect, after Professor Lawrence Fisher.

Schwert (1977) examines this proposition in detail and finds that the lagged variables are significant in equation (6) because of the nonsynchronous measurement of the data, not because of any slowness in the adjustment of seat prices to new information.

The estimation results for equation (6) are in Table 3 for several periods, where $S(\hat{\epsilon})$ is the standard error of the regression, $R^2$ is the coefficient of determination, and $SR(\hat{\epsilon})$ is the Studentized range (David, Hartley, and Pearson, 1954) of the residuals.[9] In the major subperiods, 1926–1945 and 1946–1972, which were selected on the basis of time series plots of the data to satisfy the assumption of homoscedasticity, the contemporaneous coefficients are highly significant and much larger than the coefficients of the lagged variables, except for ASE seat prices in the latter period. This regression model explains about one third of the time series variation in $r_t$ and $r_{at}$, so it increases the precision of the estimates of the effects of government regulation on seat prices by controlling for variation caused by nonregulatory phenomena. Tests for the stability of the coefficients of equation (6) across eight year subperiods within the 1926–1972 period failed to indicate any significant instability of the parameters of equation (6).

TABLE 3

DYNAMIC MODEL OF SEAT PRICE BEHAVIOR
(ASYMPTOTIC STANDARD ERRORS IN PARENTHESES)

| PERIOD | $\hat{\alpha}$ | $\hat{\beta}_0$ | $\hat{\beta}_1$ | $\hat{\gamma}_0$ | $\hat{\gamma}_1$ | $\hat{\theta}_1$ | $S(\hat{\epsilon})$ | $R^2$ | $SR(\hat{\epsilon})$ |
|---|---|---|---|---|---|---|---|---|---|
| A. NYSE SEATS: 1926–72 $r_t = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L]r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\hat{u}_t + [1 - \hat{\theta}_1 L]\hat{\epsilon}_t$ | | | | | | | | | |
| 1926–72 | −0.0073* (0.0030) | 0.8827* (0.0702) | 0.1399 (0.0739) | 0.1004* (0.0182) | 0.0263 (0.0173) | 0.3165* (0.0404) | 0.1007 | 0.340 | 8.44[a] |
| 1926–45 | −0.0065 (0.0058) | 0.8300* (0.0938) | 0.0825 (0.0995) | 0.1092* (0.0258) | 0.0214 (0.0242) | 0.2522* (0.0639) | 0.1190 | 0.366 | 7.30[a] |
| 1946–72 | −0.0103* (0.0032) | 1.040* (0.1265) | 0.3376* (0.1301) | 0.0854* (0.0277) | 0.0357 (0.0269) | 0.3924* (0.0517) | 0.0843 | 0.327 | 6.34 |
| B. ASE SEATS: 1927–72 $r_{at} = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L]r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\hat{u}_{at} + [1 - \hat{\theta}_1 L]\hat{\epsilon}_{at}$ | | | | | | | | | |
| 1927–72[b] | −0.0087 (0.0053) | 0.7206* (0.1075) | 0.6460* (0.1143) | 0.1047* (0.0227) | 0.0797* (0.0215) | 0.2128* (0.0419) | 0.1543 | 0.274 | 10.7[a] |
| 1927–45[b] | −0.0072 (0.0105) | 0.7353* (0.1499) | 0.5422* (0.1608) | 0.1537* (0.0364) | 0.0787* (0.0341) | 0.1757* (0.0663) | 0.1910 | 0.322 | 8.57[a] |
| 1946–72 | −0.0116* (0.0052) | 0.6411* (0.1845) | 0.9442* (0.1938) | 0.0329 (0.0286) | 0.0809* (0.0274) | 0.2983* (0.0538) | 0.1214 | 0.221 | 8.16[a] |

*COEFFICIENT ESTIMATE IS MORE THAN TWO STANDARD ERRORS DIFFERENT FROM ZERO.

[a]SR EXCEEDS THE 0.99 FRACTILE OF THE SAMPLING DISTRIBUTION WHEN SAMPLING FROM A NORMAL POPULATION.

[b]ASE SHARE VOLUME DATA BEGIN IN 1927.

□ **Methodology for estimating regulatory effects.** If the market is efficient in assessing the impact of regulatory changes on seat prices,

[9] The known statistical properties of these regression equations, which were estimated using nonlinear least squares, are based upon asymptotic results (cf. Pierce, 1972).

the market may anticipate regulatory changes before they are publicly announced or implemented.[10] However, the actual adjustment of seat prices in response to changes in regulation is not easy to specify *a priori*. Even if the market fully adjusts seat prices instantaneously as new information becomes available, observed price behavior might exhibit a gradual adjustment to changes in regulation if the leakage of information about the effects of the regulation or its enforcement is gradual. That is, even if the market makes an unbiased assessment of the effects of regulatory changes, or any other factor affecting profitability, the market does not have perfect foresight. Subsequent events could cause the market to reevaluate its perceptions of the effects of the regulatory changes. For this reason it is important to be able to pinpoint the time when regulatory changes become new information to the market for seats.

In this analysis of regulatory changes I define dummy or indicator variables

$$d_t = \begin{cases} 1 \text{ if the event occurs in month } t, \text{ and} \\ \\ 0 \text{ otherwise} \end{cases}$$

for the months when major regulatory changes first became public knowledge. The estimator of the coefficient of the dummy variable $\delta$, when it is added to equation (6),

$$r_t = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L]\, r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\, \hat{u}_t + \hat{\delta}\, d_t + [1 - \hat{\theta}_1 L]\hat{\epsilon}_t, \quad (7)$$

indicates the average unexpected change in seat prices in months when the regulatory changes represented by $d_t$ occur. This is analogous to the analysis of outliers from the residuals from the regression equation (6), except that the estimated coefficient $\delta$ is a more efficient measure of regulatory effect.[11]

To check the specification of the dummy variable, $d_t$, the regression residuals from equation (7) are cross correlated with the dummy variable $d_t$ as suggested by Box and Jenkins (1976, pp. 394–395). If the original dating of the initial public awareness of regulatory change is incorrect, and if the change has a significant impact on seat prices, the correlation coefficient between $d_t$ and some past or future value of the regression residual, $\hat{\epsilon}_{t\pm k}$, should be large in comparison to its asymptotic standard error, $T^{-\frac{1}{2}}$. This diagnostic check on the adequacy of equation (7) is used to insure that significant effects of regulatory change are not overlooked as a result of misspecifying the dummy variable $d_t$.[12]

Since the ASE has essentially the same membership but a nonoverlapping list of traded securities, the public regulation which affects NYSE profitability should have a similar impact on ASE profitability. However, ASE seats are not traded so frequently as NYSE seats, so the statistical problems caused by the nontrading

[10] Fama (1970) reviews evidence that markets in other assets behave in this manner.

[11] Box and Tiao (1975) discuss the use of dummy variables in univariate autoregressive-integrated-moving average models. They refer to this procedure as "intervention analysis."

[12] The cross correlation function between the residuals $\hat{\epsilon}_t$ and the dummy variable $d_t$ is analogous to the residual analysis technique pioneered by Fama, Fisher, Jensen, and Roll (1969) for the analysis of unusual behavior of common stock returns.

phenomenon are more serious with ASE data. This is indicated by the relatively large coefficients of lagged variables in equation (6) for ASE data in the 1946–1972 period. Therefore, primary emphasis will be placed on the analysis of NYSE seat prices, and the ASE results will be used to corroborate the NYSE findings. This is important, since the analysis of NYSE seat price behavior in response to regulatory change involves preliminary data analysis before the final parametric models are estimated.

## 3. Analysis of the effects of SEC regulation

■ Congress decided to regulate the securities industry in 1933–1934 through the Securities Act of 1933 (the 1933 Act) and the Securities Exchange Act of 1934 (the 1934 Act). The latter created the Securities and Exchange Commission (SEC) as an independent regulatory agency of the Executive branch of government. Since 1934, the SEC has been charged with the primary responsibility for regulating the securities industry.

The SEC regulates the provision of information by firms which endeavor to raise capital by issuing new securities in public markets and requires firms which list their securities on organized exchanges to report their financial condition periodically. While these activities of the SEC do not directly involve the securities brokerage industry, they could have two effects on the demand for brokerage services. (1) by increasing public confidence in the integrity of the securities traded on organized exchanges, the SEC may increase the demand for these securities as financial instruments, which may increase the demand for brokerage services, and (2) by increasing the costs to firms of having publicly held securities, the SEC may decrease the supply of publicly available securities which may adversely affect the derived demand for brokerage services.

The SEC also oversees all the rules of organized securities exchanges and organizations of brokers. It has the power to have all such rules changed in accordance with its wishes. Since the SEC has the major responsibility for the regulation of the securities brokerage industry, several important changes in SEC regulatory behavior are examined.

□ **The 1934 act.** The 1934 Act was the first source of the direct government regulation of the securities brokerage industry. The 1933 Act had been primarily concerned with disclosure rules which applied to new issues of corporate securities, so it was not until the 1934 Act that the activities of NYSE brokers were significantly affected. As Sobel (1965, p. 298) observed:

> Wall Street had accepted the Securities Act and the Glass-Steagall Act with little grumbling, and had welcomed other legislation of the early New Deal. . . . The proposed regulation of the securities markets was one of the Administration moves which changed the New Deal honeymoon into a bitter battle.

The scope of public regulation of the securities markets which is encompassed in the 1934 Act is so broad that it is difficult to deduce the net effect of this legislation on brokers' profits. One potentially important role of SEC regulation was the "restoration of public confidence" in securities markets. By legislating against fraud and certain types of activities which were alleged to have manipulated the

prices of securities, and by restricting "speculative" practices such as the highly leveraged investment trusts which were popular in the late 1920's, the 1934 Act might have made the NYSE a "safer" market in the eyes of some traders. In fact, DeBedts (1964, p. 84) noted that in the period when the 1934 Act was being considered by Congress:

> . . . some responsible brokers were heard to say that with some regulation the public might very well reenter the market more readily.

This general effect of SEC regulation is to shift to the right the industry demand curve for brokerage services and probably to increase the profits earned by NYSE brokers.

The NYSE also could have benefited from the initiation of SEC regulation if the existence of the SEC reduced the costs incurred by the NYSE to police its price-fixing agreement. Doede (1967) and Baxter (1970), among others, have argued that the NYSE has acted as one of the most effective cartels in American economic history. If seat prices at least partially reflect the value of the monopoly rents earned by cartel members, the NYSE and ASE had operated successful cartels long before the initiation of federal securities regulation. However, maintenance of a stable cartel agreement must involve some costs of enforcing the fixed commission rates which the NYSE and ASE charged their customers. If the SEC was willing to support this cartel behavior, as it might if it were "captured" by the industry, the enforcement burden on the NYSE could have been reduced. For example, the SEC has the power to restrict entry into the production of stock exchange services through rules which prevent the trading of any security on more than one exchange in the same city, and this may have benefited NYSE brokers.[13]

While it is possible that the NYSE expected to benefit from the public regulation embodied in the 1934 Act, it is also possible that this regulation was not beneficial to NYSE brokers. For example, if brokers expected SEC regulation to increase the costs of operating a brokerage business by imposing incremental data collection costs, or to reduce the demand for these services by outlawing certain types of profitable trading activities, or to reduce the monopoly power of the NYSE cartel by threatening its price-fixing agreement, the NYSE would have viewed the 1934 Act as a threat to its profitability. In fact, the public accounts of the 1934 Act in the financial news section of the *Bank and Quotation Record* at the time of its introduction to Congress in February, 1934, suggested that SEC regulation would have deleterious effects on the health of the NYSE:

> . . . the agitation in Congress for the regulation of the Stock Exchanges on a basis that would make illegal the greater part of the business now done on the Stock Exchange, as proposed in the Fletcher-Rayburn Stock Exchange control bill, also had a dampening effect on the stock market. . . . Owing in good part to the threat of severe governmental regulation of the Stock Exchange, under measures now before Congress, trading in stocks was a desultory affair during March . . . .

President Roosevelt viewed control of NYSE activities as an important part of his New Deal legislation: "I am certain that the country as a whole will not be satisfied unless such legislation has teeth in it."

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[13] Recently the SEC has reconsidered the appropriateness of rules such as this one.

And it seemed that the NYSE perceived this public regulation as a threat, as noted in the *Bank and Quotation Record:*

> New York Stock Exchange authorities promptly expressed their intention to cooperate with the supervisory officials in Washington. It was clear, though, that it would be difficult to cooperate with so cumbrous and inflexible a regulatory machine as is being set up. The bill, jammed through by an Administration with a professed interest in increasing employment, was necessarily greeted in Wall Street with further reductions in staff and cuts in pay.

However, the best measure of how the securities brokerage industry perceived the initiation of SEC regulation is the behavior of NYSE and ASE seat prices during this period. The net effect of SEC regulation on expected profits can be seen through unanticipated changes in seat prices.

The initial version of the 1934 Act was introduced into Congress on February 6, 1934, so the dummy variable which represents that change in public regulation is defined as:

$$d_{1t} = \begin{cases} 1 \text{ if } t = \text{February 1934, and} \\ \\ 0 \text{ otherwise.} \end{cases}$$

The NYSE clearly anticipated that government regulation would expand at this time; on February 13, 1934, they adopted their own rules to prohibit members from

> participating in pools, syndicates, and joint accounts "organized or used intentionally for the purpose of unfairly influencing the market price of any security," and then forbade specialists from "disclosing to any person, other than certain committees of the Exchange, any information in regard to orders entrusted to him" . . . (or from) "acquiring or granting any option on the stocks in which they specialize."[14]

Voluntary compliance with some components of the 1934 Act prior to its enactment was presumably done to render direct government supervision unnecessary and redundant.

It should be noted from Table 4, which lists the dates and prices of all NYSE seat trades for February and March, 1934, that no seat trades occurred after February 6 until March. Thus, it seems that the major impact of the 1934 Act on NYSE seat prices occurred in

TABLE 4

NYSE SEAT TRANSACTIONS IN FEBRUARY AND MARCH, 1934[a]

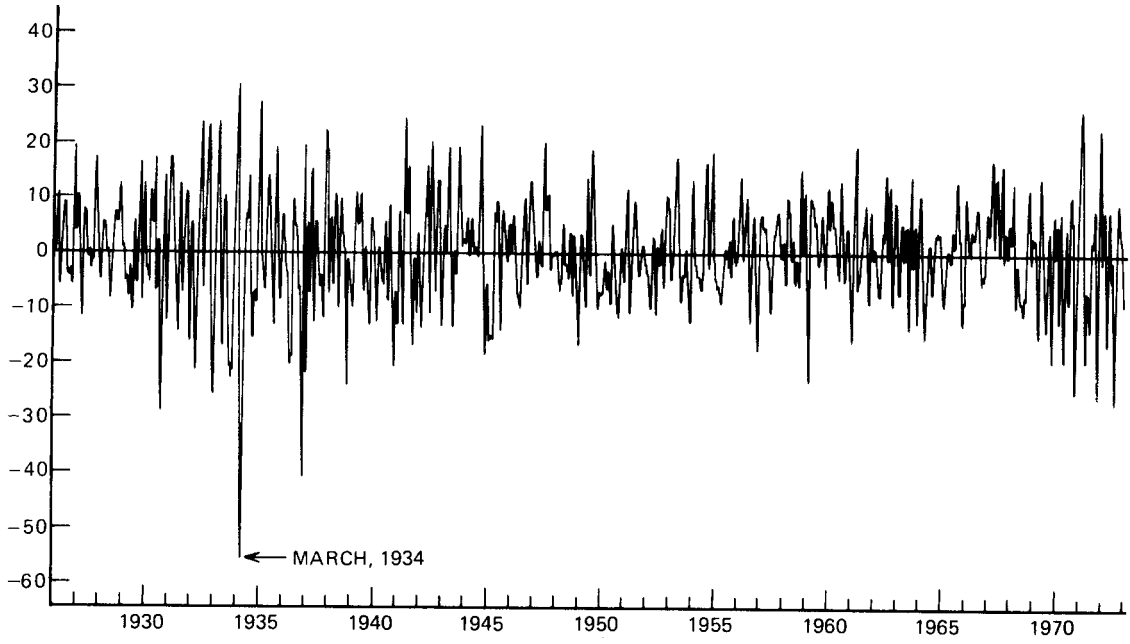
| DATE | PRICE |
|---|---|
| FEBRUARY 3 | $190,000 (TWO TRADES AT THIS PRICE) |
| MARCH 21 | 110,000 |
| MARCH 21 | 105,000 |
| MARCH 26 | 112,000 |
| MARCH 27 | 100,000 |
| MARCH 27 | 85,000 |
| MARCH 27 | 83,000 |
| MARCH 27 | 100,000 |
| MARCH 29 | 100,000 |

[a]THIS INFORMATION WAS PROVIDED BY MR. THOMAS MURPHY OF THE NYSE.

[14] Sobel (1975), p. 18. Sobel provides the historical background for the period immediately following the initiation of SEC activity.

FIGURE 1

UNEXPECTED MONTHLY PERCENT CHANGE IN NYSE SEAT PRICES: 1926–72




March, 1934, and that the magnitude of this instantaneous adjustment is quite large. The time series plot of the regression residuals from equation (6) in Figure 1 indicates that the unexpected percent change in NYSE seat prices, $\hat{\epsilon}_t$, in March, 1934, is larger than any other. The magnitude of this outlier reinforces the impression that the 1934 Act had a significant impact on NYSE seat prices.

To estimate the magnitude of the revision in seat prices caused by the 1934 Act the dummy variable $d_{1t-1}$ is added to equation (6):

$$r_t = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L]r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\hat{u}_t + \hat{\delta}_1 d_{1t-1} + [1 - \hat{\theta}_1 L]\hat{\epsilon}_t \quad (8)$$

and the estimation results are reported in Table 5. The estimate of the coefficient of the dummy variable for March, 1934, $\hat{\delta}_1$, is large relative to its standard error and implies a 55-percent decrease in the level of seat prices in the month associated with the 1934 Act. Different versions of equation (8) are presented in Table 5 to indicate that the magnitude of the coefficient of the regulatory dummy variable does not depend on the specification of the relationship with stock prices or share volume in equation (6).

From the plot of the residuals from equation (6) in Figure 1 it appears that seat prices may have fluctuated more in the 1930–1937 period than in the rest of the 1926–1945 subperiod.[15] To be sure that the March, 1934, fall in NYSE seat prices could not be reasonably attributed to chance, various versions of equation (8) are estimated over the 1930–1937 period, approximately four years either side of the 1934 Act. The only difference between these results and the results for the whole 1926–1945 period is that the standard errors of the coefficients are larger. This reduced precision is due to two factors: (1) the estimate of residual variance is slightly larger than for the

[15] Benston (1973) and Officer (1973) note that the 1930–1937 period was also a high variance period for the returns on NYSE common stocks.

TABLE 5

REGRESSION ANALYSIS OF THE EFFECTS OF THE 1934 ACT, NYSE DATA

$r_t = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L]r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\hat{u}_t + \hat{\delta}_1 d_{1t-1} + \hat{\delta}_2 d_{2t} + [1 - \hat{\theta}_1 L]\hat{\epsilon}_t$

(ASYMPTOTIC STANDARD ERRORS IN PARENTHESES)

| EQUATION | $\hat{\alpha}$ | $\hat{\beta}_0$ | $\hat{\beta}_1$ | $\hat{\gamma}_0$ | $\hat{\gamma}_1$ | $\hat{\delta}_1$ | $\hat{\delta}_2$ | $\hat{\theta}_1$ | $S(\hat{\epsilon})$ | $R^2$ | $SR(\hat{\epsilon})$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1926–45, T = 240 | | | | | | | | | | | |
| (8a) | −0.0032<br>(0.0075) | 0.8136*<br>(0.0399) | | 0.1055*<br>(0.0235) | | −0.5843*<br>(0.1161) | | | 0.1152 | 0.399 | 6.00 |
| (8b) | −0.0038<br>(0.0075) | 0.8019*<br>(0.0903) | 0.0997<br>(0.0954) | 0.0963*<br>(0.0248) | 0.0237<br>(0.0234) | −0.5867*<br>(0.1162) | | | 0.1152 | 0.406 | 6.12 |
| (8c) | −0.0042<br>(0.0058) | 0.8300*<br>(0.0893) | 0.0950<br>(0.0948) | 0.0951*<br>(0.0247) | 0.0249<br>(0.0231) | −0.5559*<br>(0.1121) | | 0.2197*<br>(0.0646) | 0.1134 | 0.427 | 6.37 |
| (9) | 0.0016<br>(0.0089) | 0.8341*<br>(0.0895) | 0.0991<br>(0.0950) | 0.0942*<br>(0.0248) | 0.0242<br>(0.0231) | −0.5613*<br>(0.1123) | −0.0099<br>(0.0117) | 0.2253*<br>(0.0647) | 0.1135 | 0.429 | 6.26 |
| 1930–37, T = 96 | | | | | | | | | | | |
| (6) | −0.0150<br>(0.0113) | 0.7957*<br>(0.1553) | 0.0121<br>(0.1647) | 0.1105*<br>(0.0534) | 0.1100*<br>(0.0497) | | | 0.2701*<br>(0.1048) | 0.1500 | 0.385 | 5.89 |
| (8a) | −0.0095<br>(0.0147) | 0.8025*<br>(0.1455) | | 0.0959*<br>(0.0479) | | −0.5867*<br>(0.1459) | | | 0.1431 | 0.423 | 4.79 |
| (8b) | −0.0080<br>(0.0144) | 0.7746*<br>(0.1432) | 0.0758<br>(0.1540) | 0.0750<br>(0.0503) | 0.1108*<br>(0.0462) | −0.5998*<br>(0.1424) | | | 0.1394 | 0.468 | 5.23 |
| (8c) | −0.0085<br>(0.0117) | 0.8116*<br>(0.1437) | 0.0523<br>(0.1524) | 0.0731<br>(0.0503) | 0.1173*<br>(0.0458) | −0.5738*<br>(0.1396) | | 0.1882<br>(0.1079) | 0.1383 | 0.483 | 5.38 |
| (9) | −0.0056<br>(0.0163) | 0.8142*<br>(0.1448) | 0.0544<br>(0.1535) | 0.0727<br>(0.0506) | 0.1172*<br>(0.0461) | −0.5764*<br>(0.1407) | −0.0060<br>(0.0235) | 0.1903<br>(0.1087) | 0.1390 | 0.483 | 5.30 |

*COEFFICIENT ESTIMATE IS MORE THAN TWO STANDARD ERRORS DIFFERENT FROM ZERO.

whole 1926–1945 period, and (2) the sample size is smaller. The analysis of the 1930–1937 period does not change the substantive conclusion about the effect of the 1934 Act.

Perhaps the strongest evidence that the fall in NYSE seat prices in March, 1934, was an extraordinary event associated with the introduction of the 1934 Act can be seen from the Studentized range statistics for the residuals from equations (6) and (8). The *SR* for equation (6) for the 1926–1945 period in Table 3 is 7.30, which is too large in comparison to its sampling distribution to be consistent with a stationary normal distribution for the regression disturbances. However, the *SR* for equation (8) for the 1926–1945 period in Table 4 is 6.37, which is consistent with the hypothesis that the regression disturbances are drawn from a stationary normal distribution. Thus, the magnitude of the outlier associated with March, 1934, is so large that it causes rejection of the null hypothesis of normality at usual significance levels for a test based on the order statistics of the residuals. Even if there was no knowledge that the 1934 Act might have affected seat prices, there would be statistical evidence that March, 1934, was an unusual month. Similar conclusions could be drawn from the analysis of the 1930–1937 subperiod.

The effect of the 1934 Act on ASE seat prices is estimated using equation (8) and the results are reported in Table 6. Interestingly, ASE seat prices fell unexpectedly by approximately 50 percent in March, 1934, too. This drop in the value of ASE seats is highly significant by conventional standards. In this instance the regression results for the 1930–1937 period present a clearer picture than the entire 1927–1945 period because of the heteroscedasticity in the re-

TABLE 6

REGRESSION ANALYSIS OF THE EFFECTS OF THE 1934 ACT, ASE DATA

$r_{at} = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L]r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\hat{u}_{at} + \hat{\delta}_1 d_{1t-1} + \hat{\delta}_2 d_{2t} + [1 - \hat{\theta}_1 L]\hat{\epsilon}_{at}$

(ASYMPTOTIC STANDARD ERRORS IN PARENTHESES)

| EQUATION | $\hat{\alpha}$ | $\hat{\beta}_0$ | $\hat{\beta}_1$ | $\hat{\gamma}_0$ | $\hat{\gamma}_1$ | $\hat{\delta}_1$ | $\hat{\delta}_2$ | $\hat{\theta}_1$ | $S(\hat{\epsilon})$ | $R^2$ | $SR(\hat{\epsilon})$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1927–45, T = 228 | | | | | | | | | | | |
| (8a) | −0.0025 (0.0133) | 0.7729* (0.1560) | | 0.1885* (0.0355) | | −0.5101* (0.2002) | | | 0.1994 | 0.251 | 8.43[a] |
| (8b) | −0.0053 (0.0128) | 0.7369* (0.1497) | 0.5929* (0.1590) | 0.1432* (0.0360) | 0.0754* (0.0341) | −0.5147* (0.1917) | | | 0.1908 | 0.323 | 8.57[a] |
| (8c) | −0.0049 (0.0105) | 0.7358* (0.1477) | 0.5416* (0.1585) | 0.1481* (0.0359) | 0.0818* (0.0336) | −0.5049* (0.1865) | | 0.1714* (0.0665) | 0.1883 | 0.344 | 8.72[a] |
| (9) | 0.0033 (0.0170) | 0.7392* (0.1481) | 0.5440* (0.1588) | 0.1480* (0.0360) | 0.0820* (0.0337) | −0.5135* (0.1872) | −0.0133 (0.0215) | 0.1734* (0.0666) | 0.1886 | 0.345 | 8.73[a] |
| 1930–37, T = 96 | | | | | | | | | | | |
| (6) | −0.0191* (0.0091) | 0.7363* (0.1732) | 0.3438 (0.1940) | 0.1011 (0.0527) | 0.0571 (0.0469) | | | 0.4966* (0.0929) | 0.1735 | 0.435 | 4.98 |
| (8a) | −0.0145 (0.0189) | 0.8420* (0.1816) | | 0.1457* (0.0494) | | −0.5202* (0.1853) | | | 0.1837 | 0.351 | 5.56 |
| (8b) | −0.0124 (0.0181) | 0.7792* (0.1750) | 0.4624* (0.1948) | 0.0876 (0.0524) | 0.0873 (0.0472) | −0.5414* (0.1768) | | | 0.1750 | 0.426 | 5.20 |
| (8c) | −0.0140 (0.0103) | 0.7463* (0.1666) | 0.3868* (0.1873) | 0.0855 (0.0512) | 0.0729 (0.0452) | −0.4501* (0.1559) | | 0.4127* (0.0988) | 0.1671 | 0.483 | 4.60 |
| (9) | −0.0135 (0.0144) | 0.7467* (0.1678) | 0.3870* (0.1885) | 0.0855 (0.0515) | 0.0730 (0.0455) | −0.4506* (0.1571) | −0.0010 (0.0209) | 0.4126* (0.0994) | 0.1680 | 0.483 | 4.57 |

*COEFFICIENT ESTIMATE IS MORE THAN TWO STANDARD ERRORS FROM ZERO.

[a]SR EXCEEDS THE 0.99 FRACTILE OF THE SAMPLING DISTRIBUTION WHEN SAMPLING FROM A NORMAL POPULATION.

siduals for the latter period which is indicated by the large *SR* statistics for the residuals. Thus, ASE seat price data provide corroborative evidence about the effect of the 1934 Act on the profitability of stock exchange membership.

One version of the capture hypothesis posits that regulated firms might be hurt by the initiation of regulation, but that over time the industry and the regulators develop a mutuality of interest which allows the regulated firms to reap profits from government regulation (cf. Bernstein, 1955). At this level of generality it is difficult to predict how long it takes for firms to realize that they can capture the regulators, if they can. However, it is certainly possible that the market for stock exchange seats overreacted at the initial news of the 1934 Act. To test this hypothesis another dummy variable

$$d_{2t} = \begin{cases} 1 \text{ if } t > \text{March 1934} \\ 0 \text{ if } t \leq \text{March 1934} \end{cases}$$

is added to equation (8) to determine whether NYSE and ASE seat prices ever recouped the loss which occurred in March, 1934,

$$r_t = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L]r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\hat{u}_t + \hat{\delta}_1 d_{1t-1} + \hat{\delta}_2 d_{2t} + [1 - \hat{\theta}_1 L]\hat{\epsilon}_t. \quad (9)$$

If events subsequent to March, 1934, caused securities brokers to revise their expectations of the effect of SEC regulation on their profitability, the estimated coefficient for $d_{2t}$, $\hat{\delta}_2$, should be positive,

indicating an unexpected increase in seat prices at some point after March, 1934. For example, if equation (9) is estimated over the 1926–1945 period, $d_{2t}$ would take on a unitary value for 141 months, so if $\delta_2 = 0.003$, seat prices would have recovered most of the loss which occurred in March, 1934, by the end of 1945. If equation (9) is estimated over the 1930–1937 period, $d_{2t} = 1$ for 45 months, so if $\delta_2 = 0.012$, the March, 1934, loss of over 50 percent in the value of seats would have been recouped as of the end of 1937.

The estimation results for equation (9) are contained in Table 5 for NYSE data and in Table 6 for ASE data. Every estimate of $\delta_2$ is *negative,* although none of these coefficients is estimated very precisely. Thus, there is no evidence that NYSE or ASE seat prices ever recouped the loss associated with the initial news of the 1934 Act. There is no reason to believe that securities brokers ever substantially revised their initial expectations of the negative influence of SEC regulation on their profitability.

Since there is evidence that NYSE brokers' profits were reduced by the 1934 Act, it would be interesting to determine whether this is due to increased costs, reduced demand, or a reduction in the efficacy of the NYSE cartel. It is not possible to determine this directly, since data do not exist which would allow estimation of a supply and demand model for the brokerage industry; however, it is possible to determine whether the reduction in profitability could be directly attributed to a reduction in NYSE or ASE share trading volume. To analyze the behavior of NYSE share volume subsequent to the 1934 Act, the dummy variable $d_{2t}$ which is defined above, is added to the moving average model for the difference of the log of NYSE share volume which is estimated in Table 2. If the fall in NYSE seat prices was due to the prohibition of certain types of trades which had been profitable prior to the SEC, the coefficients associated with $d_{2t}$ in equations (10) and (11) should be negative. In fact, the estimated coefficient of $d_{2t}$ for NYSE share volume data over the 1926–1945 period,

$$\underset{}{q_t} = \underset{(0.0112)}{-0.0027} + \underset{(0.0148)}{0.0025}d_{2t} + [1 - \underset{(0.0604)}{0.2336}L - \underset{(0.0662)}{0.2841}L^2 - \underset{(0.0629)}{0.1535}L^4]\hat{u}'_t \tag{10}$$

$$R^2 = 0.116 \quad S(\hat{u}') = 0.3297,$$

is a small positive number, although it is not significantly different from zero. This means that the rate of growth of NYSE share volume was slightly larger in the post-SEC period than in the pre-SEC period, although the difference is not statistically significant.

When the dummy variable $d_{2t}$ is added to the moving average model for the rate of growth of ASE share volume in Table 2 for the 1927–1945 period,

$$\underset{}{q_{at}} = \underset{(0.0201)}{-0.0045} + \underset{(0.0257)}{0.0110}d_{2t} + [1 - \underset{(0.0641)}{0.1658}L - \underset{(0.0673)}{0.2073}L^2 - \underset{(0.0664)}{0.1495}L^4]\hat{u}'_{at} \tag{11}$$

$$R^2 = 0.078 \quad S(\hat{u}'_a) = 0.3853,$$

the estimated coefficient of $d_{2t}$ is also positive, but not significantly different from zero. Thus, there is no evidence that a reduction in the rate of growth of NYSE or ASE share trading volume was the cause of the March, 1934, reduction in seat prices.

To sum up, an abnormal capital loss was suffered by NYSE and ASE seat-holders in March, 1934. The capital loss was caused by a reduction of brokers' expectations of future profits by about 50 percent as a result of the 1934 Act. The data do not indicate that subsequent information about SEC regulation caused seat prices to recover from this shock. The capture hypothesis is not borne out by behavior of the SEC with respect to the NYSE.

□ **Commission rate regulation.** A specific type of SEC regulation which might have a direct effect on the profitability of NYSE brokers is the control over brokerage commission rates which by section 19(b) of the 1934 Act requires the commission

> . . . by rules or regulations or by order to alter or supplement the rules of such exchange in respect of such matter . . . (9) the fixing of reasonable rates of commission, interest, listing, and other charges.

While the responsibility for the adoption and enforcement of commission rate regulations is maintained in the exchanges through a policy of "self-regulation," the SEC is supposed to ensure that these rules are "reasonable."

There are two divergent effects of SEC commission rate regulation on the profitability of NYSE brokers. First, if the SEC requires the NYSE to set its prices *either* too high *or* too low, the NYSE would not be able to attain a static profit-maximization position, so profits would be decreased. If the SEC wishes to reduce the cartelization of the brokerage industry, it could require rate reductions or eliminate price-fixing altogether. On the other hand, even if the SEC is willing to let the NYSE exist as a price-fixing cartel, the process of approving new price schedules could involve time delays which might cause prices to be above or below the profit-maximizing level for long periods of time. Thus, even if the SEC is not intentionally threatening the profitability of the NYSE, it is possible that the regulation of commission rates might inadvertently reduce the profits earned by NYSE brokers.

It is also possible that SEC commission rate regulation might increase the profits of NYSE brokers by reducing the costs which the NYSE must incur to enforce its cartel agreement. In fact, the NYSE and the ASE have argued that the regulatory supervision of the SEC exempts them from liability for price-fixing under the antitrust laws (cf. ASE, 1968, pp. 41–69).

The effect of commission rate regulation on brokers' profits would have been assessed along with the other types of regulations which were embodied in the 1934 Act; however, the attitude of the SEC toward commission rate regulation could have changed since 1934 and this could have caused changes in seat prices. Prior to 1968 the SEC never seriously resisted an attempt by the NYSE to raise commission rates; however, in January, 1968, the Antitrust Division of the Department of Justice recommended that the SEC force the NYSE to abandon price-fixing. This pressure from the Justice Department led to a long series of hearings on this issue and caused most of the subsequent rate changes.[16] Therefore, NYSE brokers may have re-

[16] See West and Tinic (1971), pp. 108–142, for a description of this episode in the regulatory history of NYSE commission rates.

TABLE 7

MAJOR NYSE COMMISSION RATE CHANGES SINCE 1926

| DATE | | DESCRIPTION OF RATE SCHEDULE |
|---|---|---|
| 1/1/26 | | FIXED CHARGE PER SHARE. THE LEVEL OF THE PER SHARE CHARGE INCREASED WITH THE PRICE PER SHARE, BUT AT A DECREASING RATE OF INCREASE. |
| 1/3/38 | | ALL COMMISSION RATES INCREASED BY 11 PERCENT. |
| 3/16/42 | | ALL COMMISSION RATES INCREASED BY 10 PERCENT. |
| 11/3/47 | | NEW SLIDING SCALE OF COMMISSIONS BASED UPON THE VALUE OF A ROUND LOT OF 100 SHARES. AVERAGE INCREASE OF 20 PERCENT. |
| 9/1/53 | | AVERAGE INCREASE OF ABOUT 18 PERCENT. |
| 5/1/58 | | AVERAGE INCREASE OF 13 PERCENT. |
| 3/30/59 | | RATES ON SMALL TRANSACTIONS REDUCED BY SEC ORDER. AVERAGE DECREASE OF ABOUT 1.5 PERCENT. |
| 12/5/68 | POST–1967 RATE CHANGES | VOLUME DISCOUNT ON TRADES OF MORE THAN 1,000 SHARES. AVERAGE DECREASE OF ABOUT 7 PERCENT. |
| 4/2/70 | | SMALL TRADE SURCHARGE OF $15 PER TRADE OF LESS THAN 1,000 SHARES. |
| 4/5/71 | | NEGOTIATED COMMISSION RATES FOR ORDERS OVER $500,000 ORDERED BY SEC. |
| 4/31/72 | | NEGOTIATED COMMISSION RATES FOR ORDERS OVER $300,000 ORDERED BY SEC. SMALL TRADE SURCHARGE ENDS. |
| 5/1/75 | | NEGOTIATED COMMISSION RATES ON ALL ORDERS. |

vised their expectations of the effects of commission rate regulation after 1967, even if the pre-1968 commission rate changes did not cause NYSE seat prices to change. All of the major changes in NYSE commission rates are listed in Table 7.

To test whether the post-1967 commission rate changes caused significant decreases in NYSE seat prices, a dummy variable, $d_{3t}$, is defined as equal to one in the month before, the month of, and the month after each of the post-1967 rate changes, and zero otherwise. This definition of $d_{3t}$ is equivalent to estimating the average unexpected change in seat prices in the three months immediately around December, 1968, April, 1970, April, 1971, and April, 1972. The estimate of the coefficient of $d_{3t}$, $\hat{\delta}_3$, for the 1946–1972 period which is reported in Table 8 indicates that the post-1967 rate changes had a statistically significant negative effect on NYSE seat prices which is spread over the three months surrounding the change.[17] However, the effect of these changes on ASE seat prices is not significant in this case. Similar analysis of the commission rate changes prior to 1968 showed no significant effect.

Thus, there is some evidence that the change in the regulatory environment brought about by the intervention of the Justice Department caused further reductions in NYSE seat prices. NYSE seat prices fell unexpectedly about 5 percent on average in the twelve months when $d_{3t}$ is nonzero during the 1968–1972 period. The cumulative effect of these reductions in brokers' expectations of future profitability which are associated with changes in commission rate regulation is quite substantial.

[17] Several different parameterizations were tried to test whether the post-1967 reductions in NYSE seat prices were really caused by the threat to price-fixing. Accounting for growth in third (over-the-counter) market volume in NYSE stocks and growth in the trading activity of large institutional investors did not affect these results.

TABLE 8

REGRESSION ANALYSIS OF POST–1967 COMMISSION RATE CHANGES: 1946–72

$r_t = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L]r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\hat{u}_t + \hat{\delta}_3 d_{3t} + [1 - \hat{\theta}_1 L]\hat{\epsilon}_t$

(ASYMPTOTIC STANDARD ERRORS IN PARENTHESES)

| | $\hat{\alpha}$ | $\hat{\beta}_0$ | $\hat{\beta}_1$ | $\hat{\gamma}_0$ | $\hat{\gamma}_1$ | $\hat{\delta}_3$ | $\hat{\theta}_1$ | $S(\hat{\epsilon})$ | $R^2$ | $SR(\hat{\epsilon})$ |
|---|---|---|---|---|---|---|---|---|---|---|
| NYSE | −0.0078* (0.0031) | 0.9888* (0.1263) | 0.3367* (0.1285) | 0.0892* (0.0274) | 0.0413 (0.0267) | −0.0519* (0.0178) | 0.4141* (0.0514) | 0.0833 | 0.345 | 6.29 |
| ASE | −0.0113* (0.0053) | 0.6359* (0.1862) | 0.9453* (0.1942) | 0.0330 (0.0286) | 0.0815* (0.0274) | −0.0065 (0.0287) | 0.2997* (0.0538) | 0.1216 | 0.221 | 8.16[a] |

*COEFFICIENT ESTIMATE IS MORE THAN TWO STANDARD ERRORS DIFFERENT FROM ZERO.

[a]SR EXCEEDS THE 0.99 FRACTILE OF THE SAMPLING DISTRIBUTION WHEN SAMPLING FROM A NORMAL POPULATION.

□ **The SEC budget.** Security brokers' profitability could also be affected if the SEC changes its enforcement of existing regulations. Presumably, this change in enforcement effort would be reflected in budget allocations. To test whether the growth of the SEC budget over time affected NYSE expectations of future profits, fiscal year budget data from SEC Annual Reports are used to create the percent change in the budget from the previous fiscal year, which is assumed to be constant for the months of the fiscal year. Explicitly, the monthly percent change in the SEC budget is defined as one-twelfth of the change in the natural logarithm of the annual budget relative to the previous budget: $b_t \equiv \ln(B/B_{-1})/12$. Ideally, it would be valuable to separate budget changes into expected and unexpected parts, and also to determine what fraction of the budget is allocated to activities which explicitly affect stock exchange members. However, such decompositions are not readily computable from publicly available data. With only 38 separate observations on the SEC budget, the method of assuming constant percent change across the months of the fiscal year is a convenient mechanism for analyzing the effect of budget changes on the behavior of monthly seat prices.

The estimated regression equations in Table 9 indicate that an above average increase in the SEC budget is associated with a reduction in NYSE and ASE seat prices in the 1934–1945 period. An increase in the SEC budget which is one percent per year above the average rate of growth in this period causes an average fall of about one-twelfth of one percent per month (one percent per year) in each of the months of the fiscal year which is not related to changes in stock prices or share volume. This could be interpreted as evidence that the early history of the SEC caused brokers to continually revise their expectations of the effects of regulation on their profitability in accordance with changes in the level of activity of the SEC (as measured by the budget). Since the SEC budget grew in the years after 1934 ($b_t$ is set equal to zero until the end of fiscal year 1934, and subsequent changes are measured relative to the prior fiscal year budget), this evidence would seem to confirm the earlier results from equation (9) in Tables 5 and 6 that seat prices actually had a lower than average rate of growth, *ceteris paribus*, in the 1934–1945 period than in the 1926–1934 period. It seems that the budget variable, $b_t$, explains this fall in NYSE and ASE seat prices better than the

TABLE 9

REGRESSION ANALYSIS OF EFFECTS OF SEC BUDGET ON NYSE AND ASE SEAT PRICES

$r_t = \hat{\alpha} + [\hat{\beta}_0 + \hat{\beta}_1 L]r_{mt} + [\hat{\gamma}_0 + \hat{\gamma}_1 L]\hat{u}_t + \hat{\delta}_1 d_{1t-1} + \hat{\delta}_3 d_{3t} + \hat{\delta}_4 b_t + [1 - \theta_1 L]\hat{\epsilon}_t$

(ASYMPTOTIC STANDARD ERRORS IN PARENTHESES)

| | $\hat{\alpha}$ | $\hat{\beta}_0$ | $\hat{\beta}_1$ | $\hat{\gamma}_0$ | $\hat{\gamma}_1$ | $\hat{\delta}_1$ | $\hat{\delta}_3$ | $\hat{\delta}_4$ | $\hat{\theta}_1$ | S ($\hat{\epsilon}$) | $R^2$ | SR($\hat{\epsilon}$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1926–45 | | | | | | | | | | | | |
| NYSE DATA | −0.0011 (0.0056) | 0.8399* (0.0889) | 0.1062 (0.0945) | 0.0901* (0.0247) | 0.0245 (0.0229) | −0.5529* (0.1104) | | −1.035* (0.4927) | 0.2636* (0.0643) | 0.1127 | 0.437 | 6.08 |
| ASE DATA[a] | −0.0007 (0.0107) | 0.7393* (0.1475) | 0.5525* (0.1586) | 0.1448* (0.0360) | 0.0818* (0.0335) | −0.5096* (0.1857) | | −1.278 (0.9020) | 0.1850* (0.0665) | 0.1879 | 0.349 | 8.70[b] |
| 1946–72 | | | | | | | | | | | | |
| NYSE DATA | −0.0116* (0.0042) | 1.006* (0.1269) | 0.3622* (0.1299) | 0.0884* (0.0273) | 0.0418 (0.0267) | | −0.0542* (0.0178) | 0.6084 (0.4574) | 0.4184* (0.0515) | 0.0832 | 0.348 | 6.29 |
| ASE DATA | −0.0127 (0.0071) | 0.6568* (0.1868) | 0.9366* (0.1962) | 0.0319 (0.0287) | 0.0817* (0.0275) | | 0.0996 (0.1171) | 0.1367 (0.7901) | 0.2999* (0.0539) | 0.1216 | 0.223 | 8.15[b] |

*COEFFICIENT ESTIMATE IS MORE THAN TWO STANDARD ERRORS DIFFERENT FROM ZERO.

[a]ASE EQUATION ESTIMATED FROM 1927–45.

[b]SR EXCEEDS THE 0.99 FRACTILE OF THE SAMPLING DISTRIBUTION WHEN SAMPLING FROM A NORMAL POPULATION.

assumption that the constant term in equation (8) changed after March, 1934, since the coefficient of $b_t$, $\hat{\delta}_4$, is large relative to its standard error in the 1926–1945 period in Table 9.

However, the estimation results for the 1946–1972 period do not indicate that there was any significant relationship between budget changes and seat prices after 1945. This does not necessarily mean that the SEC was captured by the NYSE and the ASE after 1945; rather, it may simply mean that post-1945 SEC budget changes contained little new information for securities brokers about the effects of government regulation on the profitability of stock exchange membership. However, the paucity of independent information contained in the time series of monthly changes in the SEC budget causes these estimates of regulatory effects to be very imprecise.

Thus, it seems that increased enforcement effort, as reflected in budget increases, is associated with decreases in NYSE and ASE profitability during the first decade of the history of the SEC. During the last 25 years it is not obvious that the changes in the level of SEC activity have had any additional effect on member brokers' profitability. The fact that the effect of budget increases is smaller in the latter period is consistent with several hypotheses, but it is not consistent with the capture hypothesis, since there is no evidence that member brokers ever *benefited* significantly from budget increases.

## 4. Conclusions

■ Baxter (1970) analyzes the public regulation of the securities brokerage industry and notes that public regulation has not eliminated the monopoly power of the stock exchange cartel since the SEC has implicitly sanctioned price-fixing by the NYSE, at least prior to May 1, 1975. Based upon Baxter's analysis, Posner (1974) cites the securities industry as a case where the public interest hypothesis of public

regulation does not work. Meltzer (1969, pp. 228–229) even suggests that the capture hypothesis may be appropriate:

> It appears, therefore, that the SEC and the 1934 Act have changed (or countenanced changes in) the types of restrictive practices used to increase profits of NYSE member firms but have not eliminated these practices. This allegation, if correct, would not be surprising. Our broad experience with regulation suggests that communities of interest develop between the regulators and the regulated.

Thus, some prominent analysts have suggested that securities brokers have captured the SEC, but no one has ever attempted a direct test of that hypothesis for this industry.

By using the time series of market prices for stock exchange seats to directly measure the impact of regulatory change on the long-run profitability of stock exchange membership, this paper has shown that the capture hypothesis does not provide an appropriate description of the public regulation of the securities brokerage industry. There is significant evidence that the expected profitability of NYSE and ASE membership was permanently reduced by the initiation of SEC activities in 1934. NYSE and ASE seat prices fell by about 50 percent in the month associated with the introduction of the 1934 Securities and Exchange Act to Congress and there is no evidence that seat prices ever recovered from this unexpected fall. There is also evidence that seat prices fell in association with the major changes in the structure of commission rates which have taken place since 1968 at the insistence of the SEC, and there is some indication that seat prices fell in association with increases in SEC activity as measured by budgetary growth during the first ten years of the agency's existence. There is no contradictory evidence that any change in the regulatory behavior of the SEC has ever been related to increases in seat prices.[18] All of these findings contradict the capture hypothesis that producers gain from regulatory supervision at the expense of consumers. There is no evidence that NYSE or ASE brokers have ever profited from the activities of the SEC.

In retrospect, the findings in this paper have a number of important implications for the analysis of the economics of the securities brokerage industry and for empirical testing of the effects of public regulation in general. Many analysts have claimed that the NYSE was a very effective private cartel long before the birth of the SEC. Stigler (1964), Baxter (1970), and especially Doede (1967) have argued that the fixed structure of commission rates which existed from 1792 until May 1, 1975, allowed NYSE member firms to earn monopoly rents, since the only way to trade at a lower price on the organized securities exchange was to buy one of the NYSE seats. This reasoning led Doede to conclude that the prices of stock exchange seats are due entirely to monopoly rents. An extreme alternative view of seat prices is that they reflect the net value of the tangible and intangible assets owned by the NYSE—for example, the building and land which house the NYSE and possibly the accumulated "goodwill" associated with the historically efficient market in corporate securities operated by the

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[18] Other regulatory changes such as changes in margin requirements, the 1940 *Multiple Listing* decision by the SEC, and the publication of the *Special Study of the Securities Markets* in 1963 were also examined and no significant changes in the seat prices were associated with any of the other regulatory events.

NYSE.[19] The results in this paper provide some direct evidence on these opposite views of the determinants of seat prices.

If stock exchange seat prices merely reflect the net value of the physical assets owned by the exchange, there would be no reason to suppose that SEC regulation could reduce seat prices, since the factors of production used by the exchange could be sold for some other productive use. On the other hand, if seat prices contained a component due to monopoly rents or rents associated with superior efficiency in organizing securities markets, the advent of regulation could cause a reduction in seat prices, since the factors causing the rents could not shift to alternative uses. Thus, the evidence that regulatory change is associated with decreases in NYSE and ASE seat prices indicates that at least some part of the value of seats prior to the SEC had to be attributable to rents of some kind. Whether the current level of seat prices reflects any rents which are expected by NYSE members remains an open question.

Given that stock exchange seats are specialized factors of production for securities brokers which have no obvious alternative use, the prices of seats provide an ideal basis for the analysis of the effects of regulatory changes on the rents earned by brokers. Perhaps this is the reason that it is possible to detect *any* significant effect of public regulation in this instance (cf. Posner (1974) for some examples of studies which have not detected any effect of regulation). Since the market for seats seems to assimilate quickly information about the future cash flows attributable to seats, it is much easier to identify effects of regulation in the market prices of seats than in nonmarket variables, such as the accounting earnings data for stock brokers, or than in nonanticipational variables, such as share trading volume on the exchanges. In addition, seat prices should be more sensitive to changes in regulation than the prices of the stocks issued by securities brokerage firms, since a large component of the latter prices may reflect competitive returns to factors of production which are not specific to the industry and should not be affected by government regulation. Thus, the use of the market prices for an *industry-specific* factor of production may substantially increase the power of tests of regulatory effect relative to more conventional techniques.

The importance of the findings in this paper is that the simple "producer protection" version of the capture hypothesis can be rejected. Other economists have previously rejected the simple "consumer protection" version of the public interest hypothesis with respect to SEC regulation. Evidently the consumer protection/producer protection dichotomy is too simplistic in this instance, whence more sophisticated models of the regulatory process must be developed to explain observable behavior.

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[19] Doede argues that the NYSE was a natural monopoly in the industry of stock exchanges, at least during the 1792–1965 period. They drove all of their (presumably less efficient) competition out of business during this period.

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