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### Author

Ferrell, Allen

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**DOES MANDATED DISCLOSURE IMPROVE ALLOCATIVE EFFICIENCY?**  
**EVIDENCE FROM THE OVER-THE-COUNTER MARKET**

ALLEN FERRELL<sup>\*</sup>

Assistant Professor of Law  
Harvard Law School  
fferrell@law.harvard.edu

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## I. INTRODUCTION

The organizing principle of U.S. securities regulation in the twentieth century is the belief that mandated disclosure of firm-specific information enables capital markets to function efficiently and in the interests of all investors. (Securities Act of 1933; Exchange Act of 1934). The regulatory response to recent corporate scandals has been to focus once again on the presumed importance of full, mandatory disclosure (Sarbanes-Oxley Law, 2002). This regulatory stance, now widely emulated around the world, raises the fundamental question of the role mandated disclosure should play in capital market regulation. Surprisingly, there has been relatively little work attempting to answer this question based on the actual effects of mandated disclosure on the capital markets.

The empirical work that has been done, most importantly the studies of the impact of the Securities Act of 1933 and the Exchange Act of 1934 on the financial markets (Stigler 1964; Benston 1973; Simon 1989), has been heavily relied upon by academics in making policy recommendations on the desirability of mandated disclosure (Romano 1998). Unfortunately, these studies suffer from the need to control for changing market conditions over the time period they study (notably the advent of the Great Depression). Moreover, these studies use measures, such as changes in average stock returns, which might not adequately capture the effect mandated disclosure has on how well the capital markets are functioning (Coffee 1984).

This paper presents empirical evidence, based on a unique database created for this study, suggesting that mandated disclosure had no measurable impact on the allocative efficiency of the capital markets. We measure the effect that the imposition of

mandated disclosure on the over-the-counter market (OTC), first required in 1964, had on the allocative efficiency of that market. Allocative efficiency, as used in this paper, refers to the informational content of a security market's prices. An increase in allocative efficiency represents an increase in the informational content of securities prices, and, hence, helps ensure that capital allocated based on stock prices is done so more efficiently.<sup>1</sup> In order to measure changes in the allocative efficiency of the OTC market, we employ several different proxies for allocative efficiency that have been developed in the finance literature (Roll 1988; Simon 1989; Morck et al 2000; Durnev et al 2001a). The finding that there was no improvement in allocative efficiency is robust to the proxy used and to the length of time studied.

The extension of mandated disclosure to the OTC market represented a fundamental change in the scope of mandated disclosure under U.S. securities law. The only other fundamental change in the scope of mandated disclosure in the twentieth century was the original securities acts themselves; the Securities Act of 1933 and the Exchange Act of 1934. These Acts placed extensive mandated disclosure requirements on exchange-listed companies. There have been other changes in the coverage of mandated disclosure requirements over the years, but none of the same fundamental importance as these two. The imposition of mandated disclosure on non-exchange listed securities – the OTC market – has never been studied.

This study has several advantages over earlier studies. First, and most importantly, exchange-listed companies form a natural control group as they were subject to the disclosure requirements of the Exchange Act of 1934 throughout the time period

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<sup>1</sup> It is perfectly possible for a market to have relatively little information impounded in the price of its securities (low allocative efficiency) and for that security market to be informationally efficient in the sense that all publicly available information is part of the information set that is impounded.

studied (1962-1968). Second, the capital markets in the 1962-68 period did not suffer a shock as dramatic as that of the Great Depression. Third, there are theoretical reasons, with empirical backing, for believing that if there were to be effects caused by mandated disclosure on the capital markets such effects would be most powerfully felt in the less-liquid, less-followed OTC market (Grossman & Stiglitz 1980; Simon 1989). The private market sources of financial information are likely to be less extensive in such a marketplace. In contrast, the New York Stock Exchange in the 1920s, the time period immediately prior to exchange-listed company mandated disclosure requirements, was a well-developed marketplace with deep liquidity.

## **II. THE EXISTING EMPIRICAL LITERATURE**

George Stigler's 1964 study marked the first attempt to study the empirical impact of the securities acts on the performance of the capital markets. Stigler examined two groups of new share issues: a pre-mandated disclosure group of new share issues (1923-28) and a post-mandated disclosure group of new share issues (1949-55). He found that the returns on securities post-mandated disclosure was the same as that of the pre-mandated disclosure group. Second, he found that the variance of the post-mandated disclosure group's stock returns fell by approximately half. Stigler interpreted these findings as consistent with the view that mandated disclosure had no beneficial effect.

In his influential 1973 study, Benston divided New York Stock Exchange (NYSE) companies pre-1934 (pre-mandated disclosure) into two groups: 193 companies which he claims did not disclose sales information and a second group of 314 companies which did

disclose sales information even though there was no statutory obligation to do so in the pre-mandated disclosure period. He found that there is little difference between the two groups both pre- and post- mandated disclosure employing several different measures. His main result is that the two groups of companies have virtually the same average monthly stock price residuals, and the same distribution of stock price residuals, throughout both the pre- and post-mandated disclosure period (p.146-147).<sup>2</sup> Carol Simon subsequently reproduced Stigler's result (and confirmed in Benston's study) that there was a substantial reduction in the variance of stock price residuals in the post-mandated disclosure period (Simon 1989).<sup>3</sup>

The Stigler and Benston studies, while important, suffer from serious shortcomings. First, the use of stock return performance as a measure of the securities acts' effects, as Stigler does, is questionable. The reason is simple: asset pricing theory implies that the expected return on an asset is the risk-free rate of return plus a premium based on the risk inherent in holding that asset. In order for changes in stock returns to serve as a proxy for changes in allocative efficiency, one would have to show that allocative efficiency has a meaningful effect on the risk-free rate of return or the premium associated with holding undiversifiable risk. Neither effect is straightforward nor obvious.

Second, the policy implications of the finding in both the Benston and Stigler study of reduced variance of stock prices (or residuals) has been extensively debated (Seligman 1983; Coffee 1984; Romano 1998; Fox 1999). But there is the threshold question of whether the reduction in variance was caused by the securities acts as

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<sup>2</sup> Residuals were calculated for each company's stock in Benston's study using a market model.

<sup>3</sup> Residuals were calculated for each company's stock in Simon's study using a model more sophisticated than the market model, enabling her to take into account effects such as that of firm size on stock prices.

defenders of mandated disclosure contend (Friend & Westerfield 1975) or resulted from the impact of the Great Depression, as Benston (1975) claims. It is extraordinarily difficult to adjudicate this debate convincingly given the econometric evidence indicating that the Great Depression did have a profound effect on the capital markets, including reduced variance. Simon found, for instance, that the market as a whole experienced a forty-five percent reduction in variance during the Great Depression. (1989, p.309)

Conceivably the effects of the Great Depression and the securities acts could be disentangled if a good control group were available. Benston's group of 314 companies that apparently disclosed sales information voluntarily pre-mandated disclosure would arguably serve this function. But the problems with using this group as a control are serious. First, several commentators have noted that many firms in the non-disclosing group of 193 companies did in fact disclose basic financial information, such as net income and balance sheet data. (Friend & Westerfield 1975) Second, commentators have argued that the important change wrought by the securities acts was in the liability imposed for fraud and non-disclosure given the arguably poor quality of voluntary disclosures even when made (Fox 1999). The increased exposure to liability for inadequate disclosure would have affected both groups of companies. Both these criticisms raise the question of whether measuring the *differential* effect that the disclosure requirements of the securities acts had on Benston's two groups is a good measure of the acts' *overall* effect on the capital markets. If the two groups Benston uses are not all that different, then the differential effect of the securities acts on these two groups would not serve as a good measure of the acts' overall effect.

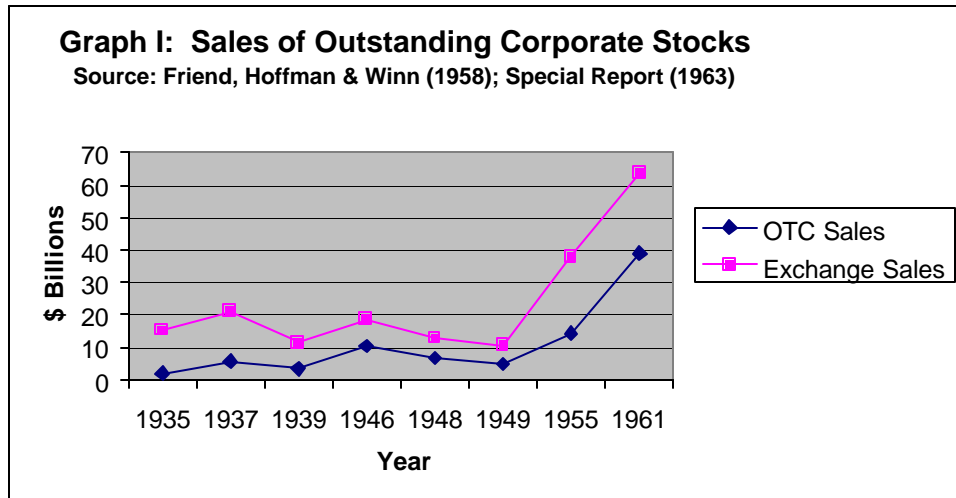
The question of how to measure the acts' overall effect highlights the fundamental problem that plagues all econometric studies (Stigler 1964; Benston 1973; Jarrell 1981; Simon 1989) of the Securities Act of 1933 and the Exchange Act of 1934. These studies need to disentangle the effects of the Great Depression on the capital markets from any effect caused by the Securities Acts. It is difficult to do this in a convincing manner.

This paper's examination of the extension of mandated disclosure requirements to the OTC market in 1964 does not suffer from this problem for the simple reason that there exists a natural control group. The control group is simply the exchange-listed companies which had been subject to the Exchange Act's disclosure requirements for some thirty years, beginning in 1934. Second, although less importantly, the time period of this study – 1962-68 – does not contain a traumatic stock market event anywhere on the same order as that of the Great Depression.

### **III. THE OTC MARKET AND THE SECURITIES ACTS AMENDMENTS OF 1964**

By the early 1960s the OTC market was a large, important and heterogeneous securities market. It had experienced dramatic growth from the time of the imposition of the Securities Acts in 1933 and 1934, which had largely exempted it from regulation, to the beginning of the 1960s. The OTC market grew from \$2.1 billion in sales in 1935 to \$38.9 billion in 1961. As a percentage of exchange sales, the OTC market grew from 16% in 1935 to an impressive 61% by 1961. The following graph illustrates this trend.





A broad range of types of securities traded on the OTC market. The OTC market included most government securities; a large number of bank and insurance companies; industrial companies; utility companies as well as a wide mix of other types of firms. Some summary statistics on the mix of firms over the course of the 1960s will be presented in Part V. Market capitalizations of OTC companies also widely varied from firms worth less than \$100,000 to companies worth billions of dollars.

In 1963, the REPORT OF SPECIAL STUDY OF SECURITIES MARKETS, a highly influential and groundbreaking Securities and Exchange Commission (SEC) study of the state of securities regulation was completed. It reported that ninety-three percent of all the cases of fraud reported by the SEC between January 1961 and July 1962 involved companies that were not subject to the Exchange Act's disclosure requirements. The REPORT OF SPECIAL STUDY also examined a large number of OTC companies with an eye to their disclosure practices. It found that twenty-five percent of OTC companies did not disseminate any financial information to shareholders. Of those that did distribute financial data, forty-four percent failed to provide any breakdown of its inventories into

categories. Thirty-three percent failed to provide any explanatory notes detailed such items as depreciation methods, contingent liabilities or long-term contractual obligations. Finally, twenty-three percent of OTC companies did not certify their financial reports.

Based on these findings, the REPORT OF SPECIAL STUDY concluded that most OTC companies “either make no reports to shareholders at all or their reports are meager and inadequate.” (p.10, Part III). The REPORT recommended that the Exchange Act’s disclosure requirements be extended to most OTC companies. Legislative action followed quickly. On August 20, 1964, the 1964 Securities Acts Amendments were signed into law. The purpose of the amendments, reflecting the analysis and recommendations of the REPORT, was to “afford investors in publicly-held companies whose securities are traded over-the-counter the same fundamental disclosure protections as have been provided to investors in companies whose securities are listed on an exchange” (SEC 1964).

The 1964 amendments placed on OTC companies the same extensive mandated disclosure requirements as those placed on exchange-listed companies. The amendments added section 12(g) to the Exchange Act of 1934. This section requires OTC companies with more than \$1 million in assets and held by more than 750 shareholders to comply with the Exchange Act’s periodic disclosure requirements. Section 12(g) does exempt certain types of OTC companies from these requirements. These include “investment companies,” such as mutual funds, section 12(g)(2)(B), and insurance companies subject to comparable state regulation, section 12(g)(2)(G). “Investment companies,” although exempt from section 12(g), already had, by 1964, substantial disclosure requirements under the Investment Company Act of 1940. Banks are not exempted from the Exchange

Act's requirements, but the administration and enforcement of the disclosure requirements are vested in the federal banking agencies rather than the SEC.

The Exchange Act's periodic disclosure requirements, to which OTC companies were subject after the 1964 amendments, include the need to file, pursuant to section 13 of the Exchange Act, the now-familiar panoply of periodic reports: the annual report (form 10-K), semiannual reports (form 9-K), quarterly reports (form 7-K) and, when certain specified events occur, a current report (form 8-K). The information contained in these reports include such items as certified annual balance sheets; acquisition or sale of a significant amount of assets; quarterly cash flow statements and semiannual profit and loss statements. Under section 18 of the Exchange Act, any person who makes a statement in an Exchange Act disclosure document that is "false or misleading with respect to any material fact" is liable to any person who buys or sells securities in reliance on such a statement and at a price affected by such a statement. In addition to periodic disclosure requirements, the Exchange Act's proxy solicitation and trading regulations were extended to non-exempt OTC companies meeting the threshold requirements of \$1 million in assets and a shareholder base of 750.

The effective date of the new reporting requirements depended on the OTC company's fiscal year. Companies had to comply with the new disclosure requirements within one hundred and twenty days after the last day of its first fiscal year ending after July 1, 1964. Accordingly, the earliest point at which an OTC company was subject to the new disclosure requirements under the statute was November 1, 1964. If an OTC company's fiscal year began at the start of the calendar year, that company would be subject to the new disclosure requirements as of May 1, 1965. This study will assume

that, on average, OTC companies were subject to the new disclosure requirements as of January 1, 1965; a point of time somewhere in between these two dates. The empirical results, however, do not hinge on using this particular date. The results remain the same whether one uses a somewhat earlier or later starting point.

#### IV. THE DATABASE

The Center for Research in Securities Prices' database (CRSP) does not include information on the OTC market pre-NASDAQ. As a result, it was necessary to construct a database containing the necessary information on OTC companies. The database contains a number of pieces of information on OTC companies from January 1, 1962 to January 1, 1968. This period covers three years prior to the imposition of mandated disclosure on the OTC market (January 1, 1962 to January 1, 1965) and three years after their imposition (January 1, 1965 to January 1, 1968).

The database contains information on companies that were either "primary" or "Eastern" OTC companies as of January 1, 1962. The "primary" and "Eastern" OTC companies, as designated by the *Barron's Statistical Section*, were OTC stocks in which there was relatively active trading and had at least 500 shareholders. In contrast, OTC companies in the "supplemental" section of the *Barron's Statistical Section* were not as actively traded and need not meet the 500 shareholder threshold. Based on data gathered by the REPORT OF SPECIAL STUDY, which counted the number of OTC companies with different shareholder bases (Table IX-C, Part III), approximately 85% of the "primary" and "Eastern" companies met the Exchange Act's 750 shareholder threshold with the other 15% having somewhere between 500 and 750 shareholders.

It is worth emphasizing that the companies on these two lists are actively traded suggesting that even if a company, at a particular point of time, has somewhere between 500 and 750 shareholders, there is the real possibility that at some other point (whether earlier or later) in time the 750 shareholder threshold would be, at least temporarily, crossed. Once that threshold is crossed, a company is subject to the Exchange Act's disclosure requirements regardless of whether the company knows it crossed the line. Once a company has more than 750 shareholders at a particular point in time, that company is subject to the Exchange Act's requirements unless its shareholder base falls below 300 shareholders. As a result, it would be highly unlikely for a company with actively traded securities and more than 500 shareholders not to comply with the Exchange Act's disclosure requirements and thereby risk running afoul of the Exchange Act. It is therefore reasonable to assume that the remaining 15% of OTC companies would, in reality, be placed under the ambit of the Exchange Act's disclosure requirements.

“Supplemental” OTC companies in the *Barron's Statistical Section*, in contrast to the “primary” and “Eastern” companies, were not included in the database given the lack of any shareholder threshold for qualification on this list. In addition, there are concerns about the accuracy and reliability of the supplemental quotations for these inactively traded securities.

The “primary” and “Eastern” OTC insurance companies, investment companies and banks were dropped from the database. OTC insurance companies were excluded given its exemption under section 12(g). Investment companies were excluded given their extensive regulation, including mandated disclosure, under the Investment Company

Act of 1940. Banks were dropped given their unique regulatory regime. In addition, all companies which had six or fewer months of returns were also dropped given the fact that the regression results rapidly lose meaning with six or fewer observations.

There were a total of 762 OTC companies as of January 1, 1962 that were neither insurance companies, investment companies or banks and had more than six return observations. For each one of these 762 companies, the following pieces of information was collected for the time period January 1, 1962 to January 1, 1965 (the pre-mandated disclosure period): (1) monthly quotations; (2) each company's market capitalization as of January 1, 1962; (3) their standard industrial classification (SIC) code to three digits; (4) annual sales; (5) any stock or cash dividends; (6) stock splits; (7) liquidation values for any company that was dissolved; (8) whether (and when) the OTC company became listed on an exchange; (9) identity of any company acquiring (or merging with) an OTC company and whether that company was an OTC or exchange-listed company; (10) quotation, dividend and stock split information on any OTC company that acquired (or merged with) one of the original 762 OTC companies; and (11) bankruptcies.

The same information was collected for all "primary" and "Eastern" OTC companies that existed as of January 1, 1965 for the time period January 1, 1965 to January 1, 1968 (the post-mandated disclosure period). Excluding insurance companies, investment companies, banks and companies with six or less return observations, there were a total of 733 OTC companies as of January 1, 1965. The market capitalization of these OTC companies was measured as of January 1, 1965.

The quotation information throughout this time period (1962-1968) was gathered primarily from *Barron's Statistical Section*. Barron's, in turn, received their quotations

from the National Association of Securities Dealers' Quotation Bureau. On a few occasions, quotations for a particular company for a specific month would not appear in Barron's "primary" or "Eastern" OTC quotation section but a quotation would be provided in its "supplemental" quotation section. In those cases, the database would include this quotation as the quotation for the stock for that month. In addition to this source, quotations were also gathered (and cross-checked) against the *Bank and Quotation Record*, published by the Commercial and Financial Chronicle, the *Standard and Poor's Security Owner's Stock Guide* and the *Wall Street Journal*. There were ten OTC companies in the 1962-65 time period for which there were some missing quotations. There were twenty-one OTC companies in the 1965-68 period for which there were missing quotations.

Dividend (cash and stock) and stock split information was gathered primarily from *Standard and Poor's Annual Dividend Record*. Information regarding name changes, acquisitions/mergers, bankruptcies, liquidations and listing on an exchange came from the *Annual Guide to Stocks: Directory of Obsolete Securities*.

Market capitalization information was available for approximately 90% of the OTC companies and came primarily from the *Standard and Poor's Security Owner's Stock Guide*. Some additional market capitalization data came from *Moody's Handbook of (Widely Held) Common Stocks*. Market capitalization was computed based on outstanding common shares. For a minority of companies outstanding preferred share information was available, but was not used given the small number of companies for which this information was available.

Standard industrial classification (SIC) information and annual sales information was available for 567 OTC companies in the 1962-65 period and 566 companies in the 1965-68 period. This constitutes approximately 75% of the OTC companies. This information was gathered from *Poor's Registry of Directors, Executives and Officers* for the years 1962 to 1968.

Out of the 762 OTC companies as of January 1, 1962, three had market capitalizations of less than \$1 million. For the 733 OTC companies as of January 1, 1965, three companies also had market capitalizations of less than \$1 million. Using market capitalization as a proxy for the value of a firm's assets, these six companies were dropped from the database given the threshold requirement of \$1 million in assets in section 12(g) of the Exchange Act.

The control group consisted of all exchange-listed companies, excluding insurance companies, investment companies, banks, and companies with six or less return observations, that had price quotations as of January 1, 1962 and all exchange-listed companies (again excluding insurance companies, investment companies, banks, and companies with six or less return observations) that existed as of January 1, 1965. The control group consists of 727 exchange-listed companies that had price quotations as of January 1, 1962 and 1,385 exchange-listed companies that existed as of January 1, 1965. Information for these companies was gathered from the CRSP and COMPUSTAT datafiles.

The weighted and equal CRSP market index returns for the 1962-1968 period were also used. The factor returns used in the Fama-French regressions are from Kenneth French's datalibrary. Finally, the risk-free rates of return were provided by



Ibbotson Associates, which has computed this return for every month for the time period studied.

## V. SUMMARY STATISTICS

Table I contains a breakdown of the OTC companies in the pre- and post-mandated disclosure time periods along a couple of basic dimensions:

**Table I**

1962-1965	1965-1968
Number of OTC companies 759	Number of OTC companies 730
OTC companies that list on an exchange 142	OTC companies that list on an exchange 156
OTC companies acquired 49	OTC companies acquired 58
OTC companies acquired by listed companies 36	OTC companies acquired by listed companies 41
Liquidations and Bankruptcies 16	Liquidations and Bankruptcies 13
Average Market Capitalization \$39.9 million	Average Market Capitalization \$32.6 million
Median Market Capitalization \$17.4 million	Median Market Capitalization \$13.7 million
Number of companies with market capitalization less than \$10 million	Number of companies with market capitalization less than \$10 million

231	253
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The number of OTC companies as of January 1, 1962 and January 1, 1965 are quite similar: there were 29 more companies (4% more) in the January 1, 1962 OTC group. There were also similar numbers of acquisitions of OTC companies, liquidations and bankruptcies in the two time periods in percentage terms. Approximately 18.7% of all OTC companies become listed on an exchange between 1962-65 compared to 21.4%, a slightly higher percentage, for all OTC companies between 1965-68.

There is a notable difference in both average and median market capitalizations between the two groups. This is most probably a result of the fact that the OTC market as a whole (as well as the broader market) had very poor returns in the 1962-1965 period.<sup>4</sup> The same basic differences in market capitalizations remain if one just looks at the group of companies that were OTC companies both in January 1, 1962 and January 1, 1965, suggesting that these differences in market capitalizations are not the result of a different mix of OTC firms in the two periods.

The mix of types of OTC firms by industry remained relatively stable between 1962-65 and 1965-68. The most noticeable difference between the two periods was the fall from approximately 14% of all OTC firms in the electrical and appliances industry classification (SIC 36) to approximately 9% in the 1965-68 period. The changes in industrial classifications of OTC firms (to two SIC digits) is summarized in the table below. A SIC code was included in the table only if at least 1% of OTC firms were in

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<sup>4</sup> The average monthly return for the CRSP equally weighted market index in the 1965-68 period was approximately five times that of the average monthly return for the 1962-65 period. The OTC market performed even worse than the CRSP equally weighted market index in the 1962-65 period.

that industry for both time periods. The SIC codes in Table II covered approximately 90% of the OTC companies for which SIC information was available.

**Table II**  
**SIC Distribution**

SIC	1962-1965 Percent	1965-1968 Percent	SIC	1962-1965 Percent	1965-1968 Percent
13	3.32%	3.65%	36	13.99%	9.03%
20	4.20%	4.86%	37	2.97%	2.78%
22	1.57%	1.39%	38	3.32%	3.13%
23	1.05%	2.60%	39	2.27%	2.43%
26	2.45%	2.43%	42	1.75%	1.74%
27	4.02%	3.65%	48	1.22%	1.04%
28	7.17%	5.03%	49	10.31%	10.76%
30	1.22%	2.08%	50	3.15%	3.13%
32	3.15%	2.08%	54	1.75%	1.74%
33	3.50%	3.65%	65	1.22%	2.43%
34	2.80%	3.65%	67	1.75%	2.78%
35	9.09%	7.99%	73	1.40%	2.26%

Differences between the pre-mandated and post-mandated disclosure OTC companies in terms of their industrial classifications and market capitalization will be addressed in the analysis.

## VI. CHANGES IN THE STANDARD DEVIATION OF ABNORMAL RETURNS

This Part will examine the effect of mandated disclosure on the dispersion of abnormal returns. Following Simon (1989), the hypothesis will be that mandated disclosure, if it were to have a beneficial effect, would be to reduce the dispersion of OTC companies' abnormal stock returns. On an intuitive level, the dispersion of abnormal returns can be thought of as representing a failure of the market to anticipate *ex*

*ante* the abnormal return in its pricing of the stock.<sup>5</sup> Accordingly, an increase in allocative efficiency, i.e. higher informational content in stock prices, would be reflected in a tighter distribution of abnormal returns of OTC stocks (controlling for changing market conditions). Fewer “errors” in pricing, resulting from the release of new information unanticipated by the market, are realized *ex post* thereby leading to a tighter distribution.

A shortcoming of the empirical literature on mandated disclosure (Stigler 1964; Benston 1974; Simon 1989) has been its almost complete lack of theory informing its choice of statistical testing.<sup>6</sup> Fortunately, the intuition that the dispersion of abnormal returns should tighten when more firm-specific information becomes available earlier (the presumed effect of mandated disclosure requirements) does enjoy theoretical support in work by West (1988) and LeRoy and Porter (1981). Further theoretical work modeling the effects of disclosure on stock price behavior is, however, needed.

#### A. Fama-French Abnormal Returns

In this Section, abnormal returns will be calculated for each company in the OTC market. This consists of the 759 companies in the 1962-1965 group and the 730 companies in the 1965-1968 group. For each OTC stock, its actual return for a three-year period is compared to the return generated by a portfolio with the same characteristics as

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<sup>5</sup> This is consistent with EMH, as it is perfectly possible that stocks prices are still unbiased (although not perfect) estimates, given the public information set that exists at the time, of a stock’s future returns.

<sup>6</sup> For instance, Simon merely states that “If the lower variance [of abnormal returns] reflects increases in information regarding future issue performance, [my] results support the contention that the information effects of securities regulation should be reflected in the [issue-specific] risk borne by investors . . .” (p.309). Stigler states, “Price dispersion is a manifestation – and, indeed, it is the measure – of ignorance in the market.” (1961). Merritt Fox states, “Presumably everyone . . . accepts the theoretical proposition that any information that is of value to investors for predicting the future with greater accuracy will lead to less share price dispersion.” (1999).

the stock, for the same three-year period. The difference between a stock's actual return and the portfolio return is the stock's abnormal return. If mandated disclosure increased allocative efficiency in the OTC market, there should be a reduction in the standard deviation of the abnormal return distribution post-1965 compared to the pre-1965 period for OTC stocks controlling for changing market conditions.

Changing market conditions over the time period studied, 1962-1968, will be controlled for through the use of a control group. The control group consists of 727 exchange-listed companies for the 1962-65 period and 1,385 exchange-listed companies for the 1965-68 period. Exchange-listed companies were subject, throughout this period, to the Exchange Act's disclosure requirements.

The portfolio that will serve as the benchmark for measuring a stock's abnormal return is a portfolio with the same factor exposure as that of the stock. The three-factor model of Fama and French will be used. (Fama & French 1992; Fama & French 1993). The three factors in this model are market, book-to-market, and size effects. Each factor represents a variable that has explanatory power in accounting for the cross-section of stocks returns. Whether these factors represent sources of undiversifiable risk or market imperfections is an issue of considerable debate (see, e.g., Griffin & Lemmon 2002; Fama & French 1995), one which it is unnecessary to resolve for the purpose of calculating a stock's abnormal return.

The three-factor model of Fama and French is estimated by:

$$R_t = \alpha + \beta_1 * Mkt_t + \beta_2 * HmL_t + \beta_3 * SmB_t + \epsilon_t$$

where  $R_t$  is the gross return to a stock in month  $t$  minus the risk-free rate, and the independent variables --  $Mkt_t$ ,  $HmL_t$ ,  $SmB_t$  -- are the month  $t$  returns to zero-investment factor-mimicking portfolios designed to capture market, book-to-market, and size effects on stock returns. The abnormal return (the deviation of the stock's performance from the three-factor model) is  $\alpha$ .

The gross return for a stock includes any dividends (stock or cash) received and are adjusted to take account of any stock splits that occurred during the time period studied. As noted earlier, comprehensive dividend and stock split information was gathered for the OTC stocks from 1962 to 1968. A number of OTC companies became listed-companies at some point, either through a change in their company's listing or through being acquired by a listed company. These companies' abnormal returns are calculated, and included in calculating the standard deviation of abnormal returns, using the monthly return data for the time they were traded on the OTC market if there are at more than six months worth of return data (i.e. they did not change their listing or were acquired by a listed company between January 1, 1962 and July of 1962 or January 1, 1965 and July of 1965). The regression results rapidly lose meaning when six or fewer observations are available.

The distribution of the abnormal returns were calculated for each stock in the OTC market for 1962-1965 (pre-mandated disclosure) and the distribution of abnormal returns of OTC stocks for 1965-1968 (post-mandated disclosure). The respective standard deviations of abnormal returns – 2.91 and 3.04 – are quite similar. Consistent with this observation, a Goldfeld-Quandt test generates an F statistic indicating that the

hypothesis that the variances of these two groups are identical cannot be rejected even at the 10% level. (Goldfeld & Quandt 1965).

Changing market conditions do not appear to account for the failure of mandated disclosure to reduce the standard deviation of OTC abnormal returns post-mandated disclosure. The difference in the standard deviation of abnormal returns for the control group, the group of exchange-listed companies, pre- and post-mandated disclosure (2.00 and 1.99) are extremely close and statistically insignificant even at very low levels of significance (20%, 30%), based on a Goldfeld-Quandt F statistic test. In any event, the difference-in-difference estimator (.14) is actually slightly *larger* than the increase in the OTC's standard deviation of abnormal returns in the 1965-68 period (.13) indicating that mandated disclosure was not accompanied by a lower standard deviation.

Table III summarizes these results:

**Table III**  
**Standard Deviation of Abnormal Returns**

	1962-1965	1965-68	Difference	F Statistic
OTC Market	2.91	3.04	.13	1.09
Listed Market	2.00	1.99	-.01	1.01
Difference	.91*	1.05*	<b>.14***</b>	1.32

\* significant at the 1% level

\*\*\* significant at the 10% level

no asterisks: no statistical significance at 10%

As one would expect, the results indicate that the OTC market was substantially less allocatively efficient (using the standard deviation of abnormal returns as a proxy for allocative efficiency) throughout the 1962-68 period compared to the listed markets. The

difference in the standard deviation of abnormal returns between the OTC market and the listed market, both pre- and post-mandated disclosure, is significant at the 1% level. In terms of variance of abnormal returns (the square of the standard deviation), the OTC market had, throughout the 1962-68 period, a variance of abnormal returns somewhere between 2 and 3 times that of the listed market.

*Effect of Industry Mix on Abnormal Returns:* Although the mix of OTC companies by industry remains, on the whole, relatively stable between the two time periods, the breakdown by SIC classification is not identical. To include the potential impact of changes in the mix of industries on the change in the standard deviation of abnormal returns in the OTC market, a new independent variable,  $RIND_t$ , representing the abnormal return of SIC industry groups, will now be introduced into the three-factor model. Let  $RIND_t$  equal the return on an equally weighted portfolio of firms in the same two digit SIC code for time  $t$  as the firm whose return constitutes the dependent variable minus the market return. The equally weighted portfolio return was calculated using all the firms in the CRSP monthly returns file with the same two digit SIC code for the desired time period.

For the approximately 75% of OTC companies for which SIC information was available, the following regression was run using  $RIND_t$  as an independent variable:

$$R_t = \alpha + \beta_1 * Mkt_t + \beta_2 * HmL_t + \beta_3 * SmB_t + \beta_4 * RIND_t + \varepsilon_t$$



For the control group, the exchange-listed companies, the independent variable  $RIND_t$  was also included in calculating abnormal returns. The mix of industries among exchange-listed companies also changes over time.

The OTC market and the listed market, once industry effects are controlled for, behave in a very similar manner. The OTC market experiences a .06 increase in its standard deviation of abnormal returns, while the listed market experiences a .07 increase in its standard deviation. The difference-in-difference estimator – -.01 – is statistically insignificant. The results are summarized in Table IV below.

**Table IV**  
**Standard Deviation of Abnormal Returns with RIND**

	1962-1965	1965-68	Difference	F Statistic
OTC Market	2.81	2.87	.06	1.04
Listed Market	1.89	1.96	.07	1.08
Difference	.92*	.91*	<b>-.01</b>	1.02

\* significant at the 1% level  
no asterisks: no statistical significance at 10%

*Effect of Market Capitalization on Abnormal Returns:* It is possible that even though mandated disclosure had no measurable effect on the OTC market as a whole, it did have a beneficial impact on the pricing accuracy of the smallest companies, i.e. those companies for which there might have been very limited private market sources of information. Accordingly, the OTC market was subdivided into those companies with market capitalizations of less than \$10 million (OTC Small-Cap). Only companies with

\$10 million in assets, during this time period, were eligible for listing on the New York Stock Exchange.

There were 231 OTC Small-Cap in the 1962-65 period and 253 OTC Small Cap companies for the 1965-68 period. Of these Small-Cap companies, there were 182 with SIC information available in the 1962-65 period and 206 with SIC information available in the 1965-68 period. The standard deviations are calculated using just the three factor Fama-French model as well as the standard deviation once the independent variable RIND is added.

The results are similar to those obtained earlier when the entire OTC group was used. Without controlling for industry effects, the OTC Small-Cap group, relative to the listed market, actually had a higher standard deviation of abnormal returns (.26) in the post-mandated disclosure period. Once industry effects are controlled for, through the introduction of the RIND independent variable, the OTC Small-Cap group experience a statistically insignificant change in its standard deviation of abnormal returns (-.02) in the post-mandated disclosure period. The results are summarized in Table V below.

**Table V**  
**Standard Deviation of Small Cap's Abnormal Return**

	1962-65	1965-68	Difference	F Statistic
OTC Small Cap without RIND	2.87	3.12	.25**	1.18
OTC Small Cap with RIND	2.93	2.98	.05	1.03
Listed Market without RIND	2.00	1.99	-.01	1.01
Listed Market with RIND	1.89	1.96	.07	1.08
Difference Small – Listed without RIND	.87	1.13	<b>.26*</b>	1.69
Difference Small – Listed with RIND	1.04	1.02	<b>-.02</b>	1.04

\* significant at the 1% level

\*\* significant at the 5% level

no asterisks: no statistical significance at 10%

*Monthly Abnormal Returns:* The abnormal returns, so far, have only been calculated based on a three-year time period, 1962-65 or 1965-68. The abnormal return of each stock in every month, not just for an entire three-year period, from January 1, 1962 to January 1, 1968 will now be calculated based on a two-step procedure. First, estimates of the coefficients on the three Fama-French independent risk factors – Mkt, HmL and SmB – will be calculated for each stock based on either the 1962-65 return data or the 1965-68 return data. Second, these estimates will then be used to calculate an abnormal return for each stock for each month using the estimated coefficients based on the 1962-65 return data for months in this time period and the estimated coefficients based on the 1965-68 return data for months in that period. For instance, the abnormal return for a stock in month  $t$  would be

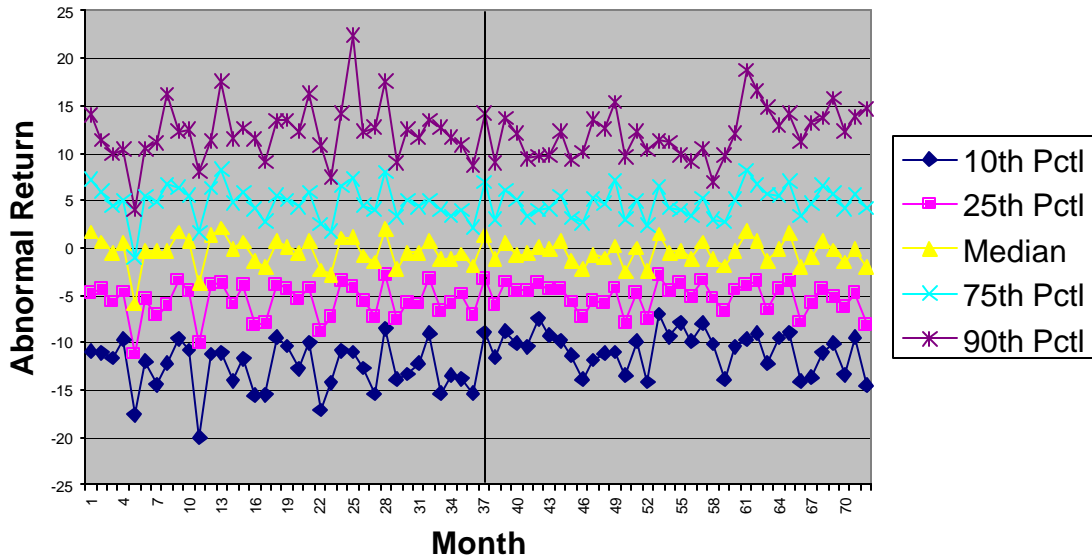
$$\text{Abnormal Return}_t = R_t - \beta_1 * \text{Mkt}_t - \beta_2 * \text{HmL}_t - \beta_3 * \text{SmB}$$

where  $R_t$  is the return for that stock in month  $t$  minus the risk-free rate and  $\beta_1, \beta_2, \beta_3$  are the estimated coefficients based on that stock's return data for either 1962-65 or 1965-68 depending on which time period month  $t$  is in.

For each month, the abnormal returns were divided into one of four groups based on their relative size: the bottom 10% of abnormal returns; the bottom 25% of abnormal returns; the top 25% of abnormal returns and the top 10% of abnormal returns. The average abnormal return for each of these groups was calculated for each month. In addition, the median abnormal return for the group overall was calculated.

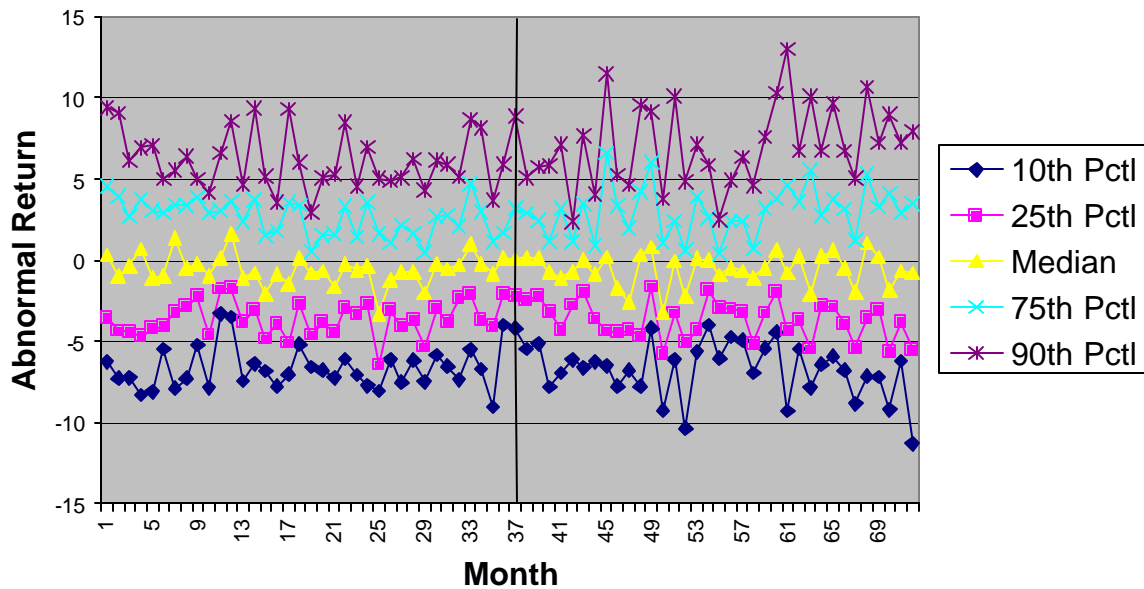
The average abnormal returns for these four groups and the median abnormal return for the 1962-68 period is summarized below. The black line represents the beginning of the mandated disclosure period.

**Graph II: OTC Market Monthly Abnormal Return**



The median abnormal return over time stays relatively close to 0 as expected. There is no noticeable difference in the behavior of the abnormal returns in the different percentile groups post-mandated disclosure. It is useful at this point to compare the OTC market monthly abnormal return chart to what was happening in the listed market at the same time based on the same breakdown into percentile groups. This is summarized in the graph below:

**Graph III: Listed Market Monthly Abnormal Return**



As with the OTC market there is no noticeable change in the behavior of the percentile groups pre- and post-mandated disclosure. The average monthly returns of the different percentile groups in the two graphs confirm the earlier finding that the variance of the OTC market throughout the 1962-1968 period was greater than that of the listed market. The abnormal returns of the four percentile groups stays almost entirely within a -10 to +10 abnormal band, while the abnormal returns of the same percentile groups in the OTC market stay largely (although not entirely) within a -15 to +15 abnormal band.

While there are clear differences between the listed market and the OTC market there does not appear to be any changes pre- and post-mandated disclosure. This observation is largely confirmed through testing whether the median abnormal return of a percentile group for the 1962-65 period is statistically different from the median abnormal return for the same percentile group for the 1965-68 period (non-parametric

testing requires that the median rather than average abnormal returns are used). A large-sample Wilcoxon rank sum test was run to see whether there were any differences in the medians between time periods within the same percentile group.

The average monthly return for each percentile group for both the listed and OTC market in both time periods, as well as whether there was a statistically significant difference in the medians pre- and post- mandated disclosure is summarized in Table V.

**Table VI**  
**Abnormal Monthly Return Averages for Percentile Groupings**

	10th Pctl	25th Pctl	75th Pctl	90th Pctl
OTC Market 1962-65	-12.70	-5.69	4.74	12.15
OTC Market 1965-68	-10.69	-5.08	4.80	12.09
Z statistic for difference	<b>-3.25*</b>	<b>-1.14</b>	<b>.15</b>	<b>-.05</b>
Listed Market 1962-65	-6.67	-3.63	2.6	6.12
Listed Market 1965-68	-6.69	-3.66	2.99	7.07
Z statistic for difference	<b>-.68</b>	<b>.10</b>	<b>-.86</b>	<b>-1.71</b>

\* significant at the 1% level  
no asterisks: no statistical significance at 10%

The results of these tests indicate that there was no statistically significant difference, even at the 10% level, in the median abnormal return for three of the four OTC percentile groups pre- and post-mandated disclosure. The OTC percentile grouping that captured

outliers in terms of their abnormal returns (10th percentile) was different (with a Z statistic of  $-3.25$ ). Overall, the testing provides further support for the earlier finding that the distribution of abnormal returns in the OTC market did not change in response to mandated disclosure.

### *B. Net-of-Market Returns*

As a robustness check on the Fama-French estimate of abnormal return, an alternative specification was used in estimating abnormal returns. Stephen Brown and Jerold Warner (1980) have shown that net-of-market returns often accurately capture abnormal returns. Accordingly, for each stock, its gross returns minus the overall market return was estimated. Two different measures of market return were used: the CRSP value-weighted market return (a broad market index in which returns are weighted by market capitalization) and the CRSP equally weighted market return (a broad market index in which returns are equally weighted, regardless of market capitalization). The results are the same as those generated by the Fama-French regressions.

## **VII. CHANGES IN STOCK PRICE SYNCHRONICITY**

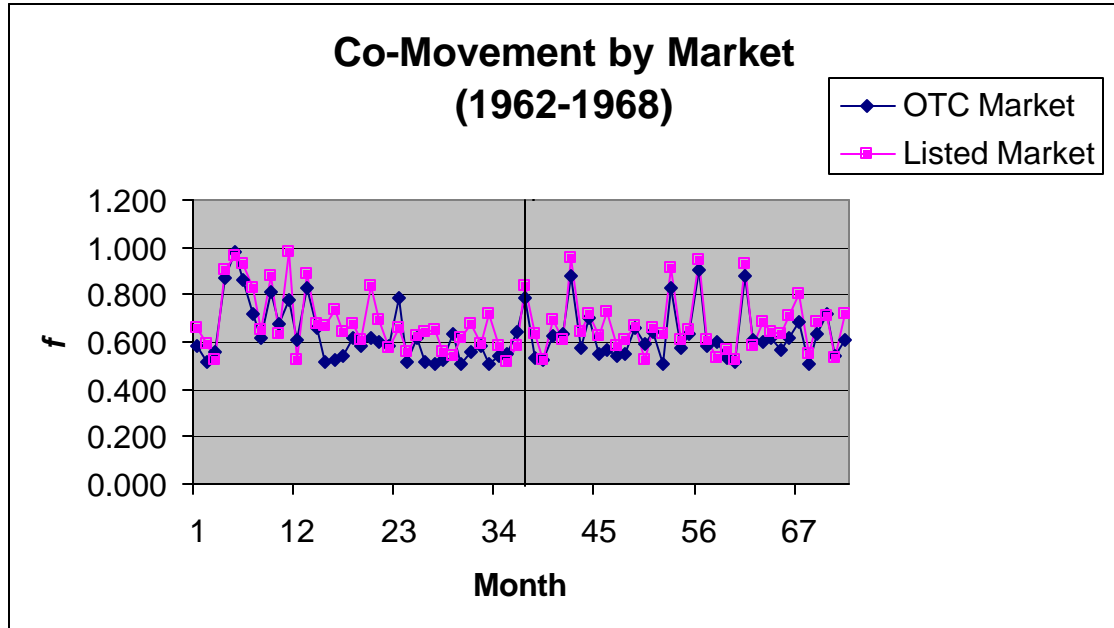
Research by Morck et al (2000) indicates that the informational content of security prices can be estimated by measuring stock price synchronicity. If mandated disclosure improved the informational content of OTC stock prices, then the stock price synchronicity of the OTC market should fall. This Part will apply the two stock price synchronicity measures employed by Morck et al (2000).



### *A. Co-Movement of Stocks*

The first straightforward measure of stock price synchronicity is based on the co-movement of stocks. (Morck et al 2000). The stock price synchronicity of a market for any given month, based on the co-movement of stocks, is the number of stocks that move up (if that number is greater than the number that move down) or the number of stocks that move down (if that number is greater than the number that move up) divided by the total number of stocks that move either up or down that month. Accordingly, the co-movement measure of stock price synchronicity, call it  $f$ , will lie somewhere between .5 and 1.

The  $f$  for both the listed market and the OTC market were estimated for each month. Stocks whose prices have not changed have been dropped from the calculation of  $f$  to avoid bias due to non-trading. The results are summarized below. The black line once again represents the first month of 1965, the beginning of the mandated disclosure period.



The averages for the OTC and listed markets are:

**Average Co-Movement**

	Listed Market	OTC Market
1962-65 period	.68	.63
1965-68 period	.67	.63

As is clear from the averages, there is no change in stock price synchronicity in the OTC market throughout this period. This is consistent with the earlier results concerning the standard deviation of abnormal returns which indicated that the listed market experienced no change in its dispersion of abnormal returns between the 1962-65 period and the 1965-68 period. In the listed market there was a slight decrease in the co-movement of stocks. There is thus no basis for concluding that there was a drop in the

stock price synchronicity exhibited by the OTC market whether one uses the listed market as a control group or not.

If one confines one's attention to the period immediately surrounding the imposition of mandated disclosure, the changes in the OTC market's co-movement mirrors that experienced by the listed market. One can see this graphically in the Co-Movement by Market graph.

### *B. $R^2$*

The  $R^2$  measure of stock price synchronicity was originally explored by Roll (1988). It measures stock price synchronicity by the extent to which the returns of a stock can be accounted for (explained) by a market index's returns during the same period of time. Recent empirical research has indicated that  $R^2$  is economically meaningful. Firms with high  $R^2$  stocks invest capital less efficiently than their low  $R^2$  firm counterparts. (Wurgler 2000). On a related note,  $R^2$  is also inversely related to a stock's informational content. High  $R^2$  stocks impound less information about the company's future earnings than low  $R^2$  stocks. (Durnev et al 2001b). Finally, as the U.S. stockmarket has developed over the last forty years, there has been a decline in the average  $R^2$  of U.S. stocks (Campbell, Lettau, Malkiel and Xu 2001).

The  $R^2$  measure of stock synchronicity is based on the following market model regression:

$$R_t = \alpha + \beta_1 * Mkt_t + \varepsilon_t$$

where  $R_t$  is the monthly return of a stock minus the risk-free rate and  $Mkt_t$  is the market return minus the risk-free rate. The stock price synchronicity measure is simply the average (adjusted)  $R^2$  across all OTC stocks for a given period of time. Following Morck (2000), a weighted market index will be used, i.e. the CRSP weighted market index.

The average (adjusted)  $R^2$  results are summarized below. The standard errors of the adjusted  $R^2$  are in parenthesis.

	1962-65	1965-68	Difference
OTC Market	.20 (.006)	.15 (.005)	.05 (.008)
Listed Market	.29 (.022)	.26 (.023)	.03 (.032)

The difference-in-difference estimator of .02 has a standard error of .033 and is therefore statistically insignificant from 0 even at the 10% level.

### VIII. CHANGES IN ABOVE-AVERAGE AND BELOW-AVERAGE RETURNS

Another test that has been used in determining whether the allocative efficiency of a market has improved focuses on whether the tails of the distribution of returns fatten and lengthen while the middle of the distribution loses mass in the period immediately after the imposition of mandated disclosure. (Durnev 2001a). If this happens this is an indication that mandated disclosure is having a beneficial effect because firms that were once concealing detrimental information have been forced to disclose thereby increase the number of poorly performing stocks (fattening and lengthening the left-hand tail of the distribution). Likewise, firms that are forced to disclose positive information would increase the number of above-average performing stocks (fattening and lengthening the

right-hand tail of the distribution). In other words, increased variance of abnormal returns, in contrast to the normal assumption that increased variance is undesirable, is a sign that mandated disclosure is improving allocative efficiency given that the increase is due to new information reaching the market.

The abnormal returns for the OTC market will be used to test whether there has been a change in the performance of below-average stocks and above-average stocks. The bottom 10% of stocks and the top 10% of stocks, in terms of their abnormal performance, were calculated for the first year after mandated disclosure (1965). The average abnormal return for the bottom 10% was -10.36 while the average abnormal return for the top 10% was 11.28 for 1965. When these numbers are compared to the averages for the entire 1965-68 period, they are actually a bit lower, rather than higher. The average for the bottom 10% and top 10% of OTC stocks in the 1965-68 period was respectively, as Table IV shows, -10.69 and 12.09. They are also lower compared to the averages for the bottom and top 10% in the 1962-65 period (-12.70 and 12.15).

## **IX. CHANGES IN AVERAGE STOCK RETURNS**

Putting aside concerns whether stock returns are useful proxies for allocative efficiency, the change in OTC stock returns pre- and post-mandated disclosure was measured. To test for changes in average returns, abnormal returns were used in order to control for changing market conditions (in this context, changes in the risk premium associated with different factor exposures). The average median monthly abnormal

return for OTC stocks as a group was calculated pre- and post- mandated disclosure.<sup>7</sup> The average median monthly abnormal return for OTC stocks, using the three-factor Fama-French model, was negative 42 basis points per month in the 1962-65 period. This is consistent with the finding in the literature that Fama-French abnormal returns tend to be negative when the stocks are of smaller companies. As noted earlier, many of the OTC companies have very small market capitalizations.

In contrast, the average median monthly abnormal return for OTC stocks in the 1965-68 period was negative 48 basis points, a return that was actually a bit worse than that in the 1962-65 period. However, a large-sample Wilcoxon rank sum test indicates that the difference in the two median abnormal returns in the two periods are statistically insignificant even at the 10% level (the Z test statistic is .57). Accordingly, even if stock returns (after controlling for changing market conditions) are a good proxy for allocative efficiency, mandated disclosure had no effect.

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<sup>7</sup> In other words, for each month, the median abnormal return was calculated and then the average of these monthly median abnormal returns was taken.

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