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Author(s): H. Nejat Seyhun

Source: *The Journal of Law & Economics*, Vol. 35, No. 1 (Apr., 1992), pp. 149-182
Published by: The University of Chicago Press for The Booth School of Business, University of Chicago and The University of Chicago Law School
Stable URL: http://www.jstor.org/stable/725558
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THE EFFECTIVENESS OF THE INSIDER-TRADING SANCTIONS*

H. NEJAT SEYHUN
University of Michigan

I. Introduction

THIS study empirically examines the effects of increases in the level and enforcement of insider-trading regulations in the 1980s on corporate insiders.[1] The main goal of the insider-trading regulations is to prevent insiders from trading on the basis of material, nonpublic corporate information. In addition, regulations require that insiders report their transactions to the Securities and Exchange Commission (SEC) and refrain from generating short-term profits by trading in their own firms' stocks. Regulations also prohibit insiders from short selling the securities of their firms.

A stated rationale for enacting the insider-trading provisions of the Securities and Exchange Act of 1934 is that insider trading erodes public confidence in capital markets, raises firms' cost of capital, and makes it more difficult to finance worthwhile projects. The regulations are also designed to prevent insiders from manipulating confidential corporate information. Hence, federal regulations help prevent insiders from ex-

* I would like to thank Kaushik Amin, Michael Bradley, Harry DeAngelo, Tom George, David Mayers, Randall Morck, Jay Ritter, Joel Seligman, George Siedel, participants at the Law and Economics seminar at the University of Michigan and an anonymous referee for comments, and Robert Comment for providing the corporate takeover data set. Kathy Hulik and Rebecca Bradley provided research assistance.

[1] Section 16(a) of the Securities and Exchange Act of 1934 defines officers, directors, and holders of more than 10 percent of any equity class of securities as insiders and requires the reporting of insiders' transactions to the Securities and Exchange Commission (SEC). Section 16(b) allows short-swing profits to be recoverable by the corporation. Section 16(c) prohibits short sales. Section 10(b) and 17(a) consider insider transactions based on material, nonpublic information as fraudulent and unlawful. Section 32 provides for a ten-year imprisonment for violation of securities laws. Richard W. Jennings & Harold Marsh, Jr., The Securities Regulation: Cases and Materials (1982), and Louis Loss, Fundamentals of Securities Regulation (1983), provide in-depth descriptions of the insider-trading regulations.

[*Journal of Law & Economics*, vol. XXXV (April 1992)]
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ploiting the public at large and promote fairness for all market participants.[2]

An alternative view holds that profitable trading by insiders is an efficient contractual arrangement to compensate insiders for their innovations without costly renegotiations.[3] In competitive managerial markets, potential managers will incorporate the additional benefits of insider trading into their wage contracts, thereby bidding their wages lower. Hence, shareholders will ultimately receive direct as well as indirect benefits of insider trading. Moreover, inside trading leads to more accurate stock prices, reduces search costs for others, and leads to better investment and consumption decisions.

While the desirability and cost effectiveness of insider-trading regulations are subject to debate and empirical verification, the SEC has targeted insider trading as a threat to key national interests. During the 1980s, the SEC increased its enforcement effort against insiders by more than sixfold. Moreover, the SEC's efforts resulted in sweeping securities legislations that increase criminal fines from $10,000 to $1 million and jail sentences from five years to ten years. The new laws also enable recovery of treble damages, create a bounty program for informants, hold top management legally responsible for insider trading by any of the firm's employees, and create a right of action for traders who lose to insiders.

This study examines the effects of the increased level and enforcement of sanctions during the 1980s on corporate insider-trading activity. Effective constraints on insider trading can come from (i) statutes, (ii) courts, or (iii) shareholders. This analysis is also expected to shed some light on the desirability of the recently enacted insider-trading regulations.

The evidence analyzed here indicates that increased statutory sanctions in the 1980s did not produce an additional deterrent effect either on the profitability or volume of insider trading. In fact, the volume of insider trading has increased by a factor of four, while the profitability increased by a factor of two in the period after 1984 as compared to the period before 1980. Large block transactions, which are more likely to attract

[2] See Roy A. Schotland, Unsafe at Any Price, A Reply to Manne, 53 Va. L. Rev. 1425 (1967); Victor Brudney, Insiders, Outsiders, and Informational Advantages under the Federal Securities Laws, 93 Harv. L. Rev. 322 (1979); and Joel Seligman, The Reformulation of Federal Securities Law Concerning Nonpublic Information, 73 Geo. L. J. 1083 (1985).

[3] See Henry Manne, Insider Trading and the Stock Market (1966); Dennis W. Carlton & Daniel R. Fischel, The Regulation of Insider Trading, 35 Stan. L. Rev. 857 (1983); David D. Haddock & Jonathan R. Macey, A Coasian Model of Insider Trading, 80 Nw. U. L. Rev. 1479 (1986); and William Carney, Signalling and Causation in Insider Trading, 36 Cath. U. L. Rev. 863 (1987).

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regulatory attention, are also three times as likely and twice as profitable as before. Finally, block transactions by top executives who are highly visible doubled both in frequency and profitability after the changes in regulations.

In contrast to the statutory changes, case law in the 1980s had an important effect on insider trading. Case law in effect defined illegal trading as trading immediately prior to takeovers and earnings announcements and other important corporate announcements. Evidence shows that insiders were less likely to trade immediately before earnings announcements and corporate takeovers in the 1980s. Taken together, evidence is consistent with the interpretation that greater involvement by the courts has given insiders greater latitude to trade on the basis of increasingly more valuable privileged information not covered by case law.

Neither the shareholders nor the new statutes enacted during the 1980s seemed to provide effective additional constraints on insider trading. This evidence suggests that everyday insider trading does not fall under the definition of legally material information. Since insiders do trade on economically material information, evidence indicates that legal materiality is highly stringent.

This study also examines shareholders' attitudes toward insider trading, given the current legal environment.[4] If insider trading were entirely detrimental to their interests, shareholders would have provided additional restrictions on insider trading not covered by case law. To date, shareholders have not generally restricted insider trading in corporate charters or employment contracts. A random sample of thirty-seven companies' code of ethics documents (as of November 1990) reveals only about 25 percent that explicitly caution against insider trading. Moreover, shareholders have not restricted the corporation itself from buying and selling shares on the basis of privileged information even though insider trading by the corporation is similar to trading by any other informed trader.[5] Overall, the data suggest that shareholders do not desire additional restrictions on insider trading.

The remainder of this article is organized as follows. Section II provides a brief historical perspective on regulatory changes. Section III

[4] The data available in this study cannot address whether the provisions of the 1934 Act—such as prohibitions against short sales or short-swing profits—are effective since this requires insider-trading data before 1934.

[5] See, for instance, Michael J. Barclay & Clifford W. Smith, Corporate Payout Policy: Cash Dividends versus Open-Market Repurchases, 22 J. Fin. Econ. 61 (1988). Barclay and Smith report that well-timed corporate share repurchases raise the bid-ask spread in the security and thereby reduce liquidity.

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examines the potential effects of regulatory changes on insider trading. Section IV presents insider-trading data and sample characteristics, followed by empirical evidence in Section V. Section VI concludes. Appendix A presents a simple formal model of insider trading and regulations, and Appendix B provides details of the event-study methodology.

II. Recent Changes in Regulations

While the regulations do not prohibit all insider trading per se, Sections 10(b) and 17(a) of the Securities and Exchange Act of 1934 (hereinafter the 1934 Act) do prohibit trading based on material, nonpublic information. Section 16(b) requires the returning of short-swing profits to the corporation, and Section 16(c) prohibits short sales.[6]

Starting with the *Cady, Roberts* decision in November 1961, insider-trading regulations have gradually become more restrictive.[7] In April 1965, executives of Texas Gulf Sulphur were indicted on insider trading after they bought 9,100 shares prior to public announcement of a mineral ore discovery by the company.[8] In 1975, Section 32 of the 1934 Act was amended to increase maximum criminal fines to $10,000 and maximum prison sentences to five years. Nevertheless, prosecuting insider-trading cases was not high on the SEC's list of priorities in the 1960s and 1970s. Between 1966 and 1980, the SEC brought only thirty-seven insider-trading cases, averaging 2.6 cases per year.[9] Moreover, twenty-five of the thirty-seven cases were settled out of court, and the SEC sought or obtained a disgorgement of profits in only twelve cases.

Greater awareness and enforcement of insider-trading regulations characterize the decade of the 1980s. The *Chiarella* decision in April 1980 narrowed the definition of an insider to corporate insiders, requiring a fiduciary responsibility.[10] David Haddock and Jonathan Macey argue that

[6] Rule 10(b)-5 states, "It shall be unlawful for any person . . . to employ any device, scheme, or artifice to defraud, to make any untrue statement of a material fact or to omit to state a material fact . . . in connection with the purchase or sale of any security" (Loss, *supra* note 1, at 807). Short-swing profit is defined as a purchase and a sale (or a sale and a purchase) within six months of each other.

[7] In the matter of Cady, Roberts & Co., 40 SEC 907 (1961).

[8] SEC v. Texas Gulf Sulphur Co., 401 F.2d 833 (1968), cert. denied, 394 U.S. 976 (1969).

[9] Michael P. Dooley, Enforcement of Insider Trading Restrictions, 66 Va. L. Rev. 1 (1980).

[10] Chiarella v. United States, 588 F.2d 1358 (2d Cir. 1978), rev'd 100 S. Ct. 1108 (1980). Vincent Chiarella was a printer who figured out the names of the target and bidder firms prior to public announcement and bought the stocks of the target firms. The Supreme Court found that Chiarella was not guilty of insider trading since he owed no fiduciary responsibility to either the target or bidder firms.

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the *Chiarella* decision caused market professionals (underwriters, brokers, market markers, members of the organized exchanges, and so on) to join forces with the SEC in opposing corporate insider trading.[11] In 1981, the new SEC chairman, John Shad, announced that he was going to "come down on insider trading with hobnail boots,"[12] which was followed by a sharp increase in the enforcement of insider-trading regulations. Haddock and Macey also report that from "January 22, 1982, to August 29, 1986, the SEC initiated 79 10(b)-5 cases, an average of 17.2 per year, which represents a more than sixfold increase in the rate of enforcement."[13] Moreover, the percentage of cases brought against the corporate insiders alone went from 49 percent to 80 percent.

In 1980, the SEC further expanded the reach of insider-trading regulations by promulgating Rule 14(e)-3. Rule 14(e)-3 makes it illegal for anyone to trade the securities of firms involved in a tender offer while in possession of material, confidential information. No fiduciary duty or intent to defraud is required.[14]

The SEC deemed the increased enforcement as insufficient deterrence and asked the Congress for increased penalties, culminating in the Insider Trading Sanctions Act of 1984 (ITSA). Signed into law on August 10, 1984, ITSA provides for up to three times the insiders' illegal profits in civil penalties and a tenfold increase in criminal penalties (from $10,000 to $100,000).[15] Increased sanctions also give the SEC greater leverage to

[11] David D. Haddock & Jonathan R. Macey, Regulation on Demand: A Private Interest Model with an Application to Insider Trading Regulation, 30 J. Law & Econ. 311 (1987).

[12] Lisa K. Meulbroek, An Empirical Analysis of Insider Trading and the Stock Market (unpublished manuscript, Securities and Exchange Commission, 1990).

[13] Haddock & Macey, *supra* note 11, at 333.

[14] Rule 14 (e)-3 defines as "a fraudulent, deceptive, or manipulative act" the purchase or sale of a security by one "who is in possession of material information relating to a tender offer which information he knows or has reason to has been acquired directly or indirectly" from the issuer, an officer, or any person acting on the issuer's behalf. 17 C.F.R. 240.1e-3(a). In May 1990, ten years after the rule was adopted, the court of appeals agreed with the defendant, appellant Chestman, that the SEC exceeded its rule-making authority and reaffirmed the fiduciary duty and intent to defraud requirement. U.S. v. Chestman, 903 F.2d 75 (2d Cir. 1990).

[15] Pub. L. No. 98-376, 98 Stat. 1264 (1984). "The legislation amends section 21(d) of the Securities and Exchange Act of 1934 (Exchange Act) to give the Securities and Exchange Commission (Commission) authority to seek from a court a civil money penalty up to three times the amount of profit gained or loss avoided by a person who violates, or aids and abets a violation of, the federal securities laws by purchasing or selling a security while in possession of material nonpublic information. The legislation also amends section 32 of the Exchange Act to increase the maximum fine for a criminal violation from $10,000 to $100,000." For analyses on the effects of ITSA, see Donald C. Langevoort, Insider Trading Sanctions Act of 1984 and Its Effect on Existing Law, 37 Vand. L. Rev. 1273 (1984); Sam Scott Miller, The Insider Trading Sanctions Act, 17 Rev. Securities Reg. 821 (1984); Steven

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negotiate more costly out-of-court settlements with alleged violators of insider-trading laws. Moreover, insider-trading convictions have led to jail sentences as a rule of thumb since 1985, while jail sentences were nonexistent before 1980.[16]

Still unsatisfied, the SEC asked the Congress for additional deterrence, resulting in the Insider Trading and Securities Fraud Enforcement Act (ITSFEA) on November 19, 1988.[17] This act created a bounty program for insider-trading informants, providing up to 10 percent of insider-trading profits to the informants at the SEC's discretion. It also created the concept of "controlling person," thereby holding top management responsible for failure to comply with insider-trading regulation by any employee of the firm. Moreover, ITSFEA enabled contemporaneous traders who lose to insiders a right of action to recover their losses. Finally, ITSFEA increased the maximum jail sentence to ten years and maximum criminal penalties to $1 million from $100,000.

III. Effects of Insider-trading Regulations

Appendix A presents a simple model of insider trading, where the probability of detection depends on the number of shares insiders trade and the rewards to outsiders for uncovering insider trading. Three testable implications for the relations between insider-trading volume, insider-trading profitability, and sanctions are derived. First, insiders should be able to predict subsequent price movements and earn abnormal profits from trading in their own firms. The magnitude of the insiders' abnormal profits measures the importance of the information. Moreover, an increase in insiders' private information is expected to lead to an increase in insider trading. Hence, a positive relation between number of shares traded and subsequent price movements strengthens the inference that insiders are trading on the basis of economically material, nonpublic information.

Second, an increase in sanctions (treble damages provisions, criminal fines, jail sentences) is expected to lead to a reduction in insider trading by reducing its net expected benefits. An increase in sanctions, such as

M. Bainbridge, A Critique of Insider Trading Sanction Act of 1984, 71 Va. L. Rev. 455 (1985); and Michael J. Metzger, Treble Damages, Deterrence, and Their Relation to Substantive Law: Ramifications of the Insider Trading Sanctions Act of 1984, 20 Val. U. L. Rev. 575 (1986), for discussions of the potential effects of ITSA. These authors argue that more strict penalties may be partially offset by less strict application of the law.

[16] Stuart Taylor, Jr., Stiffer Penalties, N.Y. Times, May 9, 1985, at D4.

[17] Pub. L. No. 100-704, 102 Stat. 4677 (1988). See U.S. House of Representatives, Report 100-910, 134 Cong. Rec. (1988).

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the bounty program for outsiders who uncover insider trading, is expected to increase the probability of detection. Since rational insiders will consider the net expected benefits, insider trading is unambiguously reduced.

Finally, an increase in sanctions is expected to reduce the positive relation between insiders' information and the volume of insider trading. Once again, a bounty program will subject the more profitable insider trading to greater scrutiny. Also, lawyers' fees are usually a percentage of insiders' illegal profits, again providing greater incentives to scrutinize more profitable insider trading. Consequently, expected benefits from engaging in large-scale insider trading should be reduced to a greater extent after the changes in regulations.

This study examines the effects of changes in insider-trading regulations by analyzing changes in (i) overall volume and profitability of insider trading, (ii) trading activity of top executives, and (iii) block trading by all insiders. In addition, insider-trading activity is examined around the time of the *Chiarella* decision and when ITSA and ITSFEA became law to determine if changes in regulations produce a temporary effect.

While Congress has been reluctant to explicitly define illegal insider trading, case law has, in effect, defined the insider trading that will result in penalties.[18] Michael Dooley reports that 80 percent of all insider-trading cases brought by the SEC are associated with trading immediately before corporate takeovers or earnings announcements.[19] Consequently, illegal insider trading has come to be associated mostly with trading before takeovers and earnings announcements. To gauge the effects of case law, this study also examines changes in insider trading (i) prior to earnings announcements and (ii) prior to corporate takeover announcements.

The overall sample period from January 1975 to December 1989 is separated into three subperiods. The pre-*Chiarella* period from January 1975 to March 1980 (sixty-three months) is characterized by a relatively lower level of enforcement. This forms the benchmark period. The post-*Chiarella*, pre-ITSA period from April 1980 to August 1984 (fifty-three months) is characterized by increased enforcement by the SEC. Finally, the post-ITSA period from September 1984 to December 1989 (sixty-four months) is characterized by both increased enforcement and increased sanctions. The effects of the changes in insider trading regulations are investigated by analyzing insider-trading activity in these three subperiods.

[18] See, for instance, Cong. Rec. H7758 (July 25, 1984).

[19] Dooley, *supra* note 9.

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IV. Data and Sample Characteristics

The data used in this study come from the National Archives. The data include all insider transactions in publicly held firms between January 1975 and December 1989. This study only examines insiders' open-market sales and purchases since open-market sales and purchases are more likely to be due to special information.[20] All duplicate transactions involving amended transactions and inconsistent transactions have been eliminated. The data set includes the firm's CUSIP number (an eight-character identifier code assigned by Standard and Poor's), the insider's relationship to the firm, the number of shares transacted, the nature of the transaction, the stock price, the date of the transaction, the date the transaction is reported to the SEC, and the publication date of the transaction.

The insider-trading data set contains open-market sales and purchases in 19,571 firms. For the event-study tests, the firm must also be listed on the daily or the monthly tapes for the New York (NYSE) and American (ASE) stock exchanges or on the tapes for the over-the-counter firms (National Association of Security Dealers Automated Quotation system; NASDAQ) by the Center for Research in Security Prices (CRSP) of the University of Chicago. This criterion is met by 8,856 firms.

The net number of shares traded by insiders in firm i and month t, $NS_{i,t}$, is computed as follows,

$$\mathrm{NS}_{i,t} = \sum_{j=1}^{N_{i,t}} H_j T_j, \tag{1}$$

where $N_{i,t}$ is the number of open-market sales or purchases by insiders in firm i and month t, $H_j = 1$ if transaction j is a purchase, $H_j = -1$ if transaction j is a sale, and T_j is the number of shares traded in transaction j. The month t in firm i is considered a purchase month if $\mathrm{NS}_{i,t}$ is positive or a sale month if $\mathrm{NS}_{i,t}$ is negative. Months when there is no insider trading or when number of shares purchased equal number of shares sold are excluded. The total net number of shares traded by insiders in month t, TNS_t, is computed by summing the absolute values of $\mathrm{NS}_{i,t}$ across the

[20] This assertion is empirically tested. Indeed, abnormal stock price movements following insiders' private transactions are smaller. For other insider transactions such as exercises of options, redemptions, and so on, abnormal stock price movements are insignificant and at times have the wrong sign.

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19,571 firms:

$$\mathrm{TNS}_t = \sum_{i=1}^{19,571} |\mathrm{NS}_{i,t}|, \tag{2}$$

where t equals January 1975–December 1989.

Another measure of insider-trading activity is computed analogously: net number of transactions is computed by setting T_j equal to 1 in equation (1) and summing using equation (2). For brevity, the two measures of insider-trading activity are simply referred to as the number of shares traded (TNS) and the number of transactions (TNT).

Table 1 shows the sample characteristics of the insider-trading data analyzed in this study, covering the period from January 1975 to December 1989. The sample contains a total of 19,571 firms. Panel A shows that there is a total of 844,399 transactions (TNT) by insiders involving 9.3 billion shares (TNS). Panel B restricts the sample to those firms that have sufficient stock return data to compute abnormal returns. This sample contains 8,856 firms. The total number of firm months equals 194,932.

Table 1 does not seem to support the proposition that increased sanc-

TABLE 1

DISTRIBUTION OF TOTAL INSIDER TRADING, JANUARY 1975–DECEMBER 1989

	Period 1	Period 2	Period 3	Overall Sample
A. Overall sample of 19,571 firms:				
No. of purchases	170,549	125,668	130,587	426,804
	(2,707)	(2,371)	(2,040)	
No. of sales	129,602	142,888	145,105	417,595
	(2,057)	(2,696)	(2,267)	
Total no. of transactions	300,151	268,556	275,692	844,399
	(4,764)	(5,067)	(4,308)	
No. of shares purchased (millions)	711.1	1,179.9	1,833.9	3,724.9
	(11.5)	(22.3)	(28.9)	
No. of shares sold (millions)	686.2	1,418.3	3,506.8	5,611.3
	(10.9)	(26.8)	(54.8)	
Total no. of shares traded (milions)	1,397.3	2,598.2	5,340.7	9,336.2
	(22.2)	(49.0)	(83.4)	
B. Sample of 8,856 firms with sufficient return data, no. of firm months	65,015	58,458	71,459	194,932
	(1,032)	(1,103)	(1,117)	

NOTE.—Monthly trading activity is shown in parentheses. Period 1 is pre-*Chiarella*, January 1975–March 1980; period 2 is post-*Chiarella*, pre-ITSA, April 1980–August 1984; period 3 is post-ITSA, September 1984–December 1989; the overall period is January 1975–December 1989.

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tions have deterred insider trading. The number of transactions per month has remained constant over the three subperiods, while the number of shares traded shows a dramatic increase. There is a threefold increase in the number of shares purchased per month, from 11.5 million during the pre-*Chiarella* period to 29.1 million during the post-ITSA period. Similarly, there is a fivefold increase in the number of shares sold per month, from 10.9 million in the pre-*Chiarella* period to 55.7 million in the post-ITSA period. On average, the total number of shares traded increases by fourfold. While a more detailed analysis of the insider-trading volume that controls for changes in total shares outstanding and total trading volume is left to Section V*C* below, there is no obvious decline in insider-trading activity.

V. Empirical Results

A. *Profitability of Insider Trading*

The empirical results presented in this section document the profitability of insiders' transactions for the three subperiods and also compare profitability across the three subperiods. Insiders' abnormal profits are computed using the familiar market model for twenty-five months around the insider-trading month. (See Appendix B for details.)

Table 2 shows dollar-weighted average abnormal profits across the three periods. In each firm, estimated abnormal profits are first weighted by the dollar volume of trade as a fraction of all dollar volume of trade in that firm. This weighting measures the gross average profits realized by insiders in each firm. Dollar-weighted average abnormal profits are then averaged equally across firms to ensure that each firm gets the same weight.

The statistical significance of gross abnormal profits are computed across twenty-five event months by taking into account their mean shifts and serial correlation structure. Each t-statistic has twenty degrees of freedom. The details of the methodology are shown in Appendix B. The first subperiod (pre-*Chiarella*) contains 65,015 firm months from January 1975 to March 1980. Table 2 shows that the insiders' average abnormal profit is estimated to be 2.4 percent after three months, 3.5 percent after six months, and 3.5 percent after twelve months.[21] The respective t-statis-

[21] The equally weighted gross average abnormal profit over twelve months is 2.6 percent. This value is comparable to the 3.1 percent reported by Seyhun over fourteen months for a similar time period, in spite of differences in samples and methodologies. See H. Nejat

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tics are 3.7, 3.8, and 2.4. The apparently gradual stock price reaction to insider trading is due partly to delays in reporting and publication of insider-trading information and partly to slow market reaction.[22]

In the second subperiod, with 58,458 firm months, insiders' abnormal profits average 2.2 percent after three months, 3.1 percent after six months, and 5.1 percent after one year. The respective t-statistics are 2.4, 1.8, and 2.6. Hence, the period of increased enforcement displays a somewhat greater profitability of insider trading. The third subperiod, with 71,459 firm months, shows a further increase in profitability: insiders' gross abnormal profits now reach 3.1 percent after three months, 5.2 percent after six months, and 7.0 percent after one year, with the t-statistics 2.3, 3.3, and 3.3, respectively. The subperiod with higher enforcement and higher sanctions contains the most profitable insider trading.

The last three columns of Table 2 show the differences in profitability of insider trading. The significance of the difference in gross abnormal profits is evaluated by also taking into account the sample autocorrelation structure. Estimating third-order autoregressive models, AR(3), for the difference in gross abnormal profits provides satisfactory models for each of the series. The Box-Pierce Q statistics at lags 6, 12, and 18 for the residuals of the AR(3) models are insignificant, indicating a lack of remainining serial correlation.

The increases in profitability of insider-trading activity from 1975 to 1989 are statistically significant. For instance, the last column in Table 2 shows that the 3.5 percent increase in gross abnormal profit from period 1 to period 3 (7.0 percent minus 3.5 percent) has a t-statistic of 3.1, which is significant at the 1-percent level. Overall, Table 2 shows increases rather than decreases in profitability across the three subperiods.

Table 3 separates insiders' transactions by purchases and sales over the three subperiods. In period 1, both purchases and sales by insiders are followed by favorable abnormal price movements. Six months after insiders trade, stock prices rise abnormally 4.4 percent following pur-

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Seyhun, Insiders' Profits, Costs of Trading, and Market Efficiency, 16 J. Fin. Econ. 189 (1986). For other studies that have examined the profitability of insider trading, see Shannon Pratt & Charles DeWere, Relationship between Insider Trading and Rates of Return for NYSE Common Stocks, 1960–66, in Modern Developments in Investment Management 259 (James Lorie & Richard Brealey eds. 1970); Jeffrey F. Jaffe, Special Information and Insider Trading, 47 J. Bus. 410 (1974); Jeffrey F. Jaffe, The Effect of Regulation Changes on Insider Trading, 5 Bell J. Econ. & Mgmt. Sci. 93 (1974); Joseph E. Finnerty, Insiders and Market Efficiency, 31 J. Fin. 1141 (1976); and Steven H. Penman, Insider Trading and Dissemination of Firm's Forecasting Information, 55 J. Bus. 479 (1982).

[22] Seyhun, *supra* note 21.

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TABLE 2

INSIDERS' DOLLAR-WEIGHTED AVERAGE GROSS ABNORMAL PROFITS (in Percent)

Holding Horizon (in Months)	Period 1	Period 2	Period 3	Overall Period	Period 2 − Period 1	Period 3 − Period 2	Period 3 − Period 1
1	1.1	.6	1.3	1.0	−.4	.7	.2
	(2.7)	(1.2)	(2.3)	(2.0)	(−1.2)	(2.3)	(.5)
2	2.1	1.3	2.2	1.9	−.8	1.0	.2
	(4.1)	(1.2)	(2.3)	(2.4)	(−1.6)	(2.5)	(.3)
3	2.4	2.2	3.1	2.6	−.2	.9	.7
	(3.7)	(2.4)	(2.3)	(2.6)	(−.3)	(1.8)	(1.2)
4	2.6	2.8	4.0	3.1	.2	1.2	1.4
	(3.4)	(2.9)	(2.8)	(2.8)	(.2)	(2.0)	(2.0)
5	3.1	3.0	4.8	3.6	−.2	1.8	1.6
	(3.7)	(2.1)	(3.4)	(3.1)	(−.2)	(3.0)	(2.2)
6	3.5	3.1	5.2	3.7	−.4	2.1	1.7
	(3.8)	(1.8)	(3.3)	(3.0)	(−.4)	(3.3)	(2.1)
12	3.5	5.1	7.0	5.2	1.6	1.9	3.5
	(2.4)	(2.6)	(3.3)	(2.9)	(1.3)	(1.8)	(3.1)
No. of firm months	65,015	58,458	71,459	194,932			

NOTE.—The t-statistics are shown in parentheses. Each t-statistic has twenty degrees of freedom. The sample contains a total of 194,932 firm months in 8,856 firms from January 1975 to December 1989. Period 1 is pre-*Chiarella*, January 1975–March 1980; period 2 is post-*Chiarella*, pre-ITSA, April 1980–August 1984; period 3 is post-ITSA, September 1984–December 1989; the overall period is January 1975–December 1989. Positive abnormal return following insiders' purchases and negative abnormal return following insiders' sales both result in positive abnormal profits.

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TABLE 3

INSIDERS' DOLLAR-WEIGHTED AVERAGE GROSS ABNORMAL PROFITS (in Percent) FOR SIX AND TWELVE MONTHS AFTER THE INSIDER-TRADING MONTH, SEPARATED BY PURCHASES AND SALES

	PERIOD 1		PERIOD 2		PERIOD 3		OVERALL PERIOD	
TYPE OF TRADING	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Purchases:								
%	4.4	4.7	2.2	2.3	1.5	−1.9	2.6	1.3
	(2.5)	(1.7)	(1.9)	(1.3)	(1.1)	(−.9)	(2.4)	(.8)
No. of firm months	34,147		24,854		31,653		90,654	
Sales:								
%	3.3	3.7	3.2	5.7	8.0	13.8	5.3	8.4
	(2.5)	(2.2)	(2.0)	(3.0)	(4.3)	(9.2)	(2.6)	(5.5)
No. of firm months	30,868		33,604		39,806		104,278	
Purchases − sales (%)	1.1	1.0	−1.0	−3.4	−6.5	−15.7	−2.7	−7.1
	(.8)	(.4)	(−.7)	(−1.8)	(−3.8)	(−6.1)	(−2.0)	(−3.6)

NOTE.—The period after the insider trading occurs is, in col. a, six months after the inside-trading month and, in col. b, twelve months after the inside-trading month. The *t*-statistics are shown in parentheses. Each *t*-statistic has twenty degrees of freedom. The sample contains a total of 194,932 firm months in 8,856 firms from January 1975 to December 1989. Period 1 is pre-*Chiarella*, January 1975–March 1980; period 2 is post-*Chiarella*, pre-ITSA, April 1980–August 1984; period 3 is post-ITSA, September 1984–December 1989; the overall period is January 1975–December 1989. Positive abnormal return following insiders' purchases and negative abnormal return following insiders' sales both result in positive abnormal profits.

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chases and fall 3.3 percent following sales.[23] The differences between purchases and sales are insignificant. In periods 2 and 3, purchases become less informative while sales become more so. In the last period, for instance, insider purchases do not appear to be based on firm-specific information. In contrast, stock prices fall abnormally by 13.8 percent over the year following insiders' sales. Overall, this evidence indicates that in the 1980s insiders have increasingly shifted to a stategy of bailing out before bad news rather than buying on good news.

Table 4 provides a year-to-year analysis of insider-trading profitability. Insiders are able to forecast future stock price movements in good and bad times. A regression of insiders' abnormal profits against market return and variance of market return finds no significant relations (not shown). Hence, the forecasting ability of insiders is a general phenomenon not confined to only a few years. Also, changes in volatility appear to be uncorrelated with changes in insider-trading profitability.

The evidence in Table 4 indicates that there are no measurable declines in either frequency or profitability of insider-trading activity immediately following increases in the level and enforcement of insider-trading sanctions. In 1981, the frequency of insider trading declines slightly (4 percent) over 1980, while the profitability increases moderately. In 1985, following the passage of ITSA, there is another slight decline in frequency of insider trading (1.6 percent), while there is a substantial increase in the profitability. Finally, after the passage of ITSFEA in 1989, the profitability of insider trading is mostly unchanged, while the frequency of insider trading increases substantially (30 percent).

B. Large Insider-trading Volume

Table 5 separates insider-trading activity by the number of shares traded in each month and focuses on months when insiders trade 10,000

[23] Seyhun, *id.*, reports similar magnitudes for the 1975–81 period. Also, neither the differences between profitability of sales and purchases nor the differences between profitability across the three subperiods can be attributed to systematic movements in either expected returns or market model parameters. The estimated average monthly expected returns over the twelve months following the insider-trading month are .0228 and .0227 for sales and purchases in the first subperiod. The corresponding estimates for sales and purchases are .0158 and .0171 for the second subperiod and .0172 and .0146 for the third subperiod. Hence, purchases for the first subperiod show the greatest profitability in spite of the highest estimates of expected returns across the three subperiods. Similarly, sales in the first subperiod show the least profitability in spite of the highest estimates of expected returns across the three subperiods. Also, in the second subperiod, sales are more profitable than purchases in spite of the lower estimated expected returns. In the third subperiods, the difference in the expected returns of .26 percent per month cannot account for the 15.7 percent difference in profitability between sales and purchases over the twelve months following the insider-trading month. Finally, estimates of the market model parameters do not suggest a possible bias. For instance, in the last subperiod, alpha estimates are .000026 and −.000978 for sales and purchases, respectively.

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TABLE 4

INSIDERS' DOLLAR-WEIGHTED AVERAGE GROSS ABNORMAL PROFITS (in Percent) FOR CALENDAR YEARS 1975–89, THE RETURN TO THE VALUE-WEIGHTED INDEX OF NYSE AND AMEX STOCKS, AND THE VARIANCE OF THE MONTHLY MARKET RETURNS

Year of Trade	Holding Horizon (in Months) 1	3	6	12	Firm Months	Value-weighted Stock Returns	σ^2
1975	.9	2.6	4.2	4.0	12,745	.377	.0029
	(.8)	(1.5)	(1.7)	(1.1)			
1976	1.1	2.7	4.0	4.3	12,882	.262	.0017
	(2.6)	(4.4)	(4.9)	(3.1)			
1977	.9	2.3	2.8	3.8	11,954	−.048	.0008
	(2.5)	(4.6)	(3.1)	(2.7)			
1978	1.6	2.8	3.9	5.5	11,967	.073	.0025
	(3.5)	(3.5)	(3.4)	(3.4)			
1979	1.1	2.2	2.8	2.1	12,119	.219	.0017
	(3.4)	(4.2)	(3.4)	(1.5)			
1980	.5	2.4	2.6	3.9	12,750	.326	.0031
	(.6)	(1.5)	(1.1)	(1.2)			
1981	1.1	2.6	3.9	4.9	12,280	−.041	.0015
	(2.4)	(3.1)	(4.1)	(2.7)			
1982	0	−.2	−.9	.8	13,510	.210	.0031
	(.0)	(−.2)	(−.6)	(.5)			
1983	1.1	2.8	4.5	6.2	14,050	.228	.0008
	(2.6)	(3.0)	(2.6)	(2.8)			
1984	1.0	2.3	3.0	5.1	13,614	.058	.0016
	(2.1)	(3.2)	(2.5)	(3.1)			
1985	1.0	3.2	4.4	7.0	13,391	.317	.0013
	(1.6)	(3.8)	(3.6)	(4.3)			
1986	1.5	3.5	5.9	6.9	13,251	.173	.0025
	(2.8)	(2.6)	(3.6)	(2.9)			
1987	1.5	2.8	4.9	2.8	11,007	.029	.0075
	(5.0)	(2.1)	(3.3)	(1.3)			
1988	1.3	3.0	4.8	7.1	12,671	.176	.0008
	(2.9)	(3.2)	(4.4)	(5.8)			
1989	1.3	2.8	4.5	4.9	16,741	.295	.0011
	(2.9)	(3.7)	(4.8)	(2.3)			

NOTE.—The t-statistics are shown in parentheses. Each t-statistic has twenty degrees of freedom. The sample contains a total of 194,932 firm months in 8,856 firms from January 1975 to December 1989. Positive abnormal return following insiders' purchases and negative abnormal return following insiders' sales both result in positive abnormal profits.

or more shares. If the increased sanctions are effective, then the positive relation between the volume of insider trading and information would be expected to lessen and even turn negative after 1984.

The first three columns of Table 5 show that the profitability of insider trading increases with the number of shares traded in each of the three periods. In the first period, insiders' gross abnormal profit after six months uniformly increases from 1.3 percent to 3.9 percent as the number

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TABLE 5

INSIDERS' DOLLAR-WEIGHTED AVERAGE GROSS ABNORMAL PROFITS (in Percent) FOR SIX AND TWELVE MONTHS AFTER THE INSIDER-TRADING MONTH, SEPARATED BY THE NUMBER OF SHARES TRADED

No. of Shares Traded	Period 1		Period 2		Period 3		Period 2 − Period 1		Period 3 − Period 2		Period 3 − Period 1	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
100 or less:												
%	1.3	1.3	−.2	−.2	−1.3	−2.8	−1.4	−1.5	−1.2	−2.6	−2.6	−4.1
	(1.9)	(1.3)	(−.2)	(−.2)	(−.9)	(−1.8)	(−2.2)	(−1.9)	(−2.1)	(−3.4)	(−3.3)	(−3.6)
No. of firm months	8,125		4,854		4,340							
101–500:												
%	2.4	3.3	.9	.9	1.6	.6	−1.6	−2.4	.7	−.4	−.9	−2.8
	(3.7)	(3.4)	(1.0)	(.8)	(1.6)	(.6)	(−2.8)	(−3.0)	(.9)	(−.3)	(−1.1)	(−2.7)
No. of firm months	14,581		9,682		9,276							
501–1,000:												
%	3.4	3.4	1.4	2.6	3.3	2.9	−2.0	−.9	1.9	.4	−.0	−.5
	(4.9)	(2.9)	(.8)	(1.3)	(3.9)	(2.0)	(−1.7)	(−.9)	(2.4)	(.4)	(−.0)	(−.5)
No. of firm months	10,146		7,403		9,625							
1,001–10,000:												
%	3.6	4.5	2.7	4.8	4.5	5.8	−.9	.3	1.7	.9	.8	1.3
	(3.7)	(2.9)	(2.8)	(3.9)	(5.5)	(3.4)	(−1.4)	(.4)	(2.8)	(.9)	(1.5)	(1.6)
No. of firm months	24,753		23,328		27,299							
More than 10,000:												
%	3.9	3.3	3.5	5.9	6.5	9.5	−.4	2.6	3.0	3.6	2.6	6.2
	(3.8)	(1.9)	(1.8)	(2.6)	(3.3)	(3.3)	(−.3)	(1.6)	(3.4)	(2.7)	(2.6)	(4.5)
No. of firm months	7,410		13,191		20,919							

NOTE.—The period after the insider trading occurs is, in col. a, six months after the insider-trading month and, in col. b, 12 months after the insider-trading month. The *t*-statistics are shown in parentheses. Each *t*-statistic has twenty degrees of freedom. The sample contains a total of 194,932 firm months in 8,856 firms from January 1975 to December 1989. Period 1 is pre-*Chiarella*, January 1975–March 1980; period 2 is post-*Chiarella*, pre-ITSA, April 1980–August 1984; period 3 is post-ITSA, September 1984–December 1989; the overall period is January 1975–December 1989. Positive abnormal return following insiders' purchases and negative abnormal return following insiders' sales both result in positive abnormal profits.

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of shares increases from 100 shares or less to more than 10,000 shares. Similarly, gross abnormal profit after six months increases from −.2 percent to 3.5 percent in the second period and from −1.3 percent to 6.5 percent in the third period, as the number of shares traded increases from less than 100 shares to more than 10,000 shares.[24] Table 5 also indicates that insiders' abnormal profits increase more rapidly with trading volume over a twelve-month period following the insider-trading month.

The last three columns of Table 5 compare the differences in insiders' abnormal profits. During the last two subperiods, large transactions (for example, more than 10,000 shares traded) are more likely to be based on private information as compared with the first subperiod. For instance, in the first subperiod the gross abnormal profit six months after a large transaction equals 3.9 percent. In the third period, the gross abnormal profit for a similar transaction equals 6.5 percent. The difference of 2.6 percent has a t-statistic of 2.6, which is significant at about the 1-percent level.

Additional information is given in Table 5 that suggests that insiders are more likely to exploit their private information by trading large volumes in later periods. In the first subperiod, 7,410 out of 65,015 firm months have large trading volumes. This constitutes 11 percent of the total firm months. In the second period, the frequency of large transactions more than doubles to 23 percent (13,191 out of 58,458 firm months). In the third period, the frequency of large transactions rises to 29 percent (20,919 out of 71,459 firm months). This evidence also suggests that insiders have become more aggressive in exploiting the private information by trading larger volumes over time.

To obtain a further insight on the deterrent effect of insider-trading regulations, Table 6 restricts the sample to those firms and months when the top executives trade. Top executives are defined as chairmen of the boards of directors, officer-directors, controlling persons, and general partners. Table 6 indicates that, on average, top executives trade on more valuable information. The last row of Table 6 shows that during one year, following transactions by top executives, stock prices moved abnormally 4.6 percent, 5.6 percent, and 9.3 percent in the insiders' favor for the three subperiods, respectively. Moreover, abnormal stock price movements increase more rapidly with the volume of trading following top executives' transactions. When top executives trade 10,000 or more

[24] Significant losses following small transactions is not predicted by theory. Losses on small transactions, however, can help camouflage other profitable transactions. Consistent with this conjecture, losses on small transactions grow over time as insider trading gets more profitable.

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TABLE 6

TOP EXECUTIVES' DOLLAR-WEIGHTED AVERAGE GROSS ABNORMAL PROFITS (in Percent) FOR SIX AND TWELVE MONTHS AFTER THE INSIDER-TRADING MONTH SEPARATED BY THE NUMBER OF SHARES TRADED

No. of Shares Traded	Period 1		Period 2		Period 3		Period 2 − Period 1		Period 3 − Period 2		Period 3 − Period 1	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
100 or less:												
%	1.3	1.7	−.2	1.0	−.4	−2.1	−1.5	−.7	−.2	−3.1	−1.7	−3.8
	(1.9)	(1.8)	(−.3)	(1.0)	(−.8)	(−2.7)	(−1.4)	(−.5)	(−.1)	(−1.7)	(−1.4)	(−4.0)
No. of firm months	2,529		1,539		841							
101–500:												
%	3.7	4.6	1.4	2.8	3.0	2.4	−2.3	−1.8	1.6	−.4	−.7	−2.2
	(3.1)	(2.6)	(1.2)	(2.9)	(2.1)	(1.1)	(−1.7)	(−1.0)	(.9)	(−.1)	(−.5)	(−1.2)
No. of firm months	3,691		1,908		1,178							
501–1,000:												
%	4.5	4.1	1.6	4.0	4.2	5.6	−2.9	−.1	2.6	1.6	−.3	1.5
	(4.5)	(2.3)	(1.3)	(2.4)	(2.0)	(2.3)	(−1.3)	(.0)	(2.3)	(1.0)	(−.2)	(.7)
No. of firm months	2,766		1,723		973							
1,001–10,000:												
%	5.1	5.2	3.4	6.3	7.7	10.4	−1.7	1.1	4.3	4.1	2.6	5.2
	(2.8)	(2.1)	(2.5)	(3.6)	(4.3)	(5.2)	(−1.3)	(.6)	(3.6)	(2.4)	(2.1)	(2.9)
No. of firm months	7,451		6,507		4,729							
More than 10,000:												
%	6.2	6.6	5.8	9.6	9.6	14.8	−.4	3.0	3.8	5.2	3.4	8.2
	(3.1)	(1.6)	(3.2)	(4.0)	(3.2)	(4.2)	(−.2)	(1.2)	(2.0)	(2.3)	(2.3)	(3.8)
No. of firm months	1,977		3,766		3,921							
All trades:												
%	4.3	4.6	3.0	5.6	6.7	9.3	−1.3	1.0	3.8	3.7	2.4	4.7
	(3.0)	(1.7)	(2.7)	(4.1)	(3.7)	(3.6)	(−.9)	(.9)	(3.7)	(2.7)	(2.4)	(3.7)
No. of firm months	18,414		15,443		11,642							

NOTE.—The period after the insider trading occurs is, in col. a, six months after the insider-trading month and, in col. b, twelve months after the insider-trading month. The t-statistics are shown in parentheses. Each t-statistic has twenty degrees of freedom. The sample contains a total of 45,499 firm months in 5,805 firms from January 1975 to December 1989. Period 1 is pre-*Chiarella*, January 1975–March 1980; period 2 is post-*Chiarella*, pre-ITSA, April 1980–August 1984; period 3 is post-ITSA, September 1984–December 1989; the overall period is January 1975–December 1989. Positive abnormal return following insiders' purchases and negative abnormal return following insiders' sales both result in positive abnormal profits.

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shares, during the next year stock prices move abnormally 6.6 percent, 9.6 percent, and 14.8 percent for the three subperiods, respectively.[25] In addition, the frequency of top executives' large transactions also increases from 10.7 percent (1,977 divided by 18,414) in the first subperiod to 33.6 percent (3,921 divided by 11,642) in the last subperiod. The last three columns of Table 6 show that increases in abnormal price movement over the three subperiods attain statistical significance.

The evidence in Tables 2–6 is not consistent with the proposition that increased sanctions in the 1980s deterred insiders from trading on the basis of their private information. Instead, the evidence suggests that insiders were more likely to bail out before bad news arrived. Insiders increased both the frequency and the profitability of their transactions over time in spite of the increased sanctions. Large transactions are more likely to anticipate substantial price movements after the increases in sanctions than before. Similarly, top executives were more likely to trade on private information after the increases in sanctions than before.

C. *Volume of Insider Trading*

Another implication of the insider-trading model presented in Appendix A is that effective sanctions will reduce the volume of insider trading. The data in Table 1 indicate that, while the number of transactions has been relatively constant over time, both the number of shares traded and the number of firms trading have, in fact, increased over time. The analysis presented in this section takes into account the changes in overall trading volume as well as the number of shares outstanding to analyze changes in insider-trading activity over time.

Table 7 shows a time-series regression analysis of the relative insider-trading volume and the proportion of the firm traded by insiders. Relative insider-trading volume is defined as the number of shares traded by insiders in all firms divided by the total number of shares traded in all firms.[26]

[25] The large abnormal returns shown in Table 6 raise the issue of whether outsiders can use publicly available information to imitate insiders and also earn abnormal profits. On average, insider-trading information becomes public three months after the insider-trading month (Seyhun, *supra* note 21). For a subsample of firms for which bid-ask spread data are available from the NASDAQ tapes, abnormal profits to outsiders over the next nine-month period net of the bid-ask spread are computed. Following 6,793 transactions by top executives for more than 10,000 shares, equally weighted net abnormal profits are −8.8 percent, .4 percent, and .5 percent over the three subperiods with t-statistics −2.3, .1, and .1, respectively. Hence, potential profits to outsiders are not significantly positive.

[26] The total number of shares traded in all publicly held firms is obtained from the *Survey of Current Business* as the total shares traded reported to the SEC. The firm-specific trading volume is available in CRSP tapes from November 1982 only and, hence, is not used here.

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TABLE 7

REGRESSION OF MONTHLY INSIDER-TRADING VOLUME AGAINST INDICATOR VARIABLES DENOTING THE TWO LATER SUBPERIODS ASSOCIATED WITH CHANGES IN INSIDER-TRADING REGULATIONS AND THE RETURN ON THE VALUE-WEIGHTED MARKET PORTFOLIO, Rv^a

DEPENDENT VARIABLE BY MODEL NO.	MODEL FOR INSIDER-TRADING VOLUME				ERROR MODEL		
	Constant	PER_2	PER_3	R_v	θ_1	θ_2	$Q(24)$*
A. All insiders:							
1. TNS/VOL	.015	.002	−.000	. . .	.15	. . .	28.1
	(10.4)	(.9)	(−.1)		(1.9)		(.17)
2. TNS/VOL	.015	.002	−.000	.007	.15	. . .	28.2
	(10.3)	(.9)	(−.1)	(.5)	(1.9)		(.17)
3. TNS/OUT	.039	.042	.033	. . .	.23	.21	30.7
	(9.6)	(6.9)	(5.7)		(3.2)	(3.0)	(.08)
4. TNS/OUT	.041	.039	.033	−.014	.24	.23	30.6
	(5.8)	(3.8)	(3.3)	(−.3)	(3.2)	(3.0)	(.08)
B. Top executives only:							
1. TNS/VOL	.0029	.0004	−.0005	. . .	.26	.14	9.4
	(6.0)	(.6)	(−.7)		(3.4)	(1.6)	(.99)
2. TNS/VOL	.0029	.0004	−.0005	.0043	.27	.13	9.0
	(5.9)	(.5)	(−.7)	(1.2)	(3.5)	(1.4)	(.99)
3. TNS/OUT	.010	.010	.004	. . .	.17	.19	20.3
	(5.5)	(3.4)	(1.6)		(2.3)	(2.6)	(.50)
4. TNS/OUT	.010	.009	.004	−.000	.17	.19	20.3
	(5.3)	(3.3)	(1.5)	(−.0)	(2.3)	(2.5)	(.50)

NOTE.—The t-statistics for the estimated coefficients are shown in parentheses. There are 19,571 firms in the sample. Insider-trading volume $= \alpha_0 + \alpha_1 PER_2 + \alpha_2 PER_3 + \alpha_3 RV + A(L)\epsilon_t$; and $A(L) = 1/(1 - \theta_1 L - \theta_2 L^2)$, where L is lag operator. The variable TNS/VOL is the number of shares traded by insiders in a given month divided by total shares traded on all exchanges for the same month, summed over all firms; TNS/OUT is the number of shares traded by insiders in a given month divided by total shares outstanding in each firm, averaged across all firms. The α coefficient estimates are multiplied by 100. The variable $PER_2 = 1$ if between April 1980 and August 1984, zero otherwise; $PER_3 = 1$ if between September 1984 and December 1989, zero otherwise; $Q(24)$ denotes the Box-Pierce Q statistic at lag 24 and has $23 - k$ degrees of freedom, where k is the number of θ parameters estimated in the error model.

* The p-values for $Q(24)$ are shown in parentheses in this column.

Hence, relative trading volume controls for changes in overall volume unrelated to insider-trading regulations. Taking into account the remaining serial correlation of the residuals, the regressions also estimate error models. Second-order autoregressive models for the errors, AR(2), produce satisfactory residuals as judged by insignificant Box-Pierce Q statistics at lag 24.

Model 1 in Table 7, panel A, shows that there are no statistically significant differences in relative insider-trading volume across the three periods. On average, insiders accounted for 1.5 percent of the trading volume in the pre-*Chiarella* period. This fraction does not decline during the later periods.

Model 2 in Table 7, panel A, uses the contemporaneous return on the

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market as an additional explanatory variable. Once again, there is no decline in relative insider-trading volume over time. Moreover, the return on the market does not explain the relative insider-trading activity.[27]

Models 3 and 4 in Table 7, panel A, analyze the fraction of the firm traded by insiders defined as the number of shares traded by insiders divided by the number of shares outstanding at the same time. The number of shares outstanding is obtained from the CRSP files. The fraction of the firm traded is then averaged across firms. Hence, this measure is not affected by changes in number of firms over time. Models 3 and 4 in Table 7, panel A, show that insiders trade about .04 percent of the outstanding shares per month during the pre-*Chiarella* period. The fraction of the firm traded increased to .08 percent per month during the later two periods. The increases are statistically significant at the 1-percent level. Once again, the contemporaneous market return does not explain the aggregate insider-trading activity.

Panel B examines the changes in trading activity of top executives: it followed the same patterns as all insiders. Trading volume by top executives as a proportion of all trading volume did not change over time. They did, however, trade a greater proportion of all outstanding shares during the last two subperiods.

Overall, the data in Table 7 suggest that insiders have increased their trading activity in the 1980s in spite of the increased sanctions. The greater insider-trading activity appears to mirror the growth in the market's overall trading volume. There is no evidence to suggest that increased regulations deterred insiders from trading.

To determine whether there has been a temporary deterrent effect, changes in insider-trading activity were examined around (i) March 1980, when the *Chiarella* decision was announced; (ii) August 1984, when ITSA was signed into law; and (iii) November 1988, when ITSFEA was signed into law. Both relative insider-trading volume and the fraction of the firm traded by insiders are taken as measures of insider-trading activity. Temporarily effective insider-trading sanctions would be expected to result in a onetime decline in the level of insider-trading activity at the time regulations changed.

Table 8 shows the results. To account for a full reaction to changes in statutes, the subsequent full calendar month was also included as part of the event month.[28] Table 8 shows that none of the three events were

[27] For a relation between market returns and the direction of insider trading activity, see H. Nejat Seyhun, The Information Content of Aggregate Insider Trading, 61 J. Bus. 1 (1988).

[28] For instance, ITSFEA was signed into law on November 19, 1988. Hence, there are only eleven days in November 1988 when ITSFEA was effective. By including December 1988 as part of the event, the full effect of the law can be gauged.

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TABLE 8

REGRESSION OF MONTHLY INSIDER-TRADING VOLUME AGAINST INDICATOR VARIABLES ASSOCIATED WITH CHANGES IN INSIDER-TRADING REGULATIONS AND THE RETURN ON THE VALUE-WEIGHTED MARKET PORTFOLIO, RV^a

Dependent by Model No. Variable	Model for Insider-trading Volume					Error Model		
	Constant	T_1	T_2	T_3	R_v	θ_1	θ_2	$Q(24)$*
A. All insiders:								
1. TNS/VOL	.016	−.007	−.003	.003	. . .	.18	. . .	28.0
	(10.4)	(−.9)	(−.3)	(.3)		(2.2)		(.18)
2. TNS/VOL	.016	−.006	−.003	.003	.006	.17	. . .	28.0
	(10.3)	(−.8)	(−.4)	(.4)	(.4)	(2.1)		(.18)
3. TNS/OUT	.063	−.010	.025	.017	. . .	.32	.33	20.5
	(9.6)	(−.5)	(1.1)	(.8)		(4.4)	(4.5)	(.49)
4. TNS/OUT	.064	−.012	.027	.016	−.035	.32	.34	19.9
	(9.4)	(−.6)	(1.2)	(.7)	(−.7)	(4.4)	(4.6)	(.53)
B. Top executives only:								
1. TNS/VOL	.0028	−.0003	−.0005	−.0014	. . .	.31	. . .	12.9
	(11.0)	(−.2)	(−.3)	(−.7)		(4.3)		(.94)
2. TNS/VOL	.0028	.000	−.0007	−.0012	.008	.31	. . .	11.0
	(10.4)	(.0)	(−.4)	(−.6)	(1.4)	(4.3)		(.97)
3. TNS/OUT	.014	−.004	.003	−.004	. . .	.20	.23	18.9
	(7.7)	(−.4)	(.3)	(−.4)		(2.7)	(3.1)	(.59)
4. TNS/OUT	.014	−.004	.004	−.004	−.002	.20	.23	19.0
	(7.6)	(−.4)	(.3)	(−.4)	(−.1)	(2.7)	(3.1)	(.59)

NOTE.—The t-statistics for the estimated coefficients are shown in parentheses. There are 19,571 firms in the sample. Insider-trading volume $= \alpha_0 + \alpha_1 T_1 + \alpha_2 T_2 + \alpha_3 T_3 + \alpha_4 \mathrm{RV} + A(L)\,\epsilon_t$. Error model $A(L) = 1/(1 - \theta_1 L - \theta_2 L^2)$, and L is lag operator. The variable $T_1 = 1$ if either March 1980 or April 1980, zero otherwise; $T_2 = 1$ if either August 1984 or September 1984, zero otherwise; $T_3 = 1$ if either November 1988 or December 1988, zero otherwise. The variable TNS/VOL is the number of shares traded by insiders in a given month divided by total shares traded on all exchanges for the same month as reported to the SEC, and the ratio is then summed over all firms in each month; TNS/OUT is the number of shares traded by insiders in a given month divided by total shares outstanding in each firm; the α coefficient estimates in eqq. (3) and (4) are multiplied by 100; $Q(24)$ denotes the Box-Pierce Q statistic at lag 24 and has $23 - k$ degrees of freedom, where k is the number of θ parameters estimated in the error model.

* The p-values for $Q(24)$ are shown in parentheses in this column.

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associated with declines in insider-trading activity. Instead, data suggest that insiders appeared not to be concerned with changes in statutes even on a temporary basis.

D. *Effects of Case Law*

Insider Trading prior to Earnings Announcements. The evidence presented in this section analyzes the extent to which insiders exploit the upcoming earnings information during the three subperiods. Earnings data are obtained from the quarterly Compustat tapes for 150,873 firm months in 6,059 firms. A simple estimate of the earnings surprise was computed as a seasonal random walk by subtracting earnings four quarters earlier from the current earnings.[29] Insider-trading activity was examined during the thirty days preceding the earnings announcement day. If the net number of transactions was in the same direction as the earnings surprise, then the insider trading was considered timely.

Table 9, panel A, shows the timely trading activity by all insiders. The constant term in model 1 indicates that prior to 1980 there was timely insider-trading activity in 12.0 percent of earnings announcement months. Hence, in general, insiders did not appear to be exploiting the upcoming earnings information. Moreover, the timely insider-trading activity declined from 12.0 percent in the first subperiod to 9.3 percent (.120 minus .027) in the third subperiod. The decline is significant at the 1-percent level. Hence, insiders' reluctance to exploit the earnings information increased as sanctions on insider trading increased.

Model 2 in Table 9, panel A, shows that the timely net number of transactions has also declined from an average of .29 transactions per month in the first subperiod to .22 transactions per month in the third subperiod. Model 3, in contrast, shows an increase in the timely net number of shares traded over time—from 1,055 shares to 2,898 shares (1055.3 plus 1842.3). While not shown in Table 9, insiders in the 6,059 firms with earnings data have, on average, traded 4,721 shares per firm month. Consequently, in spite of the increases over time, insiders traded fewer shares immediately prior to earnings announcements than at other times. Finally, model 4 shows that the timely net number of shares traded as a proportion of all trading activity also decreased in the third subperiod.

Panel B of Table 9 examines the timely trading activity of the top executives during a one-month period before the earnings announce-

[29] To the extent market's expectation of the earnings differs from a seasonal random walk, the measurement error will bias the relation between insider trading and earnings surprises to zero.

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TABLE 9

REGRESSION OF TIMELY INSIDER-TRADING ACTIVITY ONE MONTH BEFORE EARNINGS ANNOUNCEMENTS AGAINST INDICATOR VARIABLES DENOTING THE TWO LATER SUBPERIODS ASSOCIATED WITH CHANGES IN INSIDER-TRADING REGULATIONS

Timely Insider Trading by Model No.	Constant	PER_2	PER_3	θ_1	θ_2	θ_3	$Q(24)$*
A. All insiders:							
1. TIMELY × PROP	.120	.005	−.027	.18	−.18	.21	25.5
	(25.4)	(.8)	(−4.2)	(2.4)	(−2.4)	(2.8)	(.18)
2. TIMELY × TNT	.29	.06	−.07	.12	.09	.11	19.5
	(13.1)	(2.1)	(−2.6)	(1.5)	(1.1)	(1.4)	(.49)
3. TIMELY × TNS	1,055.3	1,620.2	1,842.3	.08	. . .	. . .	12.6
	(2.9)	(3.2)	(3.8)	(1.1)			(.94)
4. TIMELY × TNS/VOL	.014	.002	−.007	.10	. . .	. . .	17.2
	(5.5)	(.6)	(−2.0)	(1.4)			(.75)
B. Top executives:							
1. TIMELY × PROP	.034	−.003	−.019	.14	.16	.12	28.1
	(10.4)	(−.7)	(−4.3)	(1.8)	(2.1)	(1.5)	(.11)
2. TIMELY × TNT	.072	−.002	−.041	.05	.20	.20	24.1
	(8.6)	(−.2)	(−3.6)	(.7)	(2.6)	(2.6)	(.24)
3. TIMELY × TNS	132.7	305.8	145.9	.07	. . .	. . .	38.5
	(2.2)	(3.6)	(1.8)	(1.0)			(.02)
4. TIMELY × TNS/VOL	.002	.001	−.001	−.04	. . .	. . .	32.3
	(6.1)	(2.1)	(−2.4)	(−.5)			(.07)

NOTE.—The t-statistics are shown in parentheses. The sample contains 150,873 firm months in 6,059 firms from January 1975 to December 1989. The variable $EPS_t = EPS_{t-12} + \epsilon_t$. TIMELY = 1 if $\epsilon_t > 0$ and $NT_{t-1} > 0$ or if $\epsilon_t < 0$ and $N_{t-1} < 0$, zero otherwise. Timely insider trading $= \alpha_0 + \alpha_1 PER_2 + \alpha_2 PER_3 + A(L)\epsilon_t$. Error model $A(L) = 1/(1 - \theta_1 L - \theta_2 L^2 - \theta_3 L^3)$, and L is lag operator. The variable $PER_2 = 1$ if between April 1980 and August 1984, zero otherwise; $PER_3 = 1$ if between September 1984 to December 1989, zero otherwise; EPS_t denotes the primary earnings per share before extraordinary items announced in month t; PROP denotes the fraction of months with insider trading during one month before the earnings announcement date; TNT denotes the absolute value of the net number of transactions (NT); TNS denotes the absolute value of the net number of shares traded (NS) during one month before the earnings announcement; VOL is total number of shares traded in all firms as reported to the SEC. In eq. (4), estimated coefficients are multiplied by 10,000; $Q24$ denotes the Box-Pierce Q statistics at lag 24 and has $23 - k$ degrees of freedom, where k is the number of θ parameters estimated in the error model.

* The p-values for $Q(24)$ are shown in parentheses in this column.

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ments. This activity follows the same patterns as of all insiders. Model 1 of panel B shows that the proportion of the earnings announcement months with timely insider trading declines from 3.4 percent to 1.5 percent (.034 minus .019). Hence, the top executives also became more reluctant to trade on the basis of earnings information as sanctions increased. Models 2–4 in panel B show similar changes in other measures of top executives' activity over time.

Overall, the evidence in Table 9 suggests that insiders do not aggressively exploit the earnings information. Moreover, in spite of the significant increases in insider-trading activity over time shown in Table 1, insiders in fact became more reluctant to engage in timely trading before earnings announcements during the third subperiod. This evidence suggests that case law provided a measurable constraint on insider-trading activity immediately before earnings announcements.

Insider Trading prior to Takeover Announcements. A second effect of the case law is examined around takeover announcement. Target firms' managers often possess advance information about corporate takeovers through negotiations with the bidder managers. Trading on the basis of this information is likely to be highly profitable and also result in a high probability of litigation and significant penalties.

Table 10, panel A, examines the purchase activity of all insiders prior to corporate takeover announcements during the three subperiods. The sample contains 2,520 target firms involved in mergers or tender offers listed on exchanges from January 1975 through December 1989.[30] For each firm, insider purchase activity during the thirty days preceding the takeover announcement date is recorded.

Model 1 in Table 10, panel A, shows that the proportion of takeover announcement months with insider purchase activity falls from 14.5 percent to 7.1 percent (14.5 percent minus 7.4 percent) over the three subperiods. This decline is significant at the 1-percent level, with a t-statistic of -3.4. Model 2 shows that there is a similar decline in net number of purchases in the third subperiod. There is, however, an insignificant increase in the net number of shares traded over time.

Panel B of Table 10 examines the purchase activity of top executives. In the first subperiod, the top executives purchase shares in 2.7 percent of the takeover announcements. The average number of purchases equals .04, while the average number of shares purchased equals 3,495.8. During the last two subperiods, top executives display significant declines in stock purchases before takeover announcements. In the third subperiod, top executives purchase shares in only .5 percent (2.7 percent minus 2.2

[30] I am grateful to Robert Comment for making this data set available.

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TABLE 10

INSIDERS' STOCK PURCHASES IN TAKEOVER TARGET FIRMS DURING THE THIRTY DAYS PRIOR TO TAKEOVER ANNOUNCEMENTS IN THREE SUBPERIODS ASSOCIATED WITH CHANGES IN INSIDER-TRADING REGULATIONS

Timely Insider Trading by Model No.	Constant	PER_2	PER_3	θ_1	θ_2	θ_3	$Q(24)$*
A. All insiders:							
1. TIMELY × PROP	.145	−.018	−.074	. . .	. . .	. . .	21.5
	(9.3)	(−.8)	(−3.4)				(.55)
2. TIMELY × TNT	.465	.002	−.195	. . .	. . .	.27	13.1
	(3.9)	(.0)	(−1.2)			(3.3)	(.93)
3. TIMELY × TNS	6,395.9	2,882.7	5,670.8	. . .	. . .	. . .	13.8
	(1.5)	(.5)	(.9)				(.93)
B. Top executives:							
1. TIMELY × PROP	.027	−.008	−.022	−.13	−.13	. . .	23.7
	(6.1)	(−1.3)	(−3.5)	(−1.8)	(−1.7)		(.31)
2. TIMELY × TNT	.035	−.004	−.027	. . .	. . .	. . .	26.2
	(4.1)	(−.3)	(−2.3)				(.29)
3. TIMELY × TNS	3,495.8	−3,382.5	−3,465.5	. . .	. . .	. . .	.4
	(1.7)	(−1.1)	(−1.2)				(1.00)

NOTE—The t-statistics are shown in parentheses. The sample contains 2,520 takeover announcements from January 1975 to December 1989. The variable TIMELY = 1 if $NT_{t-1} > 0$, zero otherwise. Timely insider trading = $\alpha_0 + \alpha_1 PER_2 + \alpha_2 PER_3 + A(L)\epsilon_t$. Error model $A(L) = 1/(1 - \theta_1 L - \theta_2 L^2 - \theta_3 L^3)$, and L is lag operator. The variable PER_2 = 1 if between April 1980 and August 1984, zero otherwise; PER_3 = 1 if between September 1984 and December 1989, zero otherwise; PROP denotes the fraction of months with insider trading during one month before the takeover announcement date; TNT denotes the absolute value of the net number of transactions (NT); and TNS denotes the absolute value of the net number of shares traded (NS) during one month before the takeover announcement; $Q(24)$ denotes the Box-Pierce Q statistic at lag 24 and has $23 - k$ degrees of freedom, where k is the number of θ parameters in the error model.

* The p-values for $Q(24)$ are shown in parentheses in this column.

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percent) of the takeover announcements. This decline is again statistically significant at the 1-percent level. In the third subperiod, the net number of purchases fell to .008, while the net number of shares purchased fell to thirty shares. While not shown in Table 10, there were only six firms out of the total sample of 2,520 that exhibited purchases by top executives immediately before takeover announcements in the third subperiod.

The evidence presented in Table 10 suggests that insiders have become more reluctant to trade immediately before takeover announcements. Top executives almost completely stopped trading before takeovers during the last two subperiods. Once again, these findings are consistent with the interpretation that the effective constraint on insider trading appears to come from the courts.

E. Company Code of Ethics

To obtain some additional insight into how companies view insider trading, a random sample of thirty-seven companies' code of ethics documents were examined at the University of Michigan Career Resource Center company files.[31] These documents vary from highly detailed to fairly general statements about proper employee conduct. The documents were between one and forty-two pages long. Approximately half the companies require a signed affidavit from the employee stating that the employee has read and will abide by the code.

An examination of these codes suggests that insider trading is not of significant importance to a majority of firms. As of November 1990, 25 percent of the firms warned specifically against insider trading, another 25 percent cautioned against misuse of company confidential information, while the remaining 50 percent did not mention either insider trading or misuse of confidential information.

Of the thirty-seven documents examined, nine specifically cautioned against trading around the time of a specific corporate announcement. These firms included public accounting firms, oil companies, and technology firms. Many of these warnings took the form of a reminder that insider trading is a violation of federal laws. One firm even warned about trading securities of a competitor based on company information. Another warned about purchasing property based on inside information. Of the remaining twenty-seven firms, eight cautioned employees about using confidential corporate information for personal gain. These warnings varied from giving or selling the information to others through personal exploitation of corporate business opportunities to preservation of confi-

[31] The list of companies is available from the author on request.

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dential information. These warnings were embedded in other general statements about conflict of interest between the firm and the employee. For the remaining nineteen firms, there was no mention of insider trading.

To interpret the warnings in company code of ethics documents, it is important to note that ITSFEA of 1988 requires top executives to implement the necessary procedures to prevent insider trading by any employee of the firm. Hence, over time, most (if not all) firms will have specific warnings against insider trading in some form to demonstrate that their top executives are in compliance with ITSFEA. Nevertheless, two years after the passage of ITSFEA, a full 50 percent of companies' code of ethics documents do not mention insider trading.

VI. Conclusions and Interpretations

The decade of the 1980s witnessed significant increases in insider-trading sanctions. Legislation increased the maximum criminal fines to $1 million and prison sentences to ten years and accompanied this with significant increases in enforcement. The new statutes also enabled recovery of treble damages from insiders, created a bounty program for informants, held top management responsible for employee compliance, and created a right of action for traders who lost to insiders. This study has examined the effects of these increased sanctions on corporate insiders.

In spite of the increased statutory sanctions of the 1980s, corporate insiders earned an average of about 5.1 percent (on a dollar-weighted basis) abnormal profits over a one-year holding period between 1980 and 1984, increasing further to 7.0 percent after 1984, compared with 3.5 percent before 1980. During the 1980s, insiders increasingly sold stock before bad news. Moreover, after increases in regulations, data indicate that a larger volume of insider-trading activity was followed by greater favorable abnormal price movements. Also, top executives appear to have traded on more valuable private information in the 1980s.

Data also show increases in the volume of insider-trading activity over time. On average, the number of shares traded by insiders increased by four times from the pre-1980 to the post-1984 subperiod. Also, the frequency of large-volume insider trading increased after the ITSA became law in 1984. In fact, insiders did not reduce their trading activity even on a temporary basis following changes in regulations.

Evidence also shows that court cases regarding insider trading around the time of earnings and takeover announcements did affect insider-trading patterns. Over time, insiders displayed a greater reluctance to exploit earnings announcements and takeover information. Top execu-

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tives displayed an even greater reluctance to exploit earnings and takeover information. Taken together with increases in overall volume and profitability, the evidence is consistent with the interpretation that greater involvement by the courts have given insiders greater latitude to trade on the basis of increasingly more valuable privileged information not directly covered by case law.

Neither the shareholders nor the statutes enacted during the 1980s seemed to provide additional effective constraints on insider trading. This evidence suggests that everyday insider trading does not fall under the definition of legally material information. The statutes enacted in the 1980s may not have provided additional constraints on insider trading for a number of reasons: (i) Congress never intended to regulate everyday insider trading; (ii) there was too much insider trading relative to the resources available to enforce the statutes; (iii) the requirements for legally material information were highly stringent and did not cover most insider trading; or (iv) the legal requirements to prove fraud under the criminal statutes were too costly. Whatever the reason, corporate insiders were able to profitably trade on economically important private information not covered by case law.

Data indicate that effective constraints on insider trading come from case law rather than from statutes or shareholders. This evidence is consistent with the interpretation that shareholders do not desire additional restrictions on insider trading. Had insider trading been entirely detrimental to their interest, shareholders would have explicitly restricted all trading by corporate officials. To date, however, shareholders have not generally restricted insider trading in corporate charters or employment contracts. A majority of corporations do not appear to be concerned with insider trading in their code of ethics documents. Moreover, shareholders have not restricted insider trading by the corporation itself.

APPENDIX A

A Simple Model of Insider Trading and Sanctions

Consider a risk-neutral insider who maximizes expected profits net of sanctions costs by trading on private information:

$$E\pi = iS - cS\,p(cS), \tag{A1}$$

where i denotes the absolute value of the expected price changes based on insiders' private information and S is the number of shares insiders choose to trade. Hence, S is always positive. Without loss of generality, assume that stock price equals one. The expected variable cost of sanctions are denoted by c. Lawyers' fees usually amount to $.2i$. Disgorgement of profits implies $c = i$. Treble damages implies $c = 3i$. There are additional fixed costs of sanctions such as jail sentences,

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criminal fines, and loss of employment. Without loss of generality, these costs are ignored to keep the analysis simple.

The probability that sanctions will be imposed is denoted by $p(cS)$. The motivation behind this enforcement function is twofold. First, the SEC's market surveillance program ("stock watch") examines unusually large trading volumes prior to large price changes in each firm for possible insider-trading violations. Hence, greater insider trading is more likely to lead to detection. Second, lawyers' fees are usually a percentage of insiders' trading profits. Another common penalty is disgorgement of profits (subsequently, three times the profits). Finally, the bounty program gives informants up to 10 percent of insiders' illegal profits. Hence, greater sanctions increase the rewards to outsiders who uncover insider trading, thereby increasing the probability of detection. For simplicity, take Taylor's series expansion of the probability of detection around current insider-trading levels and truncate all second-order and higher terms:

$$dp/d(cS) > 0,$$

and (A2)

$$d^k p/d(cS)^k = 0,$$

where $k > 1$.

The first-order condition for a maximum of $E\pi$ is given by

$$\delta E\pi/\delta S = i - pc - c^2 S\, p' = 0, \tag{A3}$$

where p′ denotes the derivative of p with respect to its argument, cS. Solving equation (A3) for S yields[32]

$$S = \max\,[0, (i - pc)/(c^2 p')]. \tag{A4}$$

The second-order condition for a maximum of $E\pi$ is given by

$$\delta^2 E\pi/\delta S^2 = -(2c^2\, p') < 0. \tag{A5}$$

To examine the comparative statistics, take partial derivative of S with respect to c and i and solve for $\delta S/\delta i$, $\delta S/\delta c$, and $\delta^2 S/\delta i \delta c$. First, examine the relation between private information and insider trading. Totally differentiate equation (A3) with respect to i, and solve for $\delta S/\delta i$:

$$\delta S/\delta i = 1/2c^2 p' > 0. \tag{A6}$$

Equation (A6) yields the first testable proposition: *an increase in insiders' private information will lead to increased trading*. Hence, insiders are expected to trade a greater number of shares when they have more valuable information.

Now examine

$$\delta S/\delta c = -[(p + Scp')\,(c^2 p') + (i - pc)\,(2cp')]/2(c^2 p')^2 < 0. \tag{A7}$$

Since insiders would not trade unless profits are positive, all terms inside the brackets are positive. Hence, equation (A7) produces the model's second testable implication: *an increase in sanctions unambiguously decreases insider trading*. Hence, following the changes in regulations in the 1980s, insider-trading volume is expected to decline.

To examine the relation between insiders' response to information and sanc-

[32] Hence, in a world with no fixed sanctions and only a disgorgement of profits, insiders will always trade. From equation (4), $S = (1 - p)/ip' > 0$.

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tions, examine the cross partial $\delta^2 S/\delta i \delta c$:

$$\delta^2 S/\delta i \delta c = -1/c^3 p' < 0. \tag{A8}$$

Equation (A8) yields the third testable implication: *an increase in sanctions will reduce the positive relation between insiders' private information and number of shares traded.* Following the change in regulations in the 1980s, large-volume transactions should be associated with less valuable information when compared to the period before 1980.

APPENDIX B

Event Study Methodology

This study uses the market model to measure the expected returns to securities. The market model is a statistical model based on the assumed joint normality of the distribution of security returns. Given parameter stationarity, the market model prediction errors have an expected value of zero for firms of any size, thereby avoiding a firm-size bias introduced by the capital asset pricing model (CAPM).[33] Market model parameters α_i and β_i are estimated using sixty months of data after excluding eighteen months before and after the insider-trading month. If less than thirty months of return data are available for estimation of the market model parameters, then that event is excluded. Hence,

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \epsilon_{i,t}, \tag{B1}$$

from $t = -48$ to -19 and 19 to 48, where $r_{i,t}$ is the simple with-dividend return to security i on month t, $r_{m,t}$ is the simple with-dividend return to the value-weighted portfolio of all New York Stock Exchange and American Stock Exchange stocks on month t, and $\epsilon_{i,t}$ is the security-specific component of the return. Using return data before and after the insider-trading event attempts to capture any risk changes associated with insiders' transactions. The prediction error $\mathrm{PE}_{i,t}$ for security i on month t, from twelve months before to twelve months after each event month is calculated as follows:[34]

$$\mathrm{PE}_{i,t} = [r_{i,t} - (\alpha_i + \beta_i r_{m,t})]H, \tag{B2}$$

[33] The ratio of the net number of purchases to the net number of sales is greater than one in small firms and less than one in large firms. Banz and Reinganum document that the CAPM residuals are on average positive for small firms. See Rolf W. Banz, The Relationship between Return and Market Value of Common Stocks, 9 J. Fin. Econ. 3 (1981); and Mark R. Reinganum, Misspecification of Capital Asset Pricing, Empirical Anomalies Based on Earnings Yields and Market Values, 9 J. Fin. Econ. 19 (1981); see also Donald B. Keim, Size-related Anomalies and Stock Return Seasonality: Further Empirical Evidence, 12 J. Fin. Econ. 13 (1983). Since the majority of insider transactions in small firms are open-market purchases, the positive CAPM residuals will be associated with insiders' purchases, even if insider trading conveys no information. A similar consideration holds for CAPM benchmark and large firms. See Seyhun, *supra* note 21, for evidence on this bias.

[34] See Eugene F. Fama, Foundations of Finance, at ch. 4 (1976), for a discussion of the market model. Steven J. Brown & Jerold B. Warner, Measuring Security Price Performance, 8 J. Fin. Econ. 205 (1980), and Steve J. Brown & Jerold B. Warner, Using Daily Returns: The Case of Event Studies, 14 J. Fin. Econ. 3 (1985), examine empirical event-study methodologies. As pointed out by Seyhun, *supra* note 21, it is important to exclude one year prior to insider trading from the estimation period since this would produce biased estimated of the market model parameters.

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for $t = -12$ to 12. The parameter $H = 1$ if the number of shares purchased exceeds the number of shares sold in that month, or $H = -1$ if the number of shares sold exceeds the number of shares purchased. If the number of shares purchased equals the number of shares sold, then that month is excluded.[35]

The average portfolio prediction error in firm i for event month t, $\mathrm{APE}_{i,t}$, is the weighted averages of all prediction errors for that event month:

$$\left.\begin{aligned} \mathrm{APE}_{i,t} &= \left(\sum_{j=1}^{180} \mathrm{PE}_{i,t} W_{ij}\right) \Big/ \sum_{j=1}^{180} W_{ij}, \\ \text{and} \qquad & \\ \mathrm{APE}_t &= \left(\sum_{i=1}^{K_t} \mathrm{APE}_{i,t}\right) / K_t, \end{aligned}\right\} \tag{B3}$$

for $t = -12$ to 12, where K_t equals the number of prediction errors in month t. For dollar-weighted average prediction errors, W_{ij}, equals the absolute value of the dollar volume of insider trading in firm i and month j. There are a total of 180 months from January 1975 to December 1989. The gross abnormal profit from exploiting insider-trading information is measured by the cumulative monthly average prediction error from event month 1 (the month following the month in which insiders trade) to month T, GAP(T), which is calculated by summing the monthly average prediction errors:

$$\mathrm{GAP}(T) = \sum_{t=1}^{T} \mathrm{APE}_t. \tag{B4}$$

To retain as much information as possible, all open-market transactions by executives for the firms represented in the sample are included for study. The standard errors of the gross abnormal profits are measured by taking into account the sample serial correlation of the time series of abnormal returns. The general formula for the variance of a sum is used to compute the standard error of the gross abnormal profits. Hence,

$$s(\mathrm{GAP})(T) = \left[\sum_{i=1}^{T-t+1} \sum_{j=1}^{T-t+1} \mathrm{cov}(\mathrm{APE}_i, \mathrm{APE}_j)\right]^{1/2}, \tag{B5}$$

where covariance between APE_i and APE_j, cov (APE_i, APE_j), is estimated from a third-order, unconstrained autoregressive model for APE_t using Box and Jenkins methods.[36] The estimated model for APE_t is represented as follows:

$$\mathrm{APE}_t = \delta_0 + \delta_1 D + \phi_1 \mathrm{APE}_{t-1} + \phi_2 \mathrm{APE}_{t-2} + \phi_3 \mathrm{APE}_{t-3} + \eta_t, \tag{B6}$$

where indicator variable $D = 1$ for the six months prior to the insider-trading

[35] For alternative definitions of the event in terms of the number of traders, see Seyhun, *supra* note 21, and Jaffe, Special Information, *supra* note 21.

[36] George E. P. Box & Gwilyn M. Jenkins, Time Series Analysis, Forecasting, and Control (1976).

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month and zero otherwise. The indicator variable D is included to take into account the differences in mean abnormal returns before and after the insider-trading month. For each model using equation (B6), the Box-Pierce Q statistics at lags 6, 12, and 18 are insignificant, indicating that the residuals, η_t, are serially uncorrelated.

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