Empirical Evidence on Economic and Financial Aspects of Intensive Insider Trading

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Contents

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Introduction

Over the recent years, insider trading has been notably attracting the attention of scholars, policy makers, and the investment community. Despite the heightened media attention, the issue of insider trading is still poorly understood by the general public. This is oftentimes a result of miscommunication, as the cases reported on the news refer only to instances of illegal dealing. In reality, however, most of the trading by corporate insiders, typically defined by law as officers, directors and substantial shareholders falls within the legal bounds. Violation of the securities laws occurs only when price-sensitive, undisclosed information is exploited in the trading process. By this logic, the mere fact that an individual affiliated to the company has conducted a profitable transaction does not necessarily imply the transaction's illegality.

Acts of illegal insider trading have been traditionally condemned on fairness grounds. However, as pointed out by Bainbridge (2000), the concept of fairness is difficult to quantify and has found little traction in the law and economics literature. Instead, academics examined the whole spectrum of potential limitations and merits of insider trading deregulation using standard policy evaluation tools, such as welfare analysis (see for instance Leland (1992)). Two arguments against a ban have been frequently cited. Insider trading could improve market efficiency and, thereby, resolve part of the uncertainty associated with future asset payoffs. It can also be regarded as a flexible form of managerial compensation in instances when managers produce value-increasing innovations. Notably the latter argument does not hold when the innovations are value decreasing. These two possible benefits, however, will have to be weighed against the reduced market liquidity, higher costs of capital, undermined public confidence and a decline in private information acquisition by outsiders.

Although the deregulation debate is certainly far from being settled and many countervailing views are being presented, the arguments advocating equal access to

information have seemingly gained more prominence. Similarly, government agencies around the world, in a strive to enhance their prestige or to enforce their statutory objectives, have made attempts to target the highly unpopular crime of insider dealing.

This thesis contributes to the deregulation dispute by providing new insights into the patterns and market implications of insider trading. Furthermore, it recommends some practical guidelines for stock market investing based on insider trading data and outlines the prospective challenges to be faced by the regulators. The inferences presented here are based on the insider trading reports filed with the Polish Securities and Exchange Commission and the New Zealand Exchange. The law in both of the countries requires mandatory disclosure of changes in shareholdings by corporate insiders, securing thus a great deal of statistical material for an empirical investigation. With the data on disclosed insider trading at hand this thesis attempts to fill in some of the voids in the existing literature by propounding and verifying a number of theoretical predictions.

Most of the previous insider trading research focused exclusively on the U.S., which is arguably perceived to be the most transparent and thriving marketplace in the world. Importantly, the behavior of corporate insiders will derive and be defined by the legal and institutional setting in which they operate. Consequently, additional results from countries with different regulations and enforcement regimes could broaden our understanding of the insider trading phenomenon. More specifically, one could presume that the exploitation of material nonpublic information would be more prevalent in New Zealand and Poland. Although arguing that these markets suffer from dysnomy may be unjust, much still remains to be done in terms of improving the effectiveness of judicial proceedings and amending certain formal and informal aspects of law enforcement.

The remainder of this thesis comprises four interrelated, empirical papers and a final section with concluding remarks. First, the undue transaction profits accruing to supervisory and executive boards members, and their next of kin are examined. The cumulative abnormal

returns following insider trades are then linked to firm characteristics and trade attributes. The results of these cross-sectional regressions have meaningful implications for those who, in an attempt to beat the market, mimic insider transactions. The subsequent chapter investigates whether an aggregate insider trading index could be used to formulate forecasts about future stock market and macroeconomic fluctuations. The rationale behind any potential predictability found can be easily provided; insiders plausibly exploit their advanced knowledge of firms' future cash flows, which are dependent, both on the competitiveness of the individual firm and on economy-wide developments.

The third paper scrutinizes the market's reaction to earnings announcements conditional on prior instances of insider trading. It is conceivable that market participants decrypt the information on future company performance conveyed by insider deals. On the other hand, the benefit of the information transmission could be annihilated by the detrimental effect of insider trading on outsiders' information search. Specifically, market observers may be reluctant to collect and analyze information if the probability of trading against an insider is large. The question of whether insider trading improves or impairs market efficiency remains therefore a purely empirical issue.

Lastly, the implications of informed trading for the conditional, serial dependence of security returns are considered. Within a theoretical model Llorente, Michaely, Saar, and Wang (2001) argued that the dynamic relationship between return and volume is determined by the relative importance of private information trading versus trading for portfolio rebalancing reasons. Return continuations should be observed following large volume informed trades, whereas substantial hedging transactions induce return reversals. To verify these theoretical predictions the volume-induced autocorrelation coefficients of individual stocks are linked to a proxy of insider trading prevalence and other conventional informational asymmetry variables.

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The Information Content of Registered Insider Trading Under Lax Law Enforcement

I. Introduction

Corporate officers and directors are frequently in a position to have special knowledge of the affairs of their company. Some of the information at their disposal could be undisclosed and hence not yet discounted in stock prices. Having the prescience of events that are about to unfold or be reported, insiders are faced with temptation to exploit the informational asymmetries by trading profitably. On the other hand, the fear of potential litigation and adverse publicity may restrict insider gains.

Insider trading prohibitions and the commitment to implement existing legislation has generated a great deal of controversy. Contrary to prevalent beliefs and intuition, the academic literature seems to indicate that there is little, if any, relationship between the restrictiveness of regulation and insiders' opportunistic behavior (Jaffe (1974a), Seyhun (1992a), Banerjee and Eckard (2001)). What de facto matters to an agent who trades on the basis of his or her superior private information is the level of law enforcement (Bhattacharya and Daouk (2002)). The optimal enforcement of insider trading sanctions under nonzero investigation costs, however, is essentially a non-trivial issue. DeMarzo, Fishman and Hagerty (1998) show that the policy that maximises investors' welfare is one that permits a limited amount of insider trading, but if its volume exceeds a certain nonrandom threshold the maximum feasible penalty should be imposed.

This paper attempts to augment the scanty empirical evidence on the impact of law enforcement. This is done by evaluating the magnitude of excess profits to insiders in Poland who trade in a state of impunity. On the whole, the research into the issue of insider trading in emerging markets is severely limited due to the scarcity of available data. At the same time, the extant evidence indicates that trading on privileged information in markets with law

enforcement deficiency is the rule rather than the exception (Bhattacharya et al. (2000)), which is why our inferences could be of valuable assistance to surveillance and law enforcement divisions.

The Law on the Public Trading of Securities of 1997 specifies the civil and penal liability for exploiting material nonpublic information (Art. 176 section 2): "Whosoever in securities trading uses inside information shall be subject to a fine of up to 5,000,000 PLN and imprisonment from 6 months to 5 years." Furthermore, some of the enterprises listed on the Warsaw Stock Exchange (WSE) set their own insider trading policies through employment contracts. [1] In the twelve-year history of the WSE, the Polish Securities and Exchange Commission (SEC) forwarded to the public prosecutor 49 notifications on suspicion of breaching the aforementioned Art. 176. Nevertheless, in cases where prosecution follows, the effectiveness of the legal proceedings could be called into question. Merely one sentence has been passed on charges of insider trading; one year of imprisonment with a suspension of two years.

At times, the impasse in the enforcement of existing provisions generates heated polemics in the public domain. For instance, in her press interview [2], a prosecuting attorney from the Warsaw District Public Prosecutor's Office stated that one should not overemphasize the importance of securities law violations, as compared to other types of economic crime. As she put it: "Polish capital market is still in its infancy and only a small fraction of society is interested in its developments". She further admitted that cooperation with the SEC is not frictionless and many differences of opinion remain. Following her interview, the SEC issued a press release [3] expressing its deep concern with the statements made, for they belittle the problem of securities crime and erode the confidence in the capital market. Such disputes evince the extent to which SEC and public prosecution are unable to collaborate in gathering direct and circumstantial evidence in insider trading cases.

The perceived lack of punishment can induce corporate managers and members of supervisory boards to benefit from private information on their own rather than leak it to their friends and tippees.[4] Consequently, one would expect the registered trades of the corporate insiders to convey more information about the mispricings in their own companies. If it is indeed the case remains to be empirically verified and the Polish capital market seems to provide a good opportunity to test this conjecture. This is due to the conflict at which deterrence of regulations and the level of their enforcement remain.

Thus, the paramount objective of the study is to evaluate the magnitude of profits accruing to insiders from their legal transactions (i.e. trades reported to the SEC). Formally, the distribution of abnormal returns following the trades of individuals having monopolistic access to information is examined. Any evidence of excessive capital gains would be inconsistent with the strong form of market efficiency. Although it would be hardly surprising to find insiders earning substantial profits in trading shares of their own companies, the profitability analysis is not without its complexities. Evaluation can be hindered by the insiders' desire to act strategically in order to conceal their trading based on superior information. Reciprocal passage of information between insiders of different companies, trading on friends' accounts or the "gamesmanship" as described in Jaffe (1974b) would, in general, induce a downward bias in the estimates of true insider gains when using the legal transaction data. Although, the profits reported are likely to be understated, the wealth of evidence based on legal insider transactions has demonstrated their statistical significance (for further discussion see Section II).

The second hypothesis amenable to testing is that outsiders are able to outperform the market by imitating insider behavior. Following the publication date, the trades of executives become common knowledge and it is of interest whether a moneymaking investment rule based on this publicly available information could be designed. A phenomenon of profitable mimicry would be somewhat surprising and given the great number of earlier studies

supporting the semistrong form of market efficiency it would be noted as atypical in nature[5]. This study uses the all-important publication date of insider trades, which was included in Seyhun (1986), but subsequently omitted or proxied in later studies.

Performance analysis is embedded in a traditional event study framework and examines the average abnormal returns over a fixed time period around the trading and reporting dates. The control portfolio approach is employed to compute the benchmark model. Additionally, our inquiry pinpoints the determinants of individual cumulative abnormal returns by means of cross-sectional regressions. In particular, the profitability of each trade is linked to trade attributes and company characteristics. The insights provided could be of potential use to mimickers of insiders who strive to extract a credible signal about fundamentals from an overabundance of insider transactions.

The remainder of the paper is organized as follows. The next section reviews the previous research on insider trading profitability. Section III describes the sample selection procedure and Section IV the methodology used. The results are presented and elaborated upon in Section V. The paper ends with a summary and conclusions.

II. Related Literature

The volume of available empirical evidence on legal insider transactions makes the task of providing a complete literature review rather problematic. In general, the majority of studies can be sorted into one of three main categories. The first group comprises research on the intensity of insider trading prior to company specific events, such as bankruptcies (Seyhun and Bradley (1997)), stock repurchases (Lee, Mikkelson and Partch (1992)), or takeover bids (Seyhun (1990)). The evidence in this field is not clear-cut. Since trading around the disclosure date is associated with severe legal hazards, insiders are likely to refrain from trading or self-reporting their transactions (Meulbroek (1992), Bainbridge (2000), Ke, Huddart and Petroni (2001)).

The studies falling into the second category investigate the ability of aggregate insider trading to correctly time the movements in market indices (Seyhun (1988, 1992b, 2000), Lakonishok and Lee (2001)). The demonstrated predictive power arises from the fact that insiders tend to confuse firm-specific and economywide factors. Finally, a number of academics inspected the profitability of registered insider trades and the returns that accrue to outsiders who imitate these transitions (Jaffe (1974b), Seyhun (1986), Rozeff and Zaman (1988), Lin and Howe (1990), Eckbo and Smith (1998), Lakonishok and Lee (2001)). As this particular class of research is in line with our investigation, a closer look at the results to date should prove insightful.

The first article by Jaffe (1974b) largely corroborates the results of earlier work; namely market inefficiency vis-à-vis insider trading. Yet, his finding that outsiders can benefit from information on heavy insider trading as long as eight months after its public release can be deemed astonishing. Seyhun (1986) propounds a rationalization of this anomalous result. Although he also finds that insiders earn abnormal returns (on average 3.1% within 300 trading days following the transaction) the gains to mimickers are statistically insignificant. Seyhun argues that the outsider profits reported by Jaffe can be chiefly attributed to the application of the Sharpe-Lintner CAPM as a benchmark model. Insiders seem to be more active in small firms for which the sample mean returns are higher than expected if the market portfolio was mean-variance efficient (Banz (1981)). Using a less restrictive benchmark like the market model in which prediction errors have zero expected value irrespective of company size can alleviate the bias.

With this peculiarity in mind, Rozeff and Zaman (1988) control for the size and earnings-to-price ratio effects while examining NYSE companies following intensive insider trading months. [6] Their data reveal that in the year following an approximate date of publication in the *Official Summary* the average abnormal return amounted to 2.28%. Consequently, after accounting for transaction costs outsiders would not find it extremely

lucrative to trade upon this information. The abnormal returns to insiders appeared to be considerably higher, around 5.16%.

Lin and Howe (1990) investigate the OTC market, which is believed to have a higher potential for inefficiency, nevertheless the magnitude of their estimates is in line with Seyhun (1986) and Rozeff and Zaman (1988). Interestingly, the high average relative bid-ask spread in this market (almost 7%) precludes profits from most of the active trading strategies. Additionally, they show that insiders affiliated and directly involved in operations of the company tend to trade on more valuable information.

The subsequent comprehensive study of Lakonishok and Lee (2001) scrutinizing reported transactions on the NYSE, Amex and Nasdaq markets reassuringly conforms with the former evidence. Lakonishok and Lee split the sample of companies into deciles according to their net insider purchase ratio. When only managerial trades are considered the difference between the highest and lowest decile portfolio returns equaled 7.7%. After adjustment for size and book-to-market effects the spread between the two extreme portfolios narrowed to 4.8%.

The results of the last paper discussed contrast sharply with virtually all the remaining literature in this field. Eckbo and Smith (1998) examine insider trades on the Oslo Stock Exchange using conditional performance measures that allow expected stock returns to be time-varying. The portfolios of insider holdings produce statistically insignificant or negative abnormal performance. Notwithstanding, this peculiar finding can be ascribed to the novel methodology they employ rather than to the data characteristics alone. After applying the standard event study analysis their findings become more conventional.

Overall, the earlier studies unanimously substantiate that corporate insiders are in possession of superior information and amply benefit from its use. More controversy arises around the issue of whether outsiders can profit from the information on insider trades after its public disclosure. Although there is little convincing evidence in support of this hypothesis,

some skepticism is advisable while evaluating all these studies; only Seyhun (1986) used the actual publication dates, which form the backbone of any performance analysis.

III. Data

The trading data used for this study were extracted from the daily news announcement archive of the Penetrator brokerage house at http://www.penetrator.com.pl/serwis/, and copied by hand. Pentrator database is a comprehensive archive covering the entire range of publicly disseminated news for all of the companies listed on the Warsaw Stock Exchange, accessible free of charge. The sample comprises insider transactions reported to the SEC between February 2000 and August 2002. We apply several filters to clean up the initial data. First, the transactions reflecting acquisition of stocks through the exercise of managerial options and warrants or other executive compensation schemes are discarded.[7] Second, transaction prices are compared with the actual daily quote and suspicious observations are omitted rather than adjusted. A complete database with quotes was obtained upon request from the WSE. The companies had also to be listed 100 trading days prior to the insider trading date and 250 days thereafter. This selection criterion ensures that we are able to estimate abnormal returns around the event date. In addition, we disregard trades between insiders of the same company, as the most probable motivation behind such transactions is fight for corporate control, rather than exploitation of nonpublic information. Inclusion of these observations is unlikely to change our main conclusions, as a trade between two insiders is essentially a zero-sum game.

In total 306 trades of supervisory and executive board members and their next of kin in 91 companies are included. 210 individuals were identified as members of the board of executives, 87 belonged to supervisory bodies and 9 transactions can be linked to spouses of insiders. The trade value is distributed within a range of 178 to 138,736,800 zloty [8] and a median of 99,629 zloty. The mean sample capitalization of 694 million zloty was insignificantly greater than that computed for the entire market (619 millions). Accordingly,

the conjecture that insider trading is heavier in small companies is neither conclusively confirmed nor invalidated by the nature of our data. The breakdown according to order type reveals that sales constitute 49% of the entire sample.[9]

IV. Methodology

The market model is undoubtedly the most prevalent specification used to describe the behavior of normal returns in the event-study literature. The procedure amounts to an estimation of the model during a period immediately preceding an event window and examining the prediction errors around the event date (Fama, Fisher, Jensen and Roll (1969), Brown and Warner (1985)). A notable alternative to this conventional benchmark is a control portfolio approach performed in Huberman and Kandel (1985) and Rozeff and Zaman (1988). Conceptually, this methodology hinges upon the notion that a portfolio of shares matched exactly by capitalization and book-to-market value to a share that experienced insider trading should bear the same return, assuming that the insider did not make use of confidential information.

The control portfolio approach has a particular appeal in the context of our analysis for at least three reasons. First of all, the considered time interval on the WSE was marked by low liquidity. Infrequent trading could render the conventional estimates of beta in the market model unreliable (Lo and MacKinlay (1990)). Second, unlike the market model, the control portfolio methodology does not require an estimation period. Considering the brief listing history of most Polish companies, the requirement of any reasonable estimation window would cut the sample size substantially. Furthermore, the price time series of many Polish stocks seem to be very erratic and follow bubble-like paths. The parameters of the market model are instable, resulting in unreasonable predictions. Some of the predictions are off by

large magnitudes and it is questionable whether they will diffuse in the process of aggregation.

The control portfolios are constructed as follows. At the end of the first quarter of each year all securities listed on the WSE were ranked and divided into three groups according to their market capitalization. Shares in each of these groups were subsequently split into three subgroups according to their book-to-market ratio. Finally, the returns on the nine control portfolios were computed by averaging the continuously compounded returns on the securities in each of the nine groups created.[10] The abnormal returns from 100 days before until 250 days after the event were calculated by deducting the return on the control portfolio from the return on the security that experienced insider trading:

$$AR_{i,t} = r_{i,t} - r_{cp(i),t} \qquad for \quad t = -100,250 \qquad [1]$$

where $r_{i,t}$ is the return on security i on day t, and $r_{cp(i),t}$ is the return on a control portfolio corresponding to security i on day t.

The abnormal returns were aggregated over time across all the events and the average abnormal return was calculated:

$$\overline{AR}_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t} \qquad for \quad t = -100,250 \qquad [2]$$

where $\overline{AR}_t$ is the average abnormal return on event day t and N is the total number of events. The average abnormal returns are summed over particular time intervals to obtain cumulative abnormal returns:

$$CAR(t_1,t_2) = \sum_{t=t_1}^{t_2} \overline{AR}_t \qquad [3]$$

where t_1 and t_2 are, respectively, the beginning day and ending day of the summation.

As in Foster, Olsen and Shelvin (1984), the statistical significance of the observed average cumulative abnormal returns was evaluated by comparing them with the empirical

distribution of CARs for the random sample of firms. The method of repetitive sampling from the actual data to estimate the true distribution was initially introduced by Efron (1979) and in the context of event studies the bootstrap-based tests have been shown to be an effective remedy against heteroscedasticity, non-normality, cross- and autocorrelation problems (Kramer (2001)).

The empirical distribution is generated as follows. From the entire population of companies listed between February 2000 and August 2002 and the universe of trading dates within that period, *n* combinations of firm/date are randomly selected. The parameter *n* takes the value of 306 when the overall sample profitability is tested, 151 for sale transactions and 155 for purchases. The average cumulative abnormal return for the resulting sample is computed over the time interval in question. The procedure is repeated 2000 times and the sample CARs are ranked from the lowest to the highest to obtain the empirical distribution. The bootstrap p-value is calculated as *S*/2000 for CAR > 0 and (1-*S*/2000) for CAR < 0, where S denotes the number of the simulated values above the actual profitability.

To check the robustness of conclusions based on the bootstrap test, an alternative nonparametric test is applied free of specific assumptions concerning the underlying abnormal return distribution. Under the null hypothesis that insiders do not exploit private information in security trading, positive and negative abnormal returns are equally probable. The sign test statistic is given by:

$$z_{sign} = \frac{p - 0{,}5}{\left[p(1-p)/N\right]^{1/2}} \sim N(0,1) \qquad [4]$$

where *p* is the proportion of positive abnormal returns in the sample of size *N*.

The determinants of the profitability of insider trades are explored by running regressions of CAR(1,100) and CAR(1,250) on several categorical and continuous variables. Least squares approach is used for the estimation and the White(1980) heteroscedasitcity-consistent standard errors are provided. The regressions for each of the dependent variables

are performed in three different variations. This allows to us investigate the sensitivity of the estimates to the deletion and inclusion of new variables.

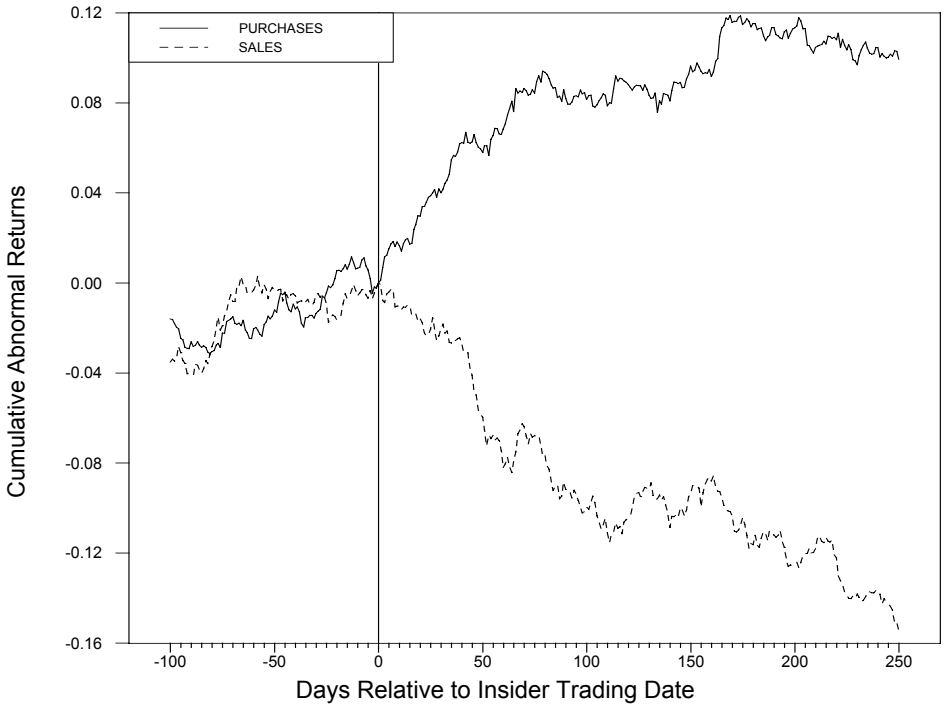
V. Empirical Results

A. Trade Performance

Figure 1 depicts the cumulative abnormal returns for sales and purchases relative to the insider-trading day. The stock prices drift in the direction of insider trades and the estimates of the profits to insiders appear to be significantly higher than those reported for mature markets. Direct comparison of the estimates should be approached with caution, though. The sample under investigation does not comprise the trades of large shareholders, which have been shown to carry the least information (Seyhun (1986), Lin and Howe (1990), Lakonishok and Lee (2001)). Had these transactions been included the average profitability would have been driven down naturally. Another plausible rationale for the observed extent of profits could be the higher opportunity cost of holding shares. Throughout the considered time span, the weighted average interest rates on 12-month zloty deposits equaled 11.39%. The high risk-free rate could constitute a real disincentive to investing based on immaterial information. Although these explanations seem raesonable enough, the gains are too sizeable to be ascribed solely to these two factors. Therefore, we propound the lax enforcement of insider trading regulations as a justification for our results.

Figure 1

Cumulative abnormal returns around insider trading date



Cumulative abnormal returns over days –100 to 250 relative to the insider trading day, separated by purchase and sale transactions.

The estimates provided in Table 1 show that the cumulative abnormal returns for one year amount to 9.9% for purchases and – 15.4% for sales. These findings may suggest that corporate insiders exploit their privileged position by trading on upcoming disclosures. A recent paper by Wisniewski (2003) investigated whether insider share dealings on the Polish market are linked to impending earnings innovations. He found that insiders utilize their foreknowledge of trends in future profitability of the firm. The puzzling conclusion, however, was that insiders traded on information regarding future, rather than current, earnings announcements. At first sight, this result may not conform with the substantial short-term abnormal returns reported in our study. However, following their transactions insiders could self-servingly issue voluntary managerial forecasts, in order to move the prices in the

direction of the trade. Alternatively, as argued by Givoly and Palmon (1985), part of the short run gains could be a manifestation of a self-fulfilling prophecy.

Table 1

Insiders' CARs and significance tests

Event period	CAR	Bootstrap p-values	Sign test
		Purchases	
(-100,0)	0.0174	0.3095	-0.7241
(1,100)	0.0816	0.0005	5.7510
(1,250)	0.0994	0.0260	3.2367
		Sales	
(-100,0)	0.0366	0.0755	3.4668
(1,100)	-0.0994	0.0005	0.0814
(1,250)	-0.1540	0.0010	-0.0814
		Overall Sample	
(-100,0)	-0.0092	0.3140	-2.8972
(1,100)	0.0904	0.0000	3.7414
(1,250)	0.1263	0.0005	2.3064

Cumulative daily average abnormal returns and significance tests for selected periods around insider trading day.

An intriguing observation is that the Polish insiders are not found to be as strongly contrarian as their peers in the U.S. The probable origin of this dissimilarity is the different autocorrelation structure of security returns in the two markets. DeBondt and Thaler (1985, 1987) and Fama and French (1988) identified long-run mean reversions in returns, which generate abnormal returns to selling past winners and buying past losers. On the other hand, only 3.6% of companies included in our sample exhibit significantly negative serial correlation of monthly returns. Although the profits from negative feedback trading could be subject to a more exhaustive analysis, preliminary tests show that they may not have been economically meaningful on the Polish stock market.

Following the event date, the nonparametric sign tests for purchases reported in Table 1 essentially coincide with the bootstrap test. A noteworthy deviation is the disputable

significance of the cumulative abnormal return for sales. Such a constellation of test statistics indicates infrequent occurrences of genuinely profitable sale transactions camouflaged with numerous liquidity trades. This deliberate insiders' conduct could potentially misguide market participants and regulators.

B. Cross-Sectional Determinants of Profits

The results of the previous section bring to mind several intriguing questions. Namely, what are the origins of the demonstrated informational advantage and is it uniform across insiders? Many of the earlier studies have fallen short of scrutinizing these matters. A formal analysis could yield precious recommendations for investors trying to imitate insiders, in a sense that it will allow them to identify the most lucrative trading opportunities.

We address the questions raised by running least squares regressions of trade profitability on a set of explanatory variables. Tables 2 and 3 report the results. The regressants are the cumulative abnormal returns after 100 and 250 trading days following the insider trading date. The two different specifications of the dependent variable provide a robustness check of our estimates. The regressors are dichotomous variables for insider type, sale dummy, time trend, value of transaction, the extent of reporting delay, market capitalization of the company and its book-to-market ratio.

The quality of information used in security trading by insiders who serve on the supervisory and executive boards comes into view as rather homogenous. On the other hand, the family members of insiders showed a nonpareil ability to time their deals correctly. Apparently, transactions on a spouse's account leave the insider leeway to avoid direct penal liability and encourage exploitation of more valuable information. The kin's profit estimates in model (i) are twice as high as the estimates for the two other insider groups and amount to 19% within 100 trading days and 23.7% within a calendar year. Interpretation of this result,

however, is subject to the caveat that there are only nine transactions of insiders' relatives in the sample.

Table 2

Cross-sectional regressions on CAR(1,100)

VARIABLE	(i)	(ii)	(iii)
Executive Board	0.0842***	0.0518	0.3676
	(0.0255)	(0.1445)	(0.2344)
Supervisory Board	0.0991*	0.0833	0.3879*
	(0.0515)	(0.1541)	(0.2166)
Family Member	0.1900	0.1362	0.4386
	(0.1678)	(0.2374)	(0.2795)
ln (Trade Size)	–	0.0113	0.0140
		(0.0127)	(0.0140)
Delay	–	0.0013	0.0015
		(0.0018)	(0.0017)
Sale	–	-0.0048	-0.0146
		(0.0494)	(0.0493)
Trend	–	-0.0003***	-0.0003**
		(0.0001)	(0.0001)
ln (Size)	–	–	-0.0167
			(0.0132)
B/M	–	–	-0.0412***
			(0.0108)
R-squared	2.04 %	2.73 %	3.96 %

Least squares regression results of the cumulative abnormal returns from 1 day to 100 days following the insider trading date on type of insiders, trade and company characteristics. The White (1980) heteroscedasticity-consistent standard errors are shown in parentheses. CAR(1,100) for sales are multiplied by –1. *Executive Board* = 1 if the trader is a member or the chairman of the executive board, otherwise *Executive Board* = 0. *Supervisory Board* = 1 if the trader is a member or the chairman of the supervisory board, otherwise *Supervisory Board* = 0. *Family Member* = 1 if trader is a next of kin of an insider, otherwise *Family Member* = 0. *ln(Trade Size)* is the natural log of the trade value (in zloty). *Delay* is the difference in days between the trading date and the date on which the transaction has been reported. *Sale* = 1 if the transaction is a sale, otherwise *Sale* = 0. *Trend* is the session number, with *Trend* = 1 for the first transaction in the sample. *ln(Size)* is the natural log of market capitalisation of the company on the insider trading day and *B/M* is its book-to-market ratio.

*** Significant at 1% level

** Significant at 5% level

* Significant at 10% level

Table 3

Cross-sectional regressions on CAR(1,250)

VARIABLE	(i)	(ii)	(iii)
Executive Board	0.1181**	0.0942	-0.0138
	(0.0445)	(0.2432)	(0.3828)
Supervisory Board	0.1410*	0.1401	0.0458
	(0.0846)	(0.2485)	(0.3654)
Family Member	0.2371	0.1986	0.1079
	(0.2659)	(0.3850)	(0.4576)
ln (Trade Size)	–	0.0079	0.0026
		(0.0212)	(0.0228)
Delay	–	0.0046*	0.0044*
		(0.0024)	(0.0023)
Sale	–	0.0382	0.0266
		(0.0847)	(0.0854)
Trend	–	-0.0003	-0.0003
		(0.0002)	(0.0002)
ln (Size)	–	–	0.0103
			(0.0206)
B/M	–	–	-0.0354
			(0.0330)
R-squared	0.10 %	1.85 %	2.27 %

Least squares regression results of the cumulative abnormal returns from 1 day to 250 days following the insider trading date on type of insiders, trade and company characteristics. The White (1980) heteroscedasticity-consistent standard errors are shown in parentheses. CAR(1,250) for sales are multiplied by –1. *Executive Board* = 1 if the trader is a member or the chairman of the executive board, otherwise *Executive Board* = 0. *Supervisory Board* = 1 if the trader is a member or the chairman of the supervisory board, otherwise *Supervisory Board* = 0. *Family Member* = 1 if trader is next of kin of an insider, otherwise *Family Member* = 0. *ln(Trade Size)* is the natural log of the trade value (in zloty). *Delay* is the difference in days between the trading date and the date on which the transaction has been reported. *Sale* = 1 if the transaction is a sale, otherwise *Sale* = 0. *Trend* is the session number, with *Trend* = 1 for the first transaction in the sample. *ln(Size)* is the natural log of market capitalisation of the company on the insider trading day and *B/M* is its book-to-market ratio.

*** Significant at 1% level

** Significant at 5% level

* Significant at 10% level

Model (ii) in Tables 2 and 3 measures, among others, the incremental impact of the reporting delay in days and the natural log of trade value on the cumulative abnormal returns. The logarithmic specification of the value of trade makes it possible to assign smaller weights to some exceptionally large trades. It is difficult to predict the influence of these factors *a priori*. Intuitively, the amount of money a risk averse insider puts at stake should be positively

linked to the quality of the private signal he receives. On the other hand, breaking the order into smaller lots or acquiring and disposing of his shares over a longer time period could moderate the unwanted attention. Akin dichotomous reasoning applies to the extent of the reporting delay. Trades based on privileged information are unlikely to be reported around the announcement date, as it is a period of intense regulatory surveillance. Accordingly, for the most profitable trades some delay is expected. Contrarily, the mechanism of self-selection into reporting once the profitability is observed suggests a relationship in the opposite direction.

To a certain extent these theoretical quandaries are reflected in the estimates reported. The slopes of *ln(Trade Size)* in models (ii) and (iii) shown in Tables 2 and 3 are not significantly different from zero, though all of them bear a positive sign. Accordingly, the claim that the value of insiders' investment is proportional to the degree of security misvaluation is only weakly validated in our data. With regard to the reporting delay, evidence is somewhat more definitive. All of the *Delay* coefficients are positive and two of them show statistical significance at the 10% level. Thus, the postponement of trade disclosure is perceived by corporate insiders as a way to mislead the regulators and public opinion.

Additional explanatory variables of interest are the sale indicator and the time trend. The numbers provided in Table 1 suggest that, on average, sales were more profitable than purchases. Nevertheless, after accounting for a wide spectrum of trade and firm attributes the slope of the dummy is insignificant. Curiously, the partial derivative with respect to time trend is negative in all considered cases, with the inverse relationship being particularly strong for the cross-sectional regressions on CAR(1,100). This finding indicates that Polish insiders were becoming more anxious over time when conducting short-term speculative deals. An alternative explanation could be that the market was converging to efficiency. Either way, the

increasing transparency is clearly desirable and hopefully this beneficial tendency will continue in the future.

Regression (iii) attempts to establish a link between the informativeness of a trade and company characteristics such as size and book-to-market values. Size is defined as the natural log of the company market capitalization on the insider-trading day. Hypothetically, large blue chips could be deemed to have a lower potential for informational asymmetries, as their affairs are subject to extensive media coverage. Nevertheless, the results reported in Tables 2 and 3 do not validate the supposition that small companies are less efficiently priced. The estimates of *ln(Size)* coefficients are statistically insignificant and vary in sign depending on the specification of the regressant.

The irrelevance of firm size to the magnitude of insider trading profits is particularly distinctive and discords with the U.S. sample-based empirical findings (see for instance Seyhun (2000) and Lakonishok and Lee (2001)). It has to be noted, however, that the WSE is characterized by a complete absence of large multinationals and the mean company capitalization is roughly ten times smaller than in the U.S. Consequently, the intra-firm barriers in information flow, formal and informal Chinese Walls arrangements inherent to colossal organizational structures are unlikely to be a pertinent factor in this context. Moreover, the number of top executives across companies tends to follow a relatively uniform distribution. This remark is of relevance, given that a wide class of Kyle (1985) – type models predicts the average insider trading profits to decrease monotonically in the number of informed competitors.

Compared to size, the influence of the book-to-market ratio on the cross-sectional estimates of profitability appears to be more meaningful. The coefficient of B/M is significant at the 1% level when the cumulative abnormal returns from day 1 to day 100 following the insider trading date are considered. Interestingly, it looses its predictive power for longer post-

event periods. These findings are consistent with an initial overreaction to news announcement in the innovative technologies market segment.

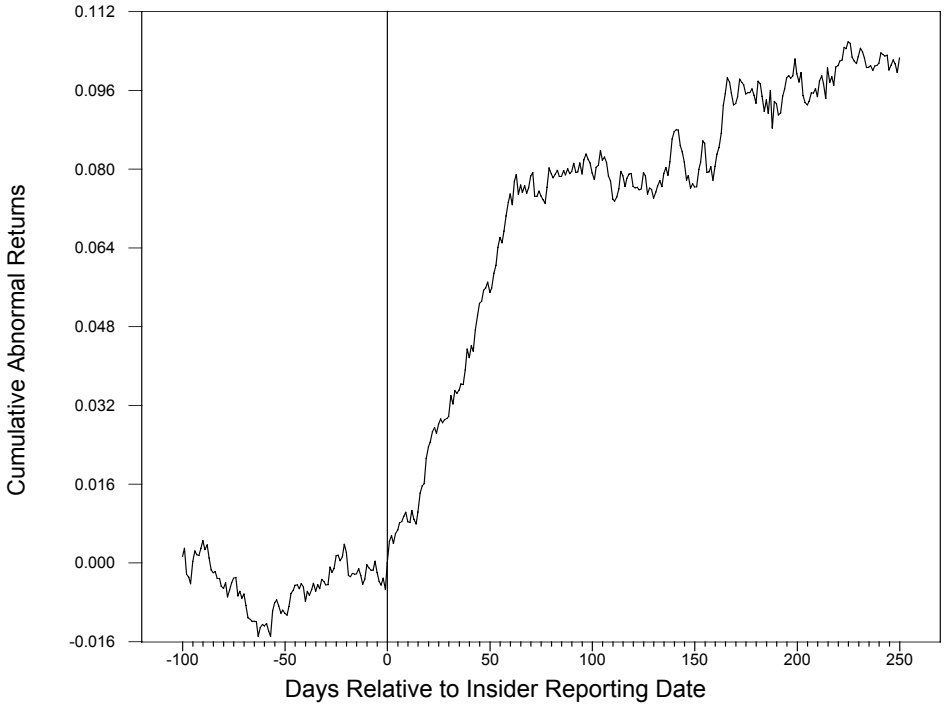
Although intuitively appealing, the results presented in this section should be approached with trepidation. In none of the regressions shown in Tables 2 and 3 does the adjusted coefficient of determination exceed 4%. Thus, there is still much variation in the dependent variables that remains unexplained.

C. Imitating Insiders' Actions

Following its public release, the information on insider transactions could be a rich source of intelligence to other market participants. This study measures abnormal profits to outsiders who replicate the direction of insider trades. Figure 2 shows the cumulative abnormal returns relative to the publication day over a 350 day event window. All transactions were aggregated and the abnormal returns for insider sales were normalized by multiplying them by minus one to match the purchases. The pattern depicted suggests that prior to the announcement date security returns tend to behave in line with the benchmark model. The bootstrap p-values for CAR(– 100,0) and CAR(– 50,0) reported in Table 4 are above the conventional rejection levels. Once the insider trading becomes common knowledge an upsurge persisting for approximately 65 trading days is observed. The impetuosity of this rise is reconfirmed by the test statistics. The succeeding changes appear to be unessential and the cumulative abnormal return oscillates within determinate bounds.

Figure 2

Cumulative abnormal returns around publication date



Cumulative abnormal returns over days –100 to 250 relative to the publication day. The abnormal returns following sales are multiplied by –1 before aggregation.

The outsider profits are comparable to those obtained by insiders themselves. An examination of the estimates provided in Tables 1 and 4 reveals that insiders outperform investors imitating them by a modest 1.1% within 100 trading days after the transaction and by 2.4% for a holding period of 250 trading days. The gains to outsiders do not disappear after adjusting for the costs of active investing. Moreover, the market initially dismisses the information on insider trading, despite the adequate attention it receives in the local financial press. It takes almost three months for the outsiders to learn the true motives behind the deals of informed agents. This finding is somewhat puzzling and remains in sharp conflict with the semi-strong version of the efficient market hypothesis.

Table 4

Outsiders' CARs and significance tests

Event period	CAR	Bootstrap p-values	Sign test
(-100,0)	-0.0017	0.4495	-2.4239
(-50,0)	0.0095	0.2340	-0.1143
(1,50)	0.0550	0.0000	3.7414
(1,100)	0.0792	0.0000	2.8972
(101,250)	0.0234	0.1720	-0.4575
(1,250)	0.1026	0.0015	2.3064

Cumulative daily average abnormal returns and significance tests for selected periods around publication day.

Before any comparison to the previous studies is made, a word of caution is in order. The reporting requirements in the U.S. and Poland are disparate. Until August 2002 Section 16(a) of the Securities and Exchange Act of 1934 forced disclosure of insiders' transactions within ten days of the end of the calendar month following the month in which the trade took place. Consequently, for an insider who traded in the U.S. at the beginning of the month, a disclosure coming about 40 calendar days after the change in his ownership still fell within the legal bounds. More recently the regulations became more rigorous and only two days are allowed for reporting the trade. The Polish SEC, on the other hand, puts a 24 hour deadline on disclosing insider transactions. Once reported, the information about the trade is instantly disseminated. Although we find the 24 hours rule frequently violated (51% of the sample) the average delay amounts to a moderate period of four days.

The currently available studies for the U.S. market are based on the pre-2002 data and fail to document unequivocally the statistical significance of gains to mimickers of informed investors. However, following the regulatory amendments, the profitability of their transactions ought to increase due to more timely access to information. An interesting extension for further research would be to reexamine the abnormal returns accruing to U.S.

outsiders who follow insiders' actions in the post-2002 period. Findings within that time frame are likely to parallel the conclusions of our study.

VI. Summary and Conclusions

Using a data set of transactions reported to the Polish SEC, this paper documents that individuals who, by virtue of their position are in possession of nonpublic information, use it without restraint in security trading. The magnitude of profits to corporate insiders vastly exceeds the estimates reported for other markets. Since the provisions of the Polish Law on the Public Trading of Securities of 1997 appear to be repeatedly transgressed, a stronger enforcement of insider trading sanctions is needed to level the playing field. The encouraging result, however, is that with the course of time insiders were becoming increasingly disinclined to engage in potentially remunerative short-term speculation.

To shed more light on the source of informational advantage, we investigate the determinants of insiders' abnormal returns. The findings of this indicate that directors and supervisory board members may be conducting highly profitable deals on the accounts of their close family members. Furthermore, trades conveying the most valuable information tend to be reported with a delay, as to misguide the regulators and the general public. Other trade attributes, such as transaction value, have only a negligible impact on profitability. Likewise, a robust relationship between the extent of informational asymmetry and company characteristics is difficult to establish.

Surprisingly, the market initially overlooks the full information content of insider trades. It takes almost 100 days for uninformed investors to grasp that the trade was based on a superior assessment of company prospects. Thus, the market participants are advised to monitor the reported transactions more closely. In particular, it has been shown that the profits to outsiders imitating insiders' actions are nearly as conspicuous as those realized by insiders

themselves. This finding can be ascribed to the relatively strict reporting requirements set by the Polish SEC.

Notes

1. Bettis, Coles, and Lemmon (2001) and Kucinski (2000) discuss various trading and corporate policies restricting trading by insiders.
2. "Co Prokuratura sadzi o Problemie Przestepstw na GPW", *Parkiet* 9 Dec. 2002.
3. "Wladze Gieldy zaniepokojone Postawa Prokuratury w Sprawie Insider Trading", *Parkiet* 20 Mar. 2003.
4. A cogent and illustrative case study by Cornell and Sirri (1992) outlines the process of information leakage to a small group of individuals and methods used by insiders to conceal their trading.
5. A comprehensive review of the evidence on the efficient market hypothesis can be found in Fama (1970, 1991).
6. An intensive insider trading month is defined as a month with at least three insiders buying and no insiders selling (or vice-versa).
7. The previous literature tended to focus only on open market transactions, see for example Jaffe (1974b), Seyhun (1986, 1988, 1990, 1992a, 1992b), Lee, Mikkelson and Partch (1992).
8. In the considered time interval the Polish Zloty / U.S. Dollar exchange rate fluctuated between 3.976 and 4.238.
9. The data set containing detailed information collected on each trade, including the name of the insider and his post, trading and announcement dates and the transaction size can be obtained by writing the authors.
10. The construction of control portfolios implicitly assumes that size and book-to-market value are important risk factors on the Polish market. To check the robustness of our conclusions we conduct supplementary tests using market-adjusted returns. The results are quantitatively and qualitatively the same.

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Insiders' Market Timing and Real Activity: Evidence from an Emerging Market

I. Introduction

Earlier research on insider trading documented unequivocally that officers, directors, and controlling shareholders are in possession of valuable private information and exploit it profitably in security trading.[1] It is widely believed that the apparent informational asymmetry arises from the foreknowledge of public disclosures. Consequently, a number of studies investigated the intensity of insider trading prior to corporate events, such as takeover bids (Seyhun (1990)), dividend and earnings announcements (John and Lang (1991), Ke, Huddart and Petroni (2003)), stock repurchases (Lee, Mikkelson and Partch (1992)), or bankruptcies (Seyhun and Bradley (1997)).

However, as argued by Seyhun (1988a, 1992), not all of the mispricing observed by insiders has to be firm-specific. Insiders are best positioned to recognize unanticipated changes in cash flows to their own firms that signal either a shift in the competitiveness of their companies or fluctuations in general business conditions. Nevertheless, all considered, they are not able to assess the relative contribution of these factors *ex ante*. Only after the macroeconomic development is widely recognized, prices of all assets adjust accordingly. This, in turn, could explain the positive correlations between the lagged values of aggregate insider trading indices, current market returns and real activity variables found in Seyhun (1988a, 1992). The signal identification problem presented here is essentially analogous to that of Lucas (1973, 1975), but used in another context.

[1] See Lorie and Niederhoffer (1968), Jaffe (1974), Finnerty (1976), Givoly and Palmon (1985), Seyhun (1986), Rozeff and Zaman (1988), Lin and Howe (1990), Lakonishok and Lee (2001), and Del Brio, Miguel, Perote (2002).

Although the literature tends to conform with the conjecture that registered insider transactions carry information about future market movements, disagreement about their predictive power remains. Using single-equation modeling methods, Seyhun (1992) concludes that up to 60 percent of variation in twelve-month-ahead excess stock returns can be forecasted using the previous twelve-month aggregate insider trading. On the other hand, the results of bivarite causality tests in Chowdhury, Howe and Lin (1993) and Iqbal and Shetty (2002) suggest that the ability of insider transactions to predict subsequent market returns is slight. The causality appeared to be stronger in the opposite direction, indicating that insiders are in aggregate contrarian investors. In their comprehensive study, Lakonishok and Lee (2001) arrive at similar conclusions.

In light of these conflicting views, the overriding motivation for this paper is to provide new evidence on the degree of stock return forecastibility and to test the theoretical implications of the cash flow hypothesis posed in Seyhun (1992). These questions are addressed quantitatively within a trivariate vector autoreggresive (VAR) framework. In particular, causality tests, forecast-error variance decomposition and orthogonalized impulse-response functions are employed to measure the strength of association between growth in industrial production, real market returns and insider trading activity in Poland. To double-check the results, two aggregate insider trading indices are constructed; first based on an entire sample of transactions, and a second one which takes into account only the trades of managers.

The contribution of this study is threefold. First, the link between insider trading indices and leading indicators of economic activity found in Seyhun (1992) has not been directly modeled in subsequent studies. This paper augments the extant evidence, within a model setting, which can provide deeper insights into the structure of dynamic interactions and casual relations. Notably, the inferences based on causality tests in a bivariate VAR, used in the literature, may not be robust to the addition of new variables into the system (Mehra

(1978), Sims (1980a) and Lee(1992)). Second, the features of the dataset permit the use of actual publication dates. Only after its public disclosure can the information about aggregate insider trading help analysts to forecast market returns and the future state of the economy. Although greatly relevant to the issue at hand, the exact disclosure dates were used previously only in Seyhun (1988a) and proxied with a delay parameter in Seyhun (1992). Third, to the best knowledge of the author, this is the first article to analyze insiders' ability to time the movements of an emerging market. As suggested by the findings of Bhattacharya et al. (2000) and Bhattacharya and Daouk (2002), the exploitation of confidential information is more evident in markets with lax enforcement of insider trading sanctions.[2] It would be of interest to determine whether the implicit costs of trading, such as the fear of potential indictment, trial or conviction effect the magnitude of predictive power.

The remainder of the paper is organized as follows. Section II describes data sources, construction of variables and sample characteristics. A brief outline of the methodology is contained in Section III. The empirical findings on the predictive ability of aggregate insider trading are presented in Section IV. The last section offers a summary and concludes.

II. Data

The sample used for this study comprises insider transactions reported to the Securities and Exchange Commission from January 1999 to May 2003, for a total of 53 calendar months.[3] The publication date is the date on which the information about the trade appeared

[2] Since the establishment of the Warsaw Stock Exchange in 1991, the Polish Securities and Exchange Commission forwarded to the public prosecutor 48 notifications of potential breaches of article 176 of the Act on Public Trading in Securities (disclosing and using confidential information). Nevertheless, up to the day of writing, merely one sentence has been passed.

[3] An inspection of the database reveals that January 1999 marks the month when insiders started to report their trades regularly. Individuals subject to mandatory disclosure requirements are defined by law as: members/chairmen of executive and supervisory bodies, next of kin of these individuals, holders of over 5% of

on the internet portal Interia. The consumer price index and industrial production time series were taken from the National Bank of Poland archive and economic service of the BZ WBK bank. Lastly, security prices, trading volume and market indices were obtained by courtesy of the Warsaw Stock Exchange.

Various filters were applied to the initial insider transaction data. First, all duplicate records were deleted and the transaction price was assumed to equal the daily closing quote wherever data on it was missing. Second, trades reflecting the exercise or conversion of managerial options, executive compensation schemes, purchases of stocks in seasoned equity offerings and private transactions were discarded. Furthermore, trades between insiders of the same company were identified and excluded, since the motivation behind such trades is unclear.

The overall sample contains 2197 trades in 184 firms, out of which 1506 can be attributed to management. Management is defined here as members/chairmen of executive and supervisory boards and close family members of these individuals. The share of registered insider trading in the total value of trade on the Warsaw Stock Exchange amounted to 1.95%. Intuitively, this estimate can be deemed large, especially given the fact that transactions driven by material nonpublic information are unlikely to be self-reported (Bainbridge (2000)). Furthermore, this proportion comes into view as sizeable relative to other markets. In a sample of U.S. companies, Bettis, Coles and Lemmon (2000) found that the average number of shares traded by insiders to the total volume per allowed trading day equaled 0.66% versus 0.21% during blackout periods.

Two indicators of insider trading activity are computed. The first one is based on the entire sample of transactions, whereas the second takes into account only the transactions by

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company shares or 10% of the total number of votes at the general meeting of shareholders (Ministry Decree 2001 Dz.U. Nr 139, poz. 1569, The Law on the Public Trading of Securities § 147). Although insiders are legally obliged to file a report to the Securities and Exchange Commission within 24 hours following their transaction, this rule was found to be frequently violated in the sample.

management.[4] A cognate way of aggregation can be found in Seyhun (1988b) and Lakonishock and Lee (2001). Aggregate insider trading indices are defined as follows:

$$AIT_t^A = \frac{\sum_{i=1}^{n_t} d_i p_{i,t} V_i}{\sum_{i=1}^{n_t} p_{i,t} V_i} \quad [1]$$

$$AIT_t^M = \frac{\sum_{i=1}^{n_t} m_i d_i p_{i,t} V_i}{\sum_{i=1}^{n_t} m_i p_{i,t} V_i} \quad [2]$$

where d_i equals one for purchases and minus one for sales, m_i takes the value of one if the insider is a manager and zero otherwise, $p_{i,t}$ is the transaction price and V_i is the volume of trade. The total number of insider transactions in a month *t* is denoted by n_t.

The two remaining variables employed in the VAR model are the real stock returns (rrEW), calculated as continuously compounded return on the equally weighted market index deflated by the changes in CPI[5], and growth of industrial production (dIP).[6] Industrial production has been chosen as a proxy for real activity, as it is the only aggregate data series available on a monthly basis. Descriptive statistics of all the variables included in the sample are displayed in Table 1.

[4] For the differences in informativeness of managers' and large shareholders' trades see Seyhun (1986), Lin and Howe (1990), Seyhun (2000), Lakonishock and Lee (2001).

[5] An equally weighted index is preferred to its value weighted counterpart, since insider trading was shown to be more heavy in small firms (Seyhun (2000)). As the data on an equally weighted market portfolio is not available in any database, it had to be computed by the author. All of the shares quoted on the main and parallel markets were taken into consideration.

[6] To avoid seasonalities in the industrial production, the dIP series is indexed to the production in the same month of the previous year.

Table 1

Descriptive statistics

Variable	Mean	Standard Deviation	Cross-Sectional Correlation			Serial Correlation		
			dIP	AIT^A	AIT^M	r_1	r_2	r_3
rrEW	-0.0126	0.0586	0.0939 (0.6866)	0.0538 (0.3922)	0.0212 (0.1544)	-0.0110 (-0.0800)	-0.0350 (-0.2549)	0.0249 (0.1811)
dIP	0.0374	0.0563	_	0.1582 (1.1664)	-0.0466 (-0.3396)	0.5806 (5.1916)	0.5621 (4.9481)	0.6128 (5.6461)
AIT^A	-0.2853	0.5048	_	_	0.6609 (6.4112)	0.1972 (1.4643)	-0.0757 (-0.5527)	-0.1060 (-0.7760)
AIT^M	-0.2737	0.4955	_	_	_	0.2644 (1.9957)	0.1810 (1.3398)	-0.0431 (-0.3139)

The *t*-statistics are shown in parentheses. rrEW = real return on the equally weighted market portfolio; dIP = percentage change in the real industrial production; AIT^A = aggregate insider trading index (all transactions); AIT^M = aggregate insider trading index (managers' transactions only). r_τ is the serial correlation coefficients at lag τ.

Table 1 reveals that the period under consideration was characterized by a moderate growth of the economy accompanied by a falling stock market. Corporate insiders, on average, decreased their shareholdings. Inspection of the distribution of the two aggregate insider trading indices shows that the behavior of managers and large shareholders could have been much alike.

The pattern of cross-correlations sheds some more light on the data. Both measures of insider trading activity show mild positive association with the changes in real asset prices. This finding implies that some favorable corporate information tends to be released shortly after an insider trading incident, or alternatively, could reflect the impact of the trade disclosure itself (Givoly and Palmon (1985)). On the other hand, an empirically robust contemporaneous relationship between insider trading and growth in industrial production can not be observed. Similarly, the theoretical background did not provide clear guidelines as to the direction and strength of this instantaneous relation. Growth in industrial production, which could be viewed as a source of systematic investment risk, is weakly and positively correlated with real stock returns. By construction, AIT^A and AIT^M covary strongly in the

same direction. Among all variables, dIP exhibits the strongest serial dependence, which can be ascribed to the method of indexing (see footnote 6).

III. Methodology

The analysis of the interaction between aggregate insider trading, changes in industrial production and the real market index is embedded in a vector-autoregressive framework developed by Sims (1980b). Since all variables are treated as endogenous and no *a priori* restrictions are imposed, the VAR model constitutes a flexible approximation of this unknown economic structure.

Suppose that $\mathbf{y}_t$, a 3×1 vector, is a covariance stationary process governed by a *p*th-order vector autoregression:

$$\mathbf{y}_t = \mathbf{c} + \mathbf{\Phi}_1 \mathbf{y}_{t-1} + ... + \mathbf{\Phi}_p \mathbf{y}_{t-p} + \boldsymbol{\varepsilon}_t \equiv \mathbf{c} + \mathbf{\Phi}(L)\mathbf{y}_t + \boldsymbol{\varepsilon}_t \qquad [3]$$

where $\mathbf{y}_t = (\text{rrEW}_t, \text{dIP}_t, X_t)'$, X_t is either AIT_t^A or AIT_t^M, $\mathbf{c}$ and $\mathbf{\Phi}_s$ are, respectively, a 3×1 vector of constants and 3×3 matrix of coefficients, *p* is the lag length, and $\boldsymbol{\varepsilon}_t$ is a column vector of forecast errors of the best linear predictor of $\mathbf{y}_t$ with mean $\mathbf{0}$ and variance $\mathbf{\Sigma}_\varepsilon$.

Inferences about causality are made in the spirit of Granger (1969). In particular, the null hypothesis that all *p* lags of the considered variable do not Granger-cause the dependent variable is tested with the F-test based on the sum of squared residuals from the restricted and unrestricted regressions. In this context, the F-test is preferred to asymptotic block-exogeneity tests, as these are likely to have inadequate empirical sizes.

Tracing the cross-equation feedbacks through the inspection of parameters of the estimated equation system [3] can be a rather involving and laborious task. An alternative approach is to use the multiplier analysis or innovative accounting technique based on the system's moving average representation. Given invertibility of the VAR, the MA(∞) representation can be obtained by recursive substitution of the right-hand side of equation [3] as follows:

$$\mathbf{y}_t = \boldsymbol{\mu} + \boldsymbol{\varepsilon}_t + \boldsymbol{\Psi}_1 \boldsymbol{\varepsilon}_{t-1} + \boldsymbol{\Psi}_2 \boldsymbol{\varepsilon}_{t-2} + \ldots \equiv \boldsymbol{\mu} + \boldsymbol{\Psi}(L)\boldsymbol{\varepsilon}_t \qquad [4]$$

where $\boldsymbol{\mu} = (\mathbf{I}_N - \boldsymbol{\Phi}_1 - \ldots - \boldsymbol{\Phi}_p)^{-1}\mathbf{c}$ with N = dim($\mathbf{y}_t$) = 3, and $\boldsymbol{\Psi}_s$ is the 3×3 coefficient matrix of dynamic responses.

The operators $\boldsymbol{\Psi}$(L) and $\boldsymbol{\Phi}$(L) have to satisfy the following condition:

$$\boldsymbol{\Psi}(L) = \left[\mathbf{I}_N - \boldsymbol{\Phi}(L)\right]^{-1} \Rightarrow \left[\mathbf{I}_N - \boldsymbol{\Phi}_1 L - \ldots - \boldsymbol{\Phi}_p L^p\right]\left[\mathbf{I}_N + \boldsymbol{\Psi}_1 L + \boldsymbol{\Psi}_2 L^2 + \ldots\right] = \mathbf{I}_N \qquad [5]$$

The coefficients of L^i, in the resulting lag polynomial [5], were set equal to zero for each *i*, yielding a triangular simultaneous equation system. Following Hamilton (1994), the MA coefficient matrices $\boldsymbol{\Psi}$ are solved recursively.

The impulse-response functions could be derived directly from equation [4]. A serious drawback of this analysis would be that it considers a shock to a single variable in isolation. In practice, however, perturbations in different variables are rarely independent and contemporaneous correlation of the error terms is likely to be observed. A procedure that orthogonalizes the innovations would take this co-variation into account. The orthogonalizing transformation proceeds as follows. The positive-definite symmetric matrix $\boldsymbol{\Sigma}_\varepsilon$ can be uniquely decomposed into **GG'** using Choleski factorization:

$$E\left(\boldsymbol{\varepsilon}_t \boldsymbol{\varepsilon}_t'\right) = \boldsymbol{\Sigma}_\varepsilon = \mathbf{ADA}' = \mathbf{AD}^{1/2}\mathbf{D}^{1/2}\mathbf{A}' = \mathbf{GG}' \qquad [6]$$

where **A** is a square matrix whose columns are eigenvectors of the sample covariance matrix $\boldsymbol{\Sigma}_\varepsilon$, **D** is a diagonal matrix of the corresponding eigenvalues, and **G** is a nonsingular, lower triangular matrix with positive elements on the diagonal.

Subsequently, a transformed innovation $\mathbf{u}_t$ is defined as:

$$\mathbf{u}_t \equiv \mathbf{G}^{-1}\boldsymbol{\varepsilon}_t \qquad [7]$$

where $\mathbf{u}_t$ is a matrix of uncorrelated components with mean **0** and variance $\mathbf{I}_N$.

Substituting equation [7] into equation [4] and taking a partial derivative with respect to variable's *i* innovation yields:

$$\frac{\partial \mathbf{y}_{t+s}}{\partial u_{i,t}} = \mathbf{\Psi}_s \mathbf{g}_i \qquad [8]$$

where $\partial \mathbf{y}_{t+s}/\partial u_{i,t}$ is the orthogonized response of $\mathbf{y}$ to a one standard deviation increase in $u_{i,t}$ at lag s, and $\mathbf{g}_i$ denotes the i-th column of $\mathbf{G}$.

In addition to the impulse response analysis, the moving average representation [4] can also be used to allocate the forecast variance of each element in $\mathbf{y}$ to different sources of shocks, as measured by the elements of $\mathbf{u}$. The error of the optimal s-step ahead forecast is:

$$\mathbf{y}_{t+s} - \hat{\mathbf{y}}_{t+s} = \sum_{i=0}^{s-1} \mathbf{\Psi}_i \boldsymbol{\varepsilon}_{t+s-i} = \sum_{i=0}^{s-1} \mathbf{\Psi}_i \mathbf{G}\mathbf{G}^{-1} \boldsymbol{\varepsilon}_{t+s-i} = \sum_{i=0}^{s-1} \mathbf{\Theta}_i \mathbf{u}_{t+s-i} \qquad [9]$$

Denoting the mn-th element of $\mathbf{\Theta}_i$ by $\theta_{mn,i}$, the proportion of the s-step ahead forecast error variance in y_j accounted for by innovations in y_n is:

$$\sum_{i=0}^{s-1} \theta_{jn,i}^2 \Big/ \sum_{i=0}^{s-1} \sum_{n=1}^{N} \theta_{jn,i}^2 \qquad [10]$$

The forecast errors of a firm casual prior in the Granger sense are mostly accounted for by its own innovations rather than by the shocks in other variables in the system.

IV. Empirical results

As the order p of the data generation process described in [3] is unknown, the Schwarz minimum bias criterion (Schwarz (1978), Rissanen (1978)) is used to determine it. Relatively to Akaike (1973, 1974) and Hannan and Quinn (1980), the Schwarz criterion has been shown to choose the correct autoregressive order more often and lead to a smaller forecasting error in finite samples (Lütkepohl (1985)). Regardless of the method of aggregating insider transactions the Schwarz criterion indicates that the estimated optimal lag length is seven.

Table 2

Granger Causality Tests

Panel A. Model with all Transactions			
	Dependent Variable		
	rrEW	dIP	AIT^A
rrEW	0.4242	2.8509**	0.7396
dIP	1.4062	5.3192***	0.6775
AIT^A	1.8916*	2.3641**	0.9637
Panel B. Model with Transactions of Managers			
	Dependent Variable		
	rrEW	dIP	AIT^M
rrEW	0.5312	3.1329**	0.9108
dIP	1.4947	8.9629***	0.6431
AIT^M	1.9167*	2.6868**	1.0108

F-test against the null hypothesis that seven lags of the left column variable do not Granger-cause the dependent variable. rrEW = real return on the equally weighted market portfolio; dIP = percentage change in the real industrial production; AIT^A = aggregate insider trading index (all transactions); AIT^E = aggregate insider trading index (managers' transactions only).

* Significance at 10% level

** Significance at 5% level

*** Significance at 1% level

The results of Granger causality tests are presented in Table 2. A unidirectional casual relation between the real market returns and first difference of log industrial production is found running in the direction from the former to the latter. The conclusion that swings in the stock market approximately capture changes in expectations of future productivity coheres with the bulk of previous literature.[7] The response of the equally weighted market portfolio to information about the real economy does not occur at lags, which conforms with the semi-strong form of market efficiency.

Insider trading foreruns both the dIP and rrEW. This evidence lends credence to the cash flow hypothesis of Seyhun (1992), for it suggests that economywide factors contribute to the insiders' ability to predict future market returns. Even after the information about insider

[7] See, for instance, Fama (1981), Schwert (1990), Lee (1992), Choi, Hauser and Kopecky (1999) and Phelps and Zoega (2001).

transactions becomes publicly available, it is still useful to forecast future market equilibrium returns and changes in industrial production. The conclusion reached is robust, in that the statistical tests confirm its validity regardless of the definition of aggregate insider trading. Managers did not significantly outperform large shareholders in their market timing ability, but the data on their trades can serve to formulate slightly more accurate predictions.

Aggregate insider trading can be viewed as a casual prior, for its history influences all remaining variables in the system, but itself is not Granger-caused by any factors. In particular, the null hypothesis of noncausality from the returns on an equally weighed market portfolio is not rejected at the conventional significance levels. Consequently, the finding of Cowdhury, Howe and Lin (1993) and Iqbal and Shetty (2002) that insiders buy after stock price decreases and sell after stock price increases is not strongly reflected in the Polish data. Had insiders acted that way, their gains would not have been much larger. The negligible autocorrelation coefficients of the monthly real returns series reported in Table 1 indicate that the profits from a negative feedback trading strategy could not have been impressive.

The transmission of shocks within the system is traced by means of multiplier analysis. Figure 1 reports the results. To conserve space, only the simulated orthogonalized dynamic responses of the VAR model with AIT^{A} are plotted. Broadly speaking, the impulse response functions of the model specified with AIT^{M} are similar.

Figure 1. Orthogonalized Impulse Responses of Variables to Shocks in Equations ± 2 Standard Errors

Figure 1a. Response of rrEW to one standard deviation shock in rrEW

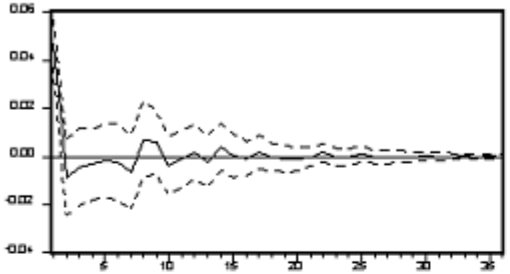


Figure 1b. Response of rrEW to one standard deviation shock in dIP

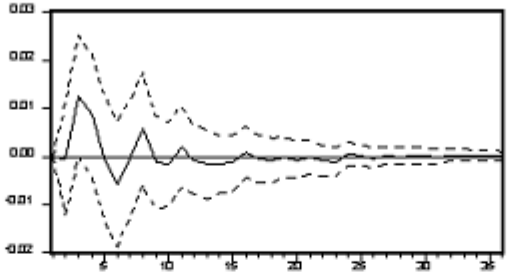


Figure 1c. Response of rrEW to one standard deviation shock in AIT(A)

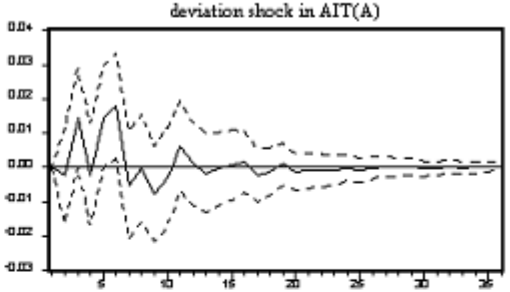


Figure 1d. Response of dIP to one standard deviation shock in rrEW

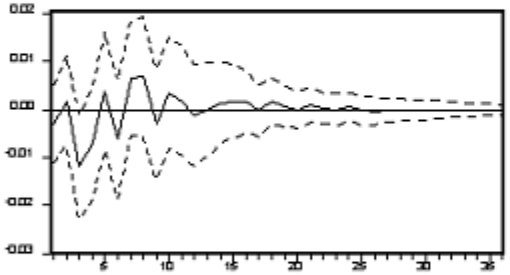


Figure 1e. Response of dIP to one standard deviation shock in dIP

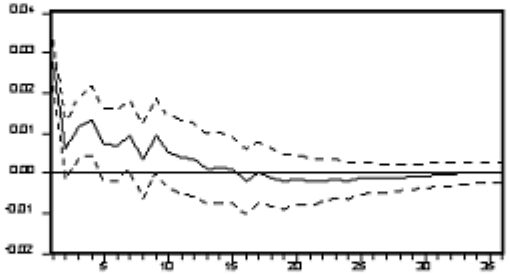


Figure 1f. Response of dIP to one standard deviation shock in AIT(A)

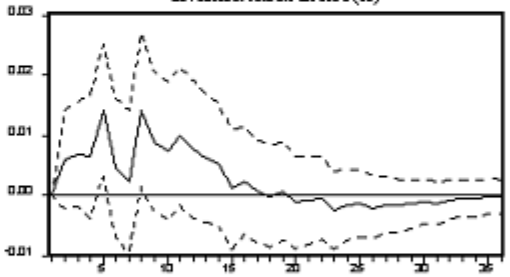


Figure 1g. Response of AIT(A) to one standard deviation shock in rrEW

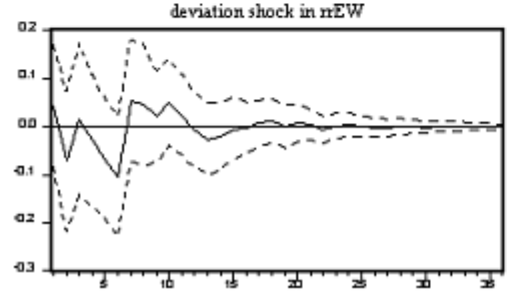


Figure 1h. Response of AIT(A) to one standard deviation shock in dIP

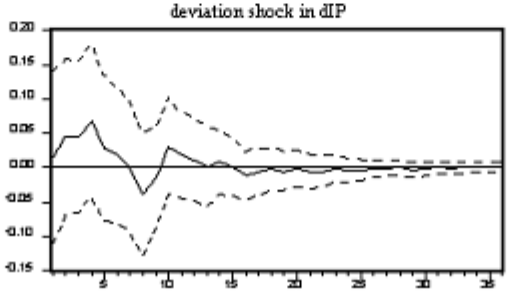
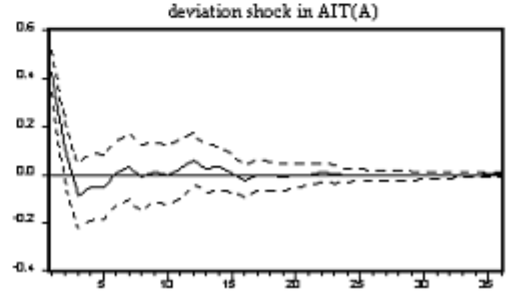


Figure 1i. Response of AIT(A) to one standard deviation shock in AIT(A)



Consistent with the cash flow hypothesis, a positive innovation in the insider trading variable engenders a rise in asset prices and index of industrial production. The real change in the stock market index provoked by the shock amounts to 4.27% after six months and 3.41% after a year. However, the positive reaction is confined mostly to half a year, which can be considered a relatively short period compared to other studies. This finding can be most probably attributed to differences in regulation. In the US, Section 16(b) of the Securities and Exchange Act of 1934 prohibits insiders from making round-trip trades within a six-month period and any profit realized by them from any purchase and sale is recoverable by the issuer. Analogous short-swing profit restrictions are absent in the Polish Law on the Public Trading of Securities of 1997 and rules thereunder. Thus, insiders are expected to be more inclined to reap the short-run speculative gains.

Figure 1g shows the response of AIT^{A} to a one standard deviation shock in stock returns. The picture is generally consistent with the notion that insiders tend to sell high and buy low, in accordance with the contrarian investment model. It should be recalled, however, that the results of Granger causality tests in Table 2 did not attest to the statistical significance of this finding. Chowdhury, Howe and Lin (1993) suggest that the negative effect of past market returns on subsequent insider transactions could be ascribed to noise trading, which drives market prices away from fundamentals (see Black (1986)). If securities are priced efficiently, significant market movements can signal deviations from the intrinsic values and the mispricing is recognised by insiders. Portfolio rebalancing reasons can be propounded as an alternative explanation of this phenomenon (Iqbal and Shetty (2002)).

According to Figure 1e the auto-response is most pronounced for the change in industrial production, which corroborates the evidence of its high own-autocorrelation coefficients reported in Table 1. The observation that a shock in asset prices induces merely

excess volatility, rather than a positive reaction in the dIP, seems at first glance somewhat counterintuitive. However, a closer look at the data provides a rationalization of this relationship. When a two dimensional VAR of rrEW and dIP is considered, production tends to increase after the innovation in the stock market. Nevertheless, after inclusion of the AIT^A index into the system, the signs of partial correlation estimates between the past values of rrEW and the current values of dIP vary depending on the choice of lag. This substantiates the view that once all the information contained in insider trading is taken into account, the changes in the stock market are not reliable predictors of future economic prosperity. Equivalently, insiders can be seen to have more advanced knowledge of future real activity than other market participants.

Table 3

Three-variable Innovation Accounting

Panel A. Model with all Transactions			
Variables Explained	By Innovations in		
	rrEW	dIP	AIT^A
rrEW	66.92	8.67	24.41
dIP	13.75	52.68	33.57
AIT^A	12.56	5.20	82.25
Panel B. Model with Transactions of Managers			
Variables Explained	By Innovations in		
	rrEW	dIP	AIT^M
rrEW	69.54	8.88	21.58
dIP	11.64	57.89	30.47
AIT^M	16.69	6.48	76.82

Percentages of 36-month forecast-error variance of the left column variables accounted for by innovations in the top row variables. rrEW = real return on the equally weighted market portfolio; dIP = percentage change in the real industrial production; AIT^A = aggregate insider trading index (all transactions); AIT^E = aggregate insider trading index (managers' transactions only).

The innovation accounting data in Table 3 indicates that insider trading is the most exogenous variable in the system, in that its own innovations account for the largest proportion of its variance. Over 20% percent of the variability in rrEW innovations is associated with shocks in insider trading. This fraction can be considered relatively large, especially compared to the result of Chowdhury, Howe and Lin (1993). A higher proportion

of 36-month forecast-error variance of industrial production growth is attributable to innovations in insider trading than to shocks in market returns. Finally, inspection of both panels in Table 3 shows that the signals about future real activity received by managers and principal shareholders are of similar quality. The results of forecast error-variance decomposition reassuringly confirm the findings of Granger causality tests and impulse response analysis.

The model was subjected to numerous diagnostic checks. First, the adjusted multivariate portmanteau statistic of Hosking (1980) and the tests for heteroscedasticity of White (1980) indicated that residuals from the VAR are independently and identically distributed. The Kolgomorov-Smirnoff tests could not reject the null of residuals normality. Second, since the results can be sensitive to the ordering of variables for orthogonalization, all order combinations have been tried and no impact on the estimates was observed. Third, another method of aggregating insider transactions was used. It can be argued, that the measures defined in equation [1] and [2] are likely to be influenced by several large trades. An alternative index based on the proportion of purchases in the total number of transactions was constructed. Nevertheless, this model specification did not produce any significant improvement over the initial fit. Lastly, a real return on the value weighted all-share index WIG was substituted for the rrEW variable. The predictive power was slightly attenuated, which is consistent with insiders being more active in small companies.

V. Concluding Remarks

Insider dealing appears to be widespread on the Polish stock market and a more vigorous enforcement regime is needed to temper the exploitation of privileged information. Only the insider transactions that were reported to the Securities and Exchange Commission generated 2% of the total trading value on the Warsaw Stock Exchange. This paper addressed the question of whether these transactions, in total, can be used to predict stock market returns

and future real activity. Results presented here corroborate the conclusions of Seyhun (1988a, 1992), who hypothesized that insiders observe unexpected changes in cash flows to their own companies prior to public disclosure, but are unable to discern whether these changes are due to firm-specific or economywide factors. However, once the shift in general business conditions is realized the prices of assets adjust accordingly.

In line with this reasoning, insider trades appeared to Granger-cause growth in industrial production and real returns on an equally weighted market portfolio. This result is robust to various model specifications and the choice of aggregation method. At a horizon of six months, a one standard deviation shock in an artificially constructed measure of aggregate insider dealing induces a real rise in the stock market prices of 4.27%, which tends to be accompanied by increased productivity. Thus, the prescience of macroeconomic development contributes to the predictive power of insider trading. Furthermore, corporate managers did not perform much better than principal shareholders in timing the market movements, but they seem more knowledgeable about future real activity.

Reaction of variables in the VAR to innovation in insider trading is confined only to the medium term. This finding implies that the informed agents have relatively short investment horizons arising from the absence of short-swing profit restrictions in Polish law. The information contained in self-reported trades does not degenerate immediately after the trades become common knowledge, which could be attributed to the strict disclosure deadline set by the Securities and Exchange Commission (24 hours following the insider transaction). Lastly, managers and large shareholders acted in a somewhat contrarian manner. This result emerged as rather vague and, unlike Chowdhury, Howe and Lin (1993) and Iqbal and Shetty (2002), this study has not documented that the influence of past stock market returns on the insider sales and purchases is statistically significant.

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Reexamination of the Link between Insider Trading and Price Efficiency

1. Introduction

It is often contended that insider dealing is unfair and failure to penalize violators of securities regulations can seriously undermine public confidence in capital markets.[1] Furthermore, the rights to privileged information would be typically assigned to the company, hence insider trading can also be viewed as theft of corporate property.[2] On the other hand, some deregulatory arguments voiced by academics emerge as equally persuasive. The exploitation of nonpublic information could be, for instance, an efficient way to compensate managers for their innovations (Manne (1966), Carlton and Fischel (1983), Roulstone (2003a)). Another channel through which insider trading could potentially benefit society is by promoting more accurate pricing of assets (Udpa (1996), Roulstone (2003b)).

This study endeavors to assess the genuineness of the last assertion, namely that the trading by insiders enhances market efficiency. If more inside information is contemporaneously discounted in securities prices, future price fluctuations will be dampened and risk-averse agents will be disposed to increase their investments (Leland (1992)). The results presented here suggest that this beneficial effect of deregulation is likely to be negligible. Although insiders on the Polish stock market seem to exploit, albeit in a subtle manner, their foreknowledge of the trends in the future financial performance of their companies, the return activity around earnings disclosures is not diminished by instances of

[1] Individuals who are members of executive and supervisory bodies of the issuer, next of kin of these individuals and large shareholders are defined in Poland as insiders by Ministry Decree 2001 Dz.U. Nr 139, poz. 1569 and The Law on the Public Trading of Securities of 1997, § 147. The issuer is obliged to file a report with the Securities and Exchange Commission within 24 hours following an insider transaction. The exploitation of preferential information is banned (The Law on the Public Trading of Securities of 1997, § 176).

[2] For a further discussion and a comprehensive survey of literature see Bainbridge (2000).

prior insider trading. This could be due to the fact that insider trading reduces the economic incentives of market professionals to collect and analyze information, as in Fishman and Hagerty (1992) and Khanna, Slezak, and Bradley (1994).

The remainder of the paper is organized as follows. The following section offers a review of literature and develops three testable hypotheses. Section 3 provides data sources, variable definitions, and summary statistics. Empirical results are given and elaborated upon in section 4. Section 5 concludes the paper.

2. Prior literature and hypotheses

This section enumerates the hypotheses to be tested and discusses the contributions in light of the extant literature. If managers and directors possess and trade upon private information regarding a firm's financial prospects, it is likely that this information will be impounded into stock prices before it is publicly released. Thus, ideally one would wish to test the following hypothesis first:

> Hypothesis 1: *Insiders exploit information about forthcoming earnings announcements in their security trading.*

Several studies have pursued an investigation of the relationship between insider trading and subsequent earnings announcements, yet the overall evidence remains mixed. Elliott, Morse, and Richardson (1984) and Lustgarten and Mande (1995) find that insiders purchase more shares prior to positive earnings surprises, but refrain from selling ahead of bad news. Givoly and Palmon (1985) investigate dealing activity around corporate news (predominantly financial statement disclosures), however fail to document any significant association. They assert that the abnormal returns following insider transactions are likely to be a manifestation of a self-fulfilling prophecy. Similarly, the results of Seyhun (1992a, 2000) suggest that individuals subject to trading disclosure requirements do not exploit earnings information aggressively. On the flipside, Piotroski and Roulstone (2003) offer compelling

evidence that insider trading is linked to the next year's ROA innovations, while Ke, Huddart, and Petroni (2003) find abnormal selling activity three to nine quarters prior to a break in a string of consecutive quarterly earnings increases.

The only common feature of all the aforesaid papers is that, due to abundance of available data, they focus exclusively on the U.S. market. The severity of improper trading, however, will derive and be circumscribed by the unique legal environment in which insiders transact. For instance, it has been shown that promulgation of the *Insider Trading and Securities Fraud Enforcement Act* of 1988 encouraged insiders to refrain from dealing on near-term earnings information (Garfinkel (1997), Piotroski and Roulstone (2003)). Similarly, the level of regulatory commitment to enforce the enacted legislation can profoundly influence the behavior of the informed agents (Bhattacharya and Daouk (2002)). Accordingly, an examination of insider trading patters in markets other than the U.S. could be a natural way to evaluate the effectiveness of different policies aimed at curbing illegal exploitation of preferential information.

The Polish stock market could be an interesting laboratory in which to test conjectures regarding insider dealing because of the conflict between its high quality regulations and the low level of their enforcement. The Law on the Public Trading of Securities of 1997 imposes a severe penalty for exploitation of inside information in security trading (fine of up to 5,000,000 PLN and imprisonment from 6 months to 5 years). On the other hand, in the thirteen year history of the Warsaw Stock Exchange there was merely one case of successful prosecution on insider trading charges. The fiasco of the enforcement efforts is likely attributable to the lack of symbiotic cooperation between the Securities and Exchange Commission and the public prosecution.[3] Enjoying the perceived impunity, corporate insiders could conceivably abuse their informational advantage in a more flagrant manner.

[3] Brycki, M. (2003, February 27). Trudne Sprawy. *Rzeczpospolita*.

Given that insider transactions are informative, they would shape the outside parties' beliefs about future company performance and thereby impact current stock prices. A wide class of theoretical models based on the rational expectations paradigm[4] predicts that inside information will be partially revealed before the terminal (publication) date. Additionally, following a change in their shareholdings, managers could exhibit a greater proclivity to generate and disseminate interim information (Penman (1982)). This, in turn, should lead to a partial resolution of uncertainty and attenuate the market's reaction to earnings news. Formally, the hypothesis of interest is:

> Hypothesis 2: *Insider trades communicate future performance of the company to the market and, thereby, reduce the overall future price volatility.*

Udpa (1996) provides evidence from a sample of 96 randomly selected U.S. companies and concludes that the information content of quarterly earnings reports is lower when they are preceded by insider trading. Analogously, Roulstone (2003b) argues that insiders add to price efficiency by reducing the market's response to earnings announcements. The findings presented here are not in accord with the results of Udpa (1996) and Roulstone (2003b), which *prima facie* may give an appearance of inconsistency. Nevertheless, the observed phenomenon can be easily justified in a model where insiders are considered to be imperfect competitors. In this framework, insiders receive high quality signals about a future firm's payoff without cost and trade against outsiders who have to expend their resources to gather information. As a result, the outside parties will suffer a monetary loss and acquire less intelligence about the company, which will lower the price efficiency. This proposition is tested formally:

> Hypothesis 3: *Insider trading crowds out the information acquisition by market professionals.*

[4] See Grossman (1976), Grossman and Stiglitz (1980), Verrecchia (1980), Diamond and Verrecchia (1981), Kyle

A number of theoretical papers have focused on the nexus between insider trading and external sources of information production. Fishman and Hagerty (1992) conclude that deregulation of insider trading is not necessarily equivalent to price efficiency improvements because of the adverse effect it can have on the competitiveness of the securities market. Khanna, Slezak, and Bradley (1994), by assuming that the cost of the outsider's signal is increasing in its precision, show that the equilibrium quality of ordinary shareholders' information is lower when restrictions on managerial trading are not imposed. Lastly, Haddock and Macey (1987) outline a Peltzmanian political support model in which insiders and market professionals rival for trading profits by lobbying for preferential SEC securities regulations.

The empirical evidence on the crowding out hypothesis is rather scanty. Bushman, Piotroski, and Smith (2003) use a large cross-section of countries and report that aggregate analyst coverage increases upon the enforcement of insider trading sanctions, with the increase being more pronounced for emerging market countries. Thus, an inquiry into the Polish stock market could yield additional insights and tangible policy implications. Furthermore, the study by Bushman, Piotroski and Smith (2003) sheds light on the problem from a macro-perspective, i.e. the relevant data has been aggregated within countries. Inferences about the validity of the hypothesis presented in this paper, on the other hand, are based on firm-level data.

3. Data

The data used in this study was collected from several sources. The information on prices, market capitalization, and book value was obtained courtesy of the Warsaw Stock Exchange (WSE). The price series were subsequently adjusted for splits and dividend payments. Data on analyst following and voluntary managerial earnings projections was

(1985), and Leland (1992).

downloaded from the archive of Parkiet, one of the most prominent Polish publishers specializing in financial markets. The panel data on net earnings per share was extracted from the Notoria Serwis database and the corresponding publication dates were found in the Emitent System. Emitent is an electronic system by means of which the issuers file their quarterly financial statements with the Securities and Exchange Commission and the WSE. Within 20 minutes, the report is forwarded to the Polish Press Agency (PAP) and disclosed on the internet. Accordingly, the disclosure dates available in Emitent are superior to those provided by other data vendors, for they represent the first date on which the information about corporate performance became public. Lastly, the insider trading data was collected from the internet portal Interia. The database includes a comprehensive and complete list of trading reports which insiders have to file with the Securities and Exchange Commission within 24 hours of a transaction.

The initial data was filtered subject to the following criteria. For a company to be included in the sample, it had to be quoted on the main, parallel, or free market prior to July 31, 1999, and have net earnings figures in the Notoria Serwis database from IQ1999 to IIIQ2002. All delisted companies were excluded from the analysis. The final sample includes 163 companies drawn from all industries over a period of 11 quarters (IQ2000-III2002), providing a total of 1793 observations.

The insider trading data was restricted to open market sales and purchases only, and corrected for obvious clerical errors. First, all duplicate records were discarded. Second, transactions reflecting purchases of stocks in seasoned equity offerings, exercises of managerial options, bonuses and inheritances are not considered.[5] Third, trades that were identified between insiders of the same company are excluded, as they are likely to be driven by corporate control motives, rather than by the informational asymmetry between the trading

[5] The perponderance of the prior literature tended to focus only on open market sales and purchases (see for instance Jaffe (1974), Finnerty (1976), Seyhun (1986, 1988, 1990, 1992a, 1992b), Lee, Mikkelson and Partch

parties. The final sample comprises 1587 transactions (604 sales and 983 purchases). Out of the 163 companies included in the sample, 118 had at least one insider trading incidence throughout the considered time period.[6] This final set of transactions is used to compute a net insider purchase index (*NIP*) for each of the firms. The index is defined as the total number of insider purchases summed between the current and the previous announcement date less the total number of sales. The measurement unit of *NIP* is the number of transactions per company-period.

An estimate of earnings surprise (*ES*) is computed as a seasonal random walk by subtracting earnings four quarters earlier from the current earnings and scaling the difference by the stock price one day prior to the announcement. Such a definition of unexpected earnings is dictated primarily by data availability. An attempt to model market expectations by means of more sophisticated time-series techniques would be hindered by the short listing history of the companies. Moreover, a preponderance of the firms are not covered by analysts (see Table 1). Nonetheless, prior research has shown that the aforementioned benchmark performs as well as more elaborate proxies for expectations. For instance, Hughes and Ricks (1987) document that the earnings surprise derived from the seasonal random walk model is more closely associated with abnormal returns around the publication date, as compared to earnings surprise based on analysts forecasts.

This study utilizes the abnormal return volatility metric (*Abvola*) to measure the uncertainty about future earnings. *Abvola* is defined as an average of squared abnormal returns over a three-day announcement window (days t=0 to t=2 relative to the announcement date), standardized by the variance of the market model residuals.[7] The estimation period for

(1992)). There seems to be a general consensus that transactions deriving from option exercises and executive compensation schemes are due to institutional factors rather than to the exploitation of non-public information.

[6] Auxiliary analysis has been conducted to investigate whether the firms which have never experienced an insider trading incidence differ significantly from the rest of the sample. The companies in which insiders were inactive had a higher market value of equity, which may suggest that blue chips are more likely to impose firm-level insider trading restrictions. A survey-based study could probably deliver more definite evidence on this issue. No other substantial discrepancies between the two sub-groups were observed.

[7] Landsman and Maydew (2002) adopt a similar information content measure.

the market model spans from t=-200 to t=–1. In addition to the modulus of *ES,* other variables were employed in the *Abvola* regression to control for the flow of information and company characteristics. Atiase (1985) and Shores (1990) argue that a high number of analyst following (*Analysts*) and the log market value of equity (*Size*) are likely to attenuate the market's reaction to earnings news.[8] To capture more predisclosure information, a dichotomous variable, *MF,* is included, which takes the value of one if management issued a voluntary earnings forecast and zero otherwise. Lastly, the book-to-market ratio (*B/M*) controls for potential differences in the response of glamour and value stocks.

Table 1

Descriptive statistics

	Mean	Std. Dev.	25th Percentile	Median	75th Percentile
NIP	0.1523	2.0623	0.0000	0.0000	0.0000
ES	-0.0349	1.8137	-0.0307	-0.0037	0.0291
Size	17.9108	1.9355	16.5755	17.6509	19.1598
B/M	1.7350	1.8665	0.7379	1.2266	2.0504
Analysts	1.4484	3.0251	0.0000	0.0000	1.0000
MF	0.1907	0.3930	0.0000	0.0000	0.0000
Liquid	0.5560	0.7615	0.1288	0.3210	0.6302
Prob_NT	0.0423	0.1176	0.0000	0.0000	0.0160
Abvola	2.8582	8.8091	0.3225	0.8425	2.3038

Note - The sample contains 1793 company-quarters from IQ 2000 to IIIQ 2002. *NIP* is the net insider purchase index, defined as the total number of insider purchases summed between the current and last announcement date less the total number of sales. *ES* is the earnings surprise, defined as actual net EPS less the random walk forecast, scaled by price one day before the announcement. *Size* is the natural logarithm of the market value of equity one day prior to the announcement date. *B/M* is the book-to-market ratio one day prior to the announcement date. *Analysts* is the number of analyst forecasts available for a given company-year (excluding forecast revisions). *MF* equals one if management issued a voluntary earnings forecast, zero otherwise. *Liquid* is the total value of trading in a given company-year divided by a firm's market capitalization. *Prob_NT* is the probability of a zero trading volume day in a given company-year. *Abvola* is the average of squared standardized OLS market model excess returns on days 0 through +2 relative to the earnings announcement date.

Table 1 shows sample characteristics of the key variables analyzed in this study. The mean *NIP* is positive indicating that insiders were, on average, conducting more purchases than sales. Nevertheless, a closer look at the data reveals that the average zloty transaction value is higher for sales than for purchases and indicators based on the value of insider

[8] The *Analysts* variable captures the number of analysts who follow the firm, rather than the number of predictions, i.e. the forecast revisions are discarded.

dealing have a negative mean. Moreover, the distribution of *NIP*, implied by the reported quartiles, suggests that the trading is rather sparse. The negative mean (median) of the earning surprise hints at unfavorable trends in aggregate net corporate profits. Investors' disappointment with the disclosed financial statements was reflected in the stock market plummet. Throughout the considered time-span the main index WIG fell by 39%. About 34% of the company-years were followed by at least one analyst and in 19% of the cases management published an earnings forecast. The annual value of share trading in a representative firm exceeded half of its market value of equity. Nevertheless, a fraction of the companies was severely illiquid, in the sense that the probability of a zero trading volume day (*Prob_NT*) was substantial.

The structure of the correlation between the variables is presented in Table 2. The estimate of the Spearman correlation between the index of net insider dealing and earnings surprise is positive, though not statistically significant. This result should be interpreted with great caution. First, the simple correlation coefficient neglects other, diverse factors which condition the investment decisions of informed traders. Second, the relation between *NIP* and *ES* could be intertemporal rather than contemporaneous. Insiders, in a strive to limit their legal exposure, could time their transactions strategically (Ke, Huddart and Petroni (2003)).

Table 2 also sheds light on further interesting patterns of the data. For instance, higher absolute values of the surprise engender greater volatility around the announcement. Along the lines of Penman (1982), *ES* is positively related to *MF*, lending some support to the presupposition that corporate officers desire to publish only favorable news which increases the market value of their firm. This result could constitute an interesting starting point for further, more extensive analysis. Lastly, analysts prefer to follow highly capitalized and liquid companies.

Table 2

Spearman correlation coefficients

	NIP	ES	|ES|	Size	B/M	Analysts	MF	Liquid	Prob_NT	Abvola
NIP	1.0000	0.0205 (0.3852)	0.0453 (0.0554)	-0.1026 (0.0000)	0.0726 (0.0021)	-0.0887 (0.0002)	0.0006 (0.9810)	0.0317 (0.1804)	-0.0174 (0.4609)	0.0160 (0.4998)
ES		1.0000	-0.0997 (0.0000)	0.2438 (0.0000)	-0.0785 (0.0009)	0.1619 (0.0000)	0.0701 (0.0030)	0.0217 (0.3578)	-0.1207 (0.0000)	-0.1404 (0.0000)
|ES|			1.0000	-0.4924 (0.0000)	0.3213 (0.0000)	-0.2744 (0.0000)	-0.1206 (0.0000)	-0.0172 (0.4661)	0.1736 (0.0000)	0.2124 (0.0000)
Size				1.0000	-0.5677 (0.0000)	0.6547 (0.0000)	0.2508 (0.0000)	0.0401 (0.0898)	-0.4443 (0.0000)	-0.2807 (0.0000)
B/M					1.0000	-0.3255 (0.0000)	-0.2272 (0.0000)	-0.0799 (0.0007)	0.2243 (0.0000)	0.1695 (0.0000)
Analysts						1.0000	0.2071 (0.0000)	0.3077 (0.0000)	-0.5004 (0.0000)	-0.1998 (0.0000)
MF							1.0000	0.1631 (0.0000)	-0.1811 (0.0000)	-0.0814 (0.0006)
Liquid								1.0000	-0.5518 (0.0000)	0.0031 (0.8974)
Prob_NT									1.0000	0.0670 (0.0045)
Abvola										1.0000

Note - The sample contains 1793 company-quarters from IQ 2000 to IIIQ 2002. The *p*-values are shown in parentheses. NIP is the net insider purchase index, defined as the total number of insider purchases summed between the current and last announcement date less the total number of sales. *ES* is the earnings surprise, defined as actual net EPS less the random walk forecast, scaled by price one day before the announcement. |*ES*| is the absolute value of earnings surprise. *Size* is the natural logarithm of the market value of equity one day prior to the announcement date. *B/M* is the book-to-market ratio one day prior to the announcement date. *Analysts* is the number of analyst forecasts available for a given company-year (excluding forecast revisions). *MF* equals one if management issued a voluntary earnings forecast, zero otherwise. *Liquid* is the total value of trading in a given company-year divided by firm's market capitalization. *Prob_NT* is the probability of a zero trading volume day in a given company-year. *Abvola* is the average of squared standardized OLS market model excess returns on days 0 through +2 relative to the earnings announcement date.

4. Methodology and Empirical Findings

4.1 Exploitation of preferential information

In its first step, the empirical analysis focuses on the determinants of insider trading occurrences. The modeling procedure involves pooling the time-series and cross-section data, while controlling for the unobserved heterogeneity across companies arising, for instance, from the differences in codes of ethics or management's attitudes towards transparency. Specifically, a fixed-effect probit specification of the following form is employed:

$$\Pr ob(y_{i,t}=1 \mid I_{i,t}) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{I_{i,t}} e^{-z^2/2} dt \qquad [1]$$

, where z ~ N(0,1) and the normal equivalent deviate $I_{i,t}$ is defined as:

$$\begin{aligned} I_{i,t} = {} & \beta_{i,0} + \beta_1 ES_{i,t} + \beta_2 (B/M)_{i,t} + \beta_3 Size_{i,t} + \beta_4 \Pr iorret_{i,t}^{n} + \\ & + \beta_5 O\_Postret_{i,t}^{n} + \sum_{j=0}^{n-1} \beta_{6+j} ES_{i,t+j} + \varepsilon_{i,t} \end{aligned} \qquad [2]$$

The dependent variable $y_{i,t}$ in Table 3A takes the value of one whenever in a given company-quarter the insider purchases outnumber insider sales. Conversely, $y_{i,t}$ in Table 3B equals one when $NIP_{i,t} < 0$, and zero otherwise. *ES* is the earnings surprise, *B/M* is the book-to-market ratio, and *Size* is the log market value of equity. $Priorret^{n}$ is the market-adjusted return computed over *n* quarters preceding the quarter for which the earnings announcement was made. $O\_Postret^{n}$ is the market-adjusted return compounded over *n* quarters following the earnings announcement quarter, orthogonized with respect to $\{ES, ES_{+1}, ..., ES_{n-1}\}$.[9] Three specifications of equation [2] are reported in each of the panels. The first one focuses on the short-run (n=1), whereas the second assumes a longer investment horizon (n=4). The third specification sets n=4 and imposes a parameter restriction, i.e. $\beta_6 = \beta_7 = \beta_8 = \beta_9$. The goodness-of-fit measure is computed in line with Efron (1978).

[9] The orthogonalization procedure amounts to regressing the cumulative market-adjusted returns on the future earnings surprises. $O\_Postret^{n}$ is equivalent to residuals from this regression. The orthogonalization is necessary, as future abnormal returns and future earnings surprises may essentially capture the same information.

Table 3A

Fixed effect Probit estimates for insider trading activity

Panel A. Probability of net insider purchases > 0				
	Predicted Sign	Specification 1	Specification 2	Specification 3
ES	+	0.1739 (0.1628)	0.1465 (0.1010)	_
ES_{+1}	+	_	0.2086** (0.1060)	_
ES_{+2}	+	_	0.0774 (0.1508)	_
ES_{+3}	+	_	0.3304** (0.1472)	_
Sum	+	_	_	0.1959** (0.0885)
B/M	?	0.0253 (0.0559)	-0.1421 (0.1336)	-0.1326 (0.1294)
Size	+	0.4403*** (0.1468)	0.2668 (0.2522)	0.2760 (0.2436)
$Priorret^1$	?	-0.0999 (0.2167)	_	_
$Priorret^4$	?	_	-0.3414** (0.1702)	-0.3254* (0.1725)
$O\_Postret^1$	+	-0.0085 (0.2003)	_	_
$O\_Postret^4$	+	_	0.1273 (0.1396)	0.1288 (0.1372)
Obs with DEP=0		1623	1164	1164
Obs with DEP=1		170	140	140
Total obs		1793	1304	1304
Efron's R^2		0.307	0.325	0.323

Note - ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

The standard errors are shown in parentheses. The dependent variable in Panel A takes the value of one if the total number of insider purchases summed between the current and last announcement date is greater than the total number of insider sales, zero otherwise. *ES* is the earnings surprise, defined as actual net EPS less the random walk forecast, scaled by price one day before the announcement. ES_{+1}, ES_{+2}, and ES_{+3} denote the earnings surprise at leads 1, 2, and 3, respectively. *Sum* is the sum of earnings surprises from *ES* to ES_{+3}. *B/M* is the book-to-market ratio one day prior to the announcement date. *Size* is the natural logarithm of the market value of equity one day prior to the announcement date. $Priorret^1$ is the market-adjusted return in the quarter preceding the quarter for which the earnings announcement was made. $Priorret^4$ is the market-adjusted return compounded over four quarters preceding the quarter for which the earnings announcement was made. $O\_Postret^1$ is the market-adjusted return in the quarter following the earnings announcement quarter, orthogonized with respect to *ES*. $O\_Postret^4$ is the market adjusted return computed over four quarters following the earnings announcement quarter, orthogonized with respect to *ES*, ES_{+1}, ES_{+2}, and ES_{+3}.

Table 3B

Fixed effect Probit estimates for insider trading activity

Panel B. Probability of net insider purchases < 0				
	Predicted Sign	Specification 1	Specification 2	Specification 3
ES	-	0.1165 (0.1122)	-0.0170 (0.1369)	_
ES_{+1}	-	_	-0.1975* (0.1039)	_
ES_{+2}	-	_	-0.1016 (0.0836)	_
ES_{+3}	-	_	-0.0220 (0.0135)	_
Sum	-	_	_	-0.0454 (0.0310)
B/M	?	0.1153** (0.0469)	-0.2062 (0.2018)	-0.1332 (0.2006)
Size	+	0.6189*** (0.1513)	0.7047** (0.3142)	0.6989** (0.2961)
Priorret[1]	?	-0.1556 (0.2264)	_	_
Priorret[4]	?	_	0.0903 (0.1889)	0.0485 (0.1885)
O_Postret[1]	-	-0.3901** (0.1949)	_	_
O_Postret[4]	-	_	-0.0991 (0.1291)	-0.1137 (0.1285)
Obs with DEP=0		1623	1164	1164
Obs with DEP=1		170	140	140
Total obs		1793	1304	1304
Efron's R^2		0.247	0.295	0.293

Note - ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

The standard errors are shown in parentheses. The dependent variable in Panel B takes the value of one if the total number of insider sales summed between the current and last announcement date is greater than the total number of insider purchases, zero otherwise. *ES* is the earnings surprise, defined as actual net EPS less the random walk forecast, scaled by price one day before the announcement. ES_{+1}, ES_{+2}, and ES_{+3} denote the earnings surprise at leads 1, 2, and 3, respectively. *Sum* is the sum of earnings surprises from *ES* to ES_{+3}. *B/M* is the book-to-market ratio one day prior to the announcement date. *Size* is the natural logarithm of the market value of equity one day prior to the announcement date. *Priorret*[1] is the market-adjusted return in the quarter preceding the quarter for which the earnings announcement was made. *Priorret*[4] is the market-adjusted return compounded over four quarters preceding the quarter for which the earnings announcement was made. *O_Postret*[1] is the market-adjusted return in the quarter following the earnings announcement quarter, orthogonized with respect to *ES*. *O_Postret*[4] is the market adjusted return computed over four quarters following the earnings announcement quarter, orthogonized with respect to *ES*, ES_{+1}, ES_{+2}, and ES_{+3}.

The results in Tables 3A and 3B do not lend credence to the assertion that insiders who, by virtue of their employment or ownership, have access to information about forthcoming earnings trade on it in the fiscal quarter immediately preceding the public disclosure. None of the coefficients of *ES* is significant and the coefficient in the first regression of Panel B is wrongly signed. Although illegal exploitation of preferential information in periods immediately surrounding the announcement does not dominate in the statistical sense, some instances of trading in breach of the existing regulation may still occur. It is rather unlikely, however, that individuals subject to mandatory disclosure requirements will routinely engage in illegal trading on their own accounts and self-report their transactions to the SEC, especially when the dealing can be easily associated with the impending material information (Bainbridge (2000)).

Instead, insiders appear to be more shrewd and cautious in undertaking their investment decisions. To circumvent the authorities and disguise the information content of their share dealings, they place their orders well ahead of the relevant earnings innovations. The signs of coefficients on the leads of unexpected earnings, both in Panel A and B, are consistent with the hypothesis that insiders utilize their foreknowledge of the trends in future profitability of the firm. Furthermore, statistical tests confirm the significance of three out of the six slopes. All in all, these findings suggest that managers, officers and large shareholders could be knowledgeable about some important facts that are not subject to the accounting measurement process. For example, information about a significant R&D breakthrough is unlikely to be disclosed unless the discovery is patented. By the time the company starts to cash in on this innovation insiders would adjust their shareholdings accordingly (Allen and Ramanan (1995)).

Juxtaposition of Tables 3A and 3B reveals that insider purchases convey more information about subsequent profit dynamics than do the insider sales.[10] The difference is vividly highlighted in Specification 3. The *Sum* coefficient in the probability of purchase quarter equation is significant at the 5% level, whereas in Panel B its p-value is merely 0.14. Justification for this asymmetry can rest on several economic arguments. One rationalization could be that purchases are driven solely by the desire to profit from the investment, whereas some sales may be conducted to satisfy unexpected liquidity needs. Alternatively, one can argue that the potential for resentment on the part of the shareholders is higher when insiders sell ahead of bad news. Form the standpoint of unprivileged market participants, gains from illegal purchases can be regarded as a form of reward to the corporate agent for having produced the favorable news. Contrarily, in the case of illegal selling, insiders can be blamed both for generating the bad news, and for moving the prices against the outside investors. As a result, the probability of prosecution is higher in the latter case (Easterbrook and Fishel (1991) provide evidence for the U.S.).

Table 3 offers further appealing inferences about the distribution of net insider trading. First of all, no clear-cut relationship between the sign of *NIP* and the book-to-market ratios is found. The data does not substantiate the finding of Rozeff and Zaman (1998) that insiders undervalue growth stocks and overvalue value stocks. Second, after controlling for a wide range of economically relevant factors, the frequency of trading is positively associated with the firm's log value of equity. This result appears logically coherent, inasmuch as big companies tend to have more insiders. Moreover, the investment style of informed traders is slightly contrarian. The slopes of the long-term non-earnings information proxy ($O\_Postret^4$) have the predicted signs, which may suggest that information about future earnings is only one of the whole spectrum of material nonpublic information to which insiders might be

[10] Elliott, Morse, and Richardson (1984) and Lustgarten and Mande (1995) report similar discrepancy between insider sales and purchases.

privy. Alternatively, insiders may be best positioned to recognize and exploit any temporary deviations of prices from the fundamentals. This result, however, has to be approached with caution as it is not statistically significant. The lack of statistical significance is likely a by-product of orthogonalization, relatively low sampling frequency, and the noisiness of the information proxy.[11]

In order to check the robustness of conclusions, a different definition of the dependent variable has been applied. In particular, the regressant has been computed as the difference between the value of insider purchases and sales scaled by the company's market value of equity. Results provided by a simple linear model reconfirm the main conclusion that corporate insiders trade on future, rather than current earnings innovations.

4.2 Implications for market efficiency

Next, the hypothesis that trading by managers and large shareholders promotes quick price discovery is tested. The scaled abnormal return volatility is linked to several explanatory variables, with a special focus on the magnitude of reaction conditioned on the prior insider deals. A formal analysis, however, should accommodate two potential econometric problems. The first concern is endogeneity. It is certainly plausible that insider trading communicates information to the market and, consequently, attenuates the market's response to earnings announcements. On the other hand, however, insiders could choose to trade ahead of substantial earnings surprises as to reap huge profits. Thus, insider trading could be endogenously related to the market's reaction on the announcement day. For more reading on this issue please refer to Roulstone (2003b). To overcome this difficulty an instrumental

[11] For more information on the behaviour of securities returns following insider transactions please refer to Lorie and Nederhoffer (1968), Jaffe (1974), Finnerty (1976), Baesel and Stein (1979), Givoly and Palmon (1985), Seyhun (1986, 2000), Lin and Howe (1990), Meulbroek (1990), Pope et al. (1990), Lakonishok and Lee (2001), and Del Brio, Miguel, Perote (2002).

variable approach is employed. Second, insider trading is observed only when insiders choose to trade. To avoid self selection biases this study utilizes the Heckman (1979) procedure.

In the spirit of Roulstone (2003b), the following set of equations is considered:

$$IT\_D_{i,t}^{n} = \Phi(\alpha_{1,i} + \alpha_2 \left|ES_{i,t}\right| + \alpha_3 Abvola_{i,t} + \alpha_4 Size_{i,t} + \alpha_5 MF_{i,t} + \alpha_6 Positive_{i,t} + \\ + \alpha_7 B/M_{i,t} + \alpha_8 \left|O\_Postret_{i,t}^{1}\right| + \varepsilon_{i,t}^{n,1}) \quad [3]$$

$$\left|NIT\_V_{i,t}^{n}\right| = \beta_{1,i} + \beta_2 \left|ES_{i,t}\right| + \beta_3 Abvola_{i,t} + \beta_4 Size_{i,t} + \beta_5 O\_Analysts_{i,t} + \beta_6 MF_{i,t} + \\ + \beta_7 Positive_{i,t} + \beta_8 B/M_{i,t} + \beta_9 \left|O\_Postret_{i,t}^{1}\right| + \beta_{10} \ln(Turnover_{i,t}) + \\ + \beta_{11} Stdret_{i,t} + \beta_{12} Mills_{i,t}^{n} + \varepsilon_{i,t}^{n,2} \quad [4]$$

$$\left|NIT\_V_{i,t}^{n}\right|_{FIT} = \left|NIT\_V_{i,t}^{n}\right| - \hat{\varepsilon}_{i,t}^{n,2} \quad [5]$$

$$Abvola_{i,t} = \gamma_1^{(1)} + \gamma_2^{(1)} \left|NIT\_V_{i,t}^{n}\right|_{FIT} + \gamma_3^{(1)} \left|ES_{i,t}\right| + \gamma_4^{(1)} Positive_{i,t} + \gamma_5^{(1)} B/M_{i,t} + \\ + \gamma_6^{(1)} Size_{i,t} + \varepsilon_{i,t}^{n,3a} \quad [6a]$$

$$Abvola_{i,t} = \gamma_1^{(2)} + \gamma_2^{(2)} \left|NIT\_V_{i,t}^{n}\right|_{FIT} + \gamma_3^{(2)} \left|ES_{i,t}\right| + \gamma_4^{(2)} Positive_{i,t} + \gamma_5^{(2)} B/M_{i,t} + \\ + \gamma_6^{(2)} Analysts_{i,t} + \gamma_7^{(2)} MF_{i,t} + \varepsilon_{i,t}^{n,3b} \quad [6b]$$

where $IT\_D_{i,t}^{n}$ is an indicator variable equal to one if there was at least one insider trading incidence *n* quarters prior to the announcement, zero otherwise. $Positive_{i,t}$ is a dummy for a good news announcement, i.e. $ES_{i,t} > 0$. $\left|NIT\_V_{i,t}^{n}\right|$ is the modulus of the net value of insider trading (purchases minus sales) *n* quarters prior to the announcement date, scaled by the total trading volume during that time. $O\_Analysts_{i,t}$ is the number of analyst forecasts available for a given company-year (excluding forecast revisions), orthogonized with respect to *Size*. $Turnover_{i,t}$ is the total value of trading in the quarter preceding the earnings announcements, scaled by the firm's market value of equity. $Stdret_{i,t}$ is the standard deviation of daily, market-adjusted returns over the quarter prior to the announcement. $Mills_{i,t}^{n}$ is the inverse Mill's ratio derived from equation [3]. The construction of the remaining variables is described in the Data section and chapter 4.1.

The estimation of the of the equation set proceeds as follows. First, equation [3] is fitted by means of a Probit model. The computed coefficients are used to construct the selectivity correction factor ($Mills_{i,t}^{n}$), which is subsequently inputted into regression [4]. Lastly, the instrumented insider trading measure $\left|NIT\_V_{i,t}^{n}\right|_{FIT}$ from [5] becomes a regressor in equations [6a] and [6b]. It has to be mentioned that the coefficient of determination in the NIT_V^{1} regression equals 17.3%, whereas in the NIT_V^{4} fit it amounts to 37.9%. Consequently, the problems related to weak instruments are not likely to apply in this context.

Two values of the parameter *n* were considered, $n = 1$ and $n = 4$. The need to consider insider transactions in windows longer than one quarter prior to the earnings disclosure date has been vividly highlighted in Tables 3A and 3B. Intuitively, to make efficient inferences about the next earnings announcement, outside investors should take into account all insider dealings over a period of at least one preceding year (i.e. $n = 4$). The *Analysts* and *Size* in the aforementioned specifications [6a] and [6b] are not bundled together, as the high correlation coefficient between these variables (see Table 2) can induce problems related to multicollinearity.

For the sake of brevity, only the results of regressions [6a] and [6b] are reported in Table 4 (see specifications (3) - (6)). The first two columns in Table 4 present simple OLS regressions in which *Abvola* is not conditioned on prior insider trading.

Table 4

Determinants of return volatility around the earnings announcement date

	Predicted Sign	(1)	(2)	(3)	(4)	(5)	(6)
Intercept		10.6018*** (1.5973)	2.5075*** (0.3130)	10.6365*** (1.5951)	2.4637*** (0.3171)	10.5928*** (1.5956)	2.5151*** (0.3189)
$\lvert NIT\_V_1 \rvert_{FIT}$	?	_	_	0.8963 (0.6619)	0.5687 (0.6686)	_	_
$\lvert NIT\_V_4 \rvert_{FIT}$	?	_	_	_	_	0.3944 (1.3441)	-0.1867 (1.3593)
|ES|	+	0.1815** (0.0823)	0.2272*** (0.0822)	0.1832** (0.0822)	0.2288*** (0.0823)	0.1821** (0.0823)	0.2269*** (0.0823)
Positive	-	-1.0084*** (0.3175)	-1.3034*** (0.3130)	-1.0094*** (0.3174)	-1.3120*** (0.3130)	-1.0076*** (0.3175)	-1.3040*** (0.3130)
B/M	-	-0.0185 (0.0867)	0.1113 (0.0826)	-0.0164 (0.0867)	0.1156 (0.0827)	-0.0186 (0.0867)	0.1112 (0.0826)
Size	-	-0.4623*** (0.0870)	_	-0.4674*** (0.0869)	_	-0.4627*** (0.0869)	_
Analysts	-	_	-0.1120** (0.0514)	_	-0.1082** (0.0516)	_	-0.1124** (0.0516)
MF	-	_	-0.4083 (0.3898)	_	-0.3974 (0.3898)	_	-0.4097 (0.3901)
R-squared		3.78%	2.64%	3.88%	2.68%	3.78%	2.65%

Note - ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

The standard errors are shown in parentheses. The sample contains 1793 quarterly earnings announcements from IQ 2000 to IIIQ 2002. The dependent variable is *Abvola* defined as the average of squared standardized OLS market model excess returns on days 0 through +2 relative to the earnings announcement date. $|NIT\_V_1|_{FIT}$ is the modulus of instrumented net value of insider trading (value of purchases minus value of sales) one quarter prior to the earnings announcement, scaled by the total value of trading during that period. $|NIT\_V_4|_{FIT}$ is the modulus of instrumented net value of insider trading four quarters prior to the earnings announcement, scaled by the total value of trading during that period. $|ES|$ is the absolute value of earnings surprise, defined as actual net EPS less the random walk forecast, scaled by price one day before the announcement. *Positive* equals one if the earnings surprise is positive, zero otherwise. *Size* is the natural logarithm of the market value of equity one day prior to the announcement date. *B/M* is the book-to-market ratio one day prior to the announcement date. *Analysts* is the number of analyst forecasts available for a given company-year (excluding forecast revisions). *MF* equals one if management issued a voluntary earnings forecast, zero otherwise.

The evidence does not support the claim that dealing by managers and large stakeholders diminishes the scaled abnormal return variance. The coefficients $\gamma_2^{(1)}$ and $\gamma_2^{(2)}$ are positive and insignificant. This result is robust to changes in the length of the event window used to compute the *Abvola* variable. Furthermore, the baseline regressions of Roulstone (2003b) also produce insignificant coefficients of *NIT_V*. A sensitivity analysis with respect to the construction of the insider trading variable has been conducted. In particular, a new variable defined as the difference between the value of insider purchases and sales, scaled by the company's market value of equity has been constructed and used. Again, the baseline regressions attest to its statistical insignificance.

The degree of a security's price revaluation is inversely related to the market capitalization and analyst following. This conforms with the rather uncontroversial postulate that heavy information flow abates the uncertainty about future prospects of the company. Similarly, the dispersion of returns is smaller for positive earnings surprises, as management tends to produce more predisclosure information in times of prosperity. Investors, however, have a proclivity to double check the reliability of voluntary managerial disclosures against other sources. For instance, after controlling for the number of forecasts issued by analysts, the *MF* variable loses much of its predictive power. Finally, there is no discernable discrepancy between the reaction of value and growth stocks.

4.3 Insider trading and analyst following

The result that dealing by managers and large stakeholders does not lead to more efficient pricing of securities is in contrast to the findings of Udpa (1996) and Roulstone (2003b) for the U.S. stock market. At least two justifications can be offered for this observed phenomenon. The first explanation rests on the relative efficiency of decrypting the information contained in insider transactions by outside market participants. As noted by Lakonishok and Lee (2001) the demand for insider trading information in the U.S. is

substantial, which has became a *raison d'être* of numerous professional newspapers and data vendors. Similarly, many investment funds track insider trading activity and adjust their strategy accordingly. It is debatable, however, whether information on insider dealing arouses similar interest and provokes an equally vigorous response from the Polish finance community.

The second explanation of why insider trading may not improve the accuracy of asset pricing is more complex and pertains to the insiders' adverse effect on market competitiveness. As pointed out by Haddock and Macey (1987), much of the literature that champions the benefits of insider trading overlooks a meaningful distinction among different classes of shareholders. In a theoretical model with at least three investor groups (insiders, liquidity traders and market professionals) the overall price efficiency may not be increased (Fishman and Hagerty (1992)). Insiders, who by nature of their employment or ownership are innately advantaged in gathering firm-specific information, would expose the analysts and arbitrageurs to significant losses. Due to this effect, some information producers will be driven out of the market and the volatility of returns around corporate disclosures could be greater. To shed more light on the validity of this hypothesis, an empirical examination of the link between prior insider trading and analyst coverage is conducted.

The selection of the appropriate econometric modeling technique in this context is not without pitfalls. The analyst following is a non-negative integer variable and the normal linear model will tend to produce inconsistent estimators of the true coefficients. Furthermore, the *Analysts* exhibits a higher fraction of zeros than is likely to be compatible with any standard count data distribution. For these reasons, parameterized zero-inflated Poisson (ZIP(τ)) regressions are employed in the spirit of Lambert (1992). The Voung (1989) statistic strongly favors the zero-inflated model against the unaltered alternative. ZIP(τ) regression mixes point mass at 0 with Poisson distribution, i.e. $Analysts_{i,t} \sim 0$ with probability $\pi_{i,t}$ and $Analysts_{i,t} \sim$ Poisson($\lambda_{i,t}$) with probability $1-\pi_{i,t}$, so that

$$P(Analysts_{i,t}=k) = \mathrm{I}(k=0)\pi_{i,t} + (1-\pi_{i,t})\frac{e^{-\lambda_{i,t}}\lambda_{i,t}^{k}}{k!}$$

where *Analysts* is the number of analyst forecasts for a given company-year (excluding forecast revisions). I(k=0) is an indicator variable taking the value 1 when k=0 and zero otherwise, $\lambda_{i,t} = \exp(\mathbf{X}_{i,t}\boldsymbol{\beta})$, $\pi_{i,t} = (1 + \lambda_{i,t}^{\tau})^{-1}$ and τ is a shape parameter to be estimated.

The following specifications are estimated using annual data on 163 companies from 2000 to 2002:

$$\begin{aligned}\mathbf{X}_{i,t}^{(1)}\boldsymbol{\beta}^{(1)} &= \beta_0^{(1)} + \beta_1^{(1)}\left|NIP_{i,t-1}\right| + \beta_2^{(1)}Size_{i,t} + \beta_3^{(1)}(B/M)_{i,t} + \beta_4^{(1)}MF_{i,t} + \beta_5^{(1)}Beta_{i,t-1} + \\ &+ \beta_6^{(1)}\sigma_{\varepsilon,i,t-1} + \beta_7^{(1)}CAR\_WIG_{i,t} + \beta_8^{(1)}Liquidity\_proxy_{i,t-1} + \beta_9^{(1)}D01_t + \beta_{10}^{(1)}D02_t\end{aligned} \quad [7]$$

$$\begin{aligned}\mathbf{X}_{i,t}^{(2)}\boldsymbol{\beta}^{(2)} &= \beta_0^{(2)} + \beta_1^{(2)}\left|NIP_{i,t-1}\right| + \beta_2^{(2)}Size_{i,t} + \beta_3^{(2)}(B/M)_{i,t} + \beta_4^{(2)}MF_{i,t} + \beta_5^{(2)}Beta_{i,t-1} + \\ &+ \beta_6^{(2)}\sigma_{\varepsilon,i,t-1} + \beta_7^{(2)}CAR\_WIG_{i,t} + \beta_8^{(2)}Liquidity\_proxy_{i,t-1} + \beta_9^{(2)}rWIG_{t-1}\end{aligned} \quad [8]$$

where *NIP* is the net insider purchase index computed for a given calendar year. [12] Size and *B/M* are the log market value of equity and book-to-market ratio at the beginning of a calendar year, respectively. *MF* is a dummy for managerial forecast issuance. *Beta* and σ_{ε} are, respectively, the slope coefficient and the standard deviation of daily residuals from a market model in a given company-year. *CAR_WIG* is the cumulative abnormal return over a WIG benchmark. *Liquidity_proxy* is either *Liquid* or *Prob_NT*. *Liquid* is the value of trading, scaled by the firm's market capitalization. *Prob_NT* is the probability of a zero trading volume day in a given company-year. *D01* and *D02* are indicator variables for the years 2001 and 2002. *rWIG* is the continuously compounded return on the all-share value weighted market index.

Several clarifications regarding specifications [7] and [8] are in order. Each of these equations uses two different proxies for liquidity, giving rise to four empirical equations in total. The relatively low sampling frequency can be attributed to the fact that analysts make forecasts on an annual, rather than quarterly basis. A typical forecast is made one year ahead

[12] The use of the absolute value of the net insider purchase index as a regressor is consistent with the logic presented in John and Lang (1991) and Lustgarten and Mande (1995). It assumes that when insider trade on preferential information they will be either mostly selling or mostly buying.

of the actual earnings announcement, which justifies lagging the absolute value of the insider trading index and some other variables by one period. Additionally, the aggregate analyst following exhibits strong procyclical fluctuations which should be accounted for within the frames of the model. Equation [7] attempts to control for these trends by including time dummies, whereas equation [8] directly incorporates the overall tide of the market. The intuition behind the latter specification is that the upward market swings tend to increase budgets of brokerage houses and, consequently, enhance the resources expended on gathering and assimilating information.

The results presented in Table 5 may suggest that analysts are likely to lose most of the trading races against insiders. Accordingly, market professionals refrain from following firms that have experienced heavy dealing by corporate managers and large shareholders. As predicted by the theoretical model of Fishman and Hagerty (1992) and Khanna, Slezak and Bradley (1994), the coefficients $\beta_1^{(1)}$ and $\beta_1^{(2)}$ are negative. In specifications (2) – (4) these slopes are significant at the conventional 5% level, whereas in specification (1) the p-value equals 0.052. The analyst coverage is positively related to the log value of equity, as large companies are generally more transparent. The data does not reveal any strong association between the book-to-market ratio and the frequency of forecasts. Finally, a robust relationship between analyst following and voluntary managerial projection issuance is observed. Voluntary disclosures apparently aid the analysts' efforts by providing an additional source of intelligence.

Table 5

Determinants of analyst following: ZIP(τ) estimation

	Predicted Sign	(1)	(2)	(3)	(4)
Intercept		-7.2367***	-6.7014***	-6.7505***	-6.2283***
		(0.4381)	(0.4211)	(0.4447)	(0.4186)
$\lvert NIP \rvert_{-1}$	-	-0.0189*	-0.0195**	-0.0181**	-0.0187**
		(0.0097)	(0.0095)	(0.0092)	(0.0906)
Size	+	0.4248***	0.3951***	0.4215***	0.3942***
		(0.0185)	(0.0172)	(0.0188)	(0.0173)
B/M	?	-0.0269	-0.0447	-0.0124	-0.0270
		(0.0668)	(0.0659)	(0.0672)	(0.0657)
MF	+	0.1449***	0.1459***	0.1592***	0.1597***
		(0.0512)	(0.0498)	(0.0517)	(0.0503)
$Beta_{-1}$	?	0.2792***	0.3658***	0.3495***	0.4448***
		(0.0791)	(0.0771)	(0.0890)	(0.0882)
$\sigma_{\varepsilon,-1}$	-	-21.4786***	-13.4388***	-24.6755***	-16.7583***
		(4.2404)	(4.0732)	(4.5117)	(4.4507)
CAR_WIG	+	0.1611**	0.1082*	0.2074***	0.1446**
		(0.0670)	(0.0615)	(0.0720)	(0.0671)
$Liquid_{-1}$	+	0.2768***	_	0.2740***	_
		(0.0397)		(0.0420)	
$Prob\_NT_{-1}$	-	_	-2.1749**	_	-1.4382
			(0.9579)		(0.9954)
$rWIG_{-1}$	+	1.0891***	1.2074***	_	_
		(0.1224)	(0.1146)		
D01	?	_	_	-0.3505***	-0.4203***
				(0.0603)	(0.0561)
D02	?	_	_	-0.8006***	-0.8688***
				(0.0960)	(0.0970)
τ	+	1.3843***	1.3388***	1.4024***	1.3787***
		(0.1948)	(0.2106)	(0.2010)	(0.2179)
Log-likelihood		-552.4227	-567.55484	-549.69357	-565.46517

Note - ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.

The standard errors are shown in parentheses. The sample contains 489 annual observations on 163 companies over the period from 2000 to 2002. The dependent variable is *Analysts* defined as the number of analyst forecasts available for a given company-year (excluding forecast revisions). $|NIP|_{-1}$ is the absolute value of the net insider purchase index in the previous year. *Size* is the natural logarithm of the market value of equity at the beginning of a calendar year. *B/M* is the book-to-market ratio at the beginning of a calendar year. *MF* equals one if management issued a voluntary earnings forecast, zero otherwise. $Beta_{-1}$ and $\sigma_{\varepsilon,-1}$ are, respectively, the slope coefficient and the standard deviation of residuals from a market model in the previous year. *CAR_WIG* is the cumulative abnormal return over a WIG benchmark. $Liquid_{-1}$ is the value of trading in the previous company-year divided by a firm's market capitalization. $Prob\_NT_{-1}$ is the probability of a zero trading volume day in the last company-year. *D01* and *D02* are dummy variables for the years 2001 and 2002, respectively. $rWIG_{-1}$ is the return on the value weighted market.

The results also highlight a sharp conflict between the risk preferences of analysts and investors. Theoretically, investors should not require a premium for the diversifiable, company-specific risk and dislike the systematic risk only. The reverse holds for the analysts, who are primarily concerned about their career prospects. A missed prediction, which ex-post can be justified by a deteriorating macroeconomic situation, is unlikely to seriously threaten their professional position. Contrarily, a large forecast error arising from ignorance of firm-specific factors could be a real obstacle in further career advancement.

Prior research has documented that analysts who issue optimistic forecasts are more likely to experience favorable job separations (see Hong and Kubik (2003)). This is due to the fact that part of the stocks is underwritten by their brokerage houses. Supposedly, an optimistic prediction is more credible for stocks which are currently outperforming the market. Consistent with the *a priori* predictions, the impact of the *CAR_WIG* variable is positive and statistically significant. Lastly, analysts prefer to follow companies which are actively traded by investors.

An extensive sensitivity analysis of the results has been performed. A left-censored at zero Tobit model has been fitted. It accounts for the qualitative difference between limit observations and nonlimit observations, i.e. it considers a dependent variable distribution with a significant fraction of zeros. Although the Tobit model does not explicitly incorporate the count feature of the regressant, the findings are, broadly speaking, very similar to those obtained with the zero-altered Poisson regressions. Moreover, the statistical significance of the *NIP* indicator vanishes in left truncated at *Analysts* =1 Poisson regressions, indicating that it is the group of firms not followed by market professionals that has generated most of the negative co-variation. Apparently, analysts collectively avoid following companies with heavy historical insider trading, which could be a manifestation of their herding behavior. These findings paradoxically supplement and potentially strengthen our conclusions. Blatant

insider dealing is likely to discourage all analysts from following the firm, which in turn leads to a further deterioration of transparency. A classic example of a vicious cycle.

The empirical findings of this section underline the necessity of vigorous market supervision and take a lot of ground from the proponents of insider trading deregulation. The evidence for the Polish stock market refutes the customarily quoted opinion that dealings by corporate insiders lead to more efficient pricing of securities. Instead, insider trading seems to discourage other market participants from collecting firm-specific information. Unfortunately, successful prevention of this crime can be a rather onerous task. Specifically, it is difficult to link a trade to a particular piece of material nonpublic information. The strategic timing of insider transactions poses a problem to authorities who seek to prosecute individuals violating the existing regulations.

5. Conclusions

Consistent with the deterrence of legal sanctions, corporate insiders display a distinct reluctance to exploit material nonpublic information in periods of intense regulatory scrutiny, i.e. immediately prior to announcement dates. Thus, the provisions of the Polish Law on the Public Trading of Securities of 1997 can be deemed effective to the extent that the most blatant use of private information is curtailed. Nevertheless, the empirical evidence presented here indicates that insiders tend to time their transactions strategically, as to minimize the risk of a potential SEC enforcement action. Specifically, they place their orders up to four quarters ahead of the relevant accounting disclosures. In this respect, the earlier findings of Ke, Huddart and Petroni (2003) for the US stock market are corroborated in the Polish data.

Furthermore, the results highlight an asymmetry of insiders' behavior. Purchase transactions emerge as more strongly associated with future earnings surprises. The capital gains accruing from insider purchases ahead of good news can be viewed as a form of compensation to the manager for having produced the valuable information. On the other

hand, illegal selling creates perverse managerial incentives and moves the price against the existing shareholders. Consequently, the latter case is more likely to elicit shareholder lawsuits. Insiders, acting as rational economic agents, take this eventuality into account.

Along with investigating the trading patterns of informed agents, this paper addressed several issues revolving around the impact of their transactions on stock price efficiency. A large class of theoretical models predicts that insiders will reveal the preferential information they possess through the process of trading. This should generate a partial resolution of uncertainty about the future fundamental value and, in turn, reduce the return variance around the date at which companies disclose their accounting figures. The empirical findings do not confirm the validity of these theoretical predictions. Instead, the effect of prior insider trading on the volatility of scaled abnormal returns proved negligible.

Two rationalizations of the observed relationship can be offered. First, outsiders can be misguided by the strategic nature of insider trading and misinterpret the signals conveyed by their transactions. The second explanation is more formal and directly testable. Fishman and Hagerty (1992) and Khanna, Slezak, and Bradley (1994) hypothesize that insider trading deters outside parties from bearing the cost of acquiring information because in a round of trading with a better informed insider this becomes a sunk cost. This paper offers evidence which indeed substantiates the claim that analysts are disinclined to follow companies with historically heavy insider buying / selling.

Analysts, however, are only one conduit by which information gets impounded into stock prices. Further research could also inquire into the relationships between insider trading and other sources of information production. Moreover, the interpretation of the results is subject to the caveat that quarterly earnings reports may not accurately reflect the financial standing of the company. In particular, following an increase in their shareholdings, insiders are faced with a temptation to inflate accounting figures. By the same token, analysts would

avoid making forecasts for the companies that are likely to manipulate their financial statements.

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The Relationship between Insider Trading and Volume-Induced Return Autocorrelation

I. Introduction

Llorente, Michaely, Saar, and Wang (2001, henceforth LMSW) develop a theoretical model with heterogeneously informed agents to show that the return-volume dynamics of individual stocks is governed by the degree of informational asymmetry. In particular, the stocks with a high proportion of private information trading volume exhibit return continuations, whereas stocks in which investors trade predominantly for portfolio rebalancing reasons have a negative volume-induced return autocorrelation. The rationale behind this result is that whenever an insider exploits nonpublic information by trading in securities, prices will partially reflect the information before it is announced. Conversely, dealings driven by allocational motives tend to generate return reversals. The stock price will initially move in the direction of the hedging transaction in order to encourage other market participants to take the other side. However, since the trade does not reflect any superior knowledge of future payoffs the stock price is likely to rebound in the next period. By conditioning on volume, the LMSW model isolates the aforementioned impact of trading on serial correlations of returns.

LMSW perform a cross-sectional regression analysis of the trade-generated first-order autocorrelation coefficient and provide persuasive evidence that its magnitude can be successfully explained by the standard informational asymmetry proxies such as capitalization, bid-ask spreads and analyst following. In a related paper, Grishchenko, Litov and Mei (2002) examined market index constituents from 18 emerging markets and concluded that stocks in countries that enforce insider trading laws and provide better investor protection exhibit less return continuation following high volume days. It has to be noted,

however, that the dichotomous variable for a successful prosecution on insider trading charges used in their study is a rather indirect measure of the degree of speculative trading based on private information. The authors were unable to develop a more explicit proxy due to a lack of data. It is our intention to empirically expand on the model of LMSW by explicitly including insider transactions into the model. Specifically, the analysis focuses on the corporate insider trading reports filed with the New Zealand Exchange (NZX)[1] and investigates the relationship between the degree of insider trading and volume-induced autocorrelations.

The remainder of the paper is organized as follows. The following section describes the sample and variable construction. Section 3 outlines the methodology and provides empirical results. Section 4 concludes the paper.

2. Data

The sample employed in this study was drawn from companies listed on the NZX between January 1995 and December 2003 for which insider trades could be collected. This resulted in a sample of 83 companies, 577 firm-years and 3031 insider trades. Information on insider transactions came from the NZX and company annual reports. Data on company prices, volume, bid-ask spreads and market capitalization were collected from Thompson Financial Datastream while analyst following data came from Datex. The analyst following data, however, was only available from 1997 necessitating a smaller sample be used in some specifications.

The insider trading variable is defined as the absolute value of net insider trading volume (volume of purchases minus volume of sales) scaled by the total volume of trading in a given company-year (as consistent with the reasoning of John and Lang (1991), Lustgarten

[1] Insiders, defined as directors, substantial shareholders and executives, are required to disclose changes in their shareholdings under the Securities Market Act 1988 and Securities Market Amendment Act 2002. For more information on the institutional setting of insider trading in New Zealand we would refer the reader to Eterbari, Tourani-Rad and Gilbert (2004).

and Mande (1995) and Roulstone (2003)). Scaling by the total volume follows directly from the LMSW model which predicts that the relation between the volume-induced return autocorrelation and the significance of speculative trades relative to hedging trades is monotonic.

Table 1

Summary Statistics

Variable	Mean	Median	Standard Deviation	Cross-Sectional Correlations		
				Size	Analysts	BAS
INS	0.0292	0.0016	0.0876	0.0055 (0.8951)	-0.0159 (0.7327)	0.1265 (0.0023)
Size	11.3934	11.3097	1.8252	_	0.6729 (0.0000)	-0.8073 (0.0000)
Analysts	2.7909	1.0000	3.2982	_	_	-0.6380 (0.0000)
BAS	-3.6499	-3.7146	0.9475	_	_	_

Note - The *p*-values are shown in parentheses. *INS* is the absolute value of net insider trading volume (volume of purchases minus volume of sales) scaled by the total volume of trading in a given company-year. *Size* is the natural logarithm of the average market value of equity during a given firm-year. *Analysts* is the number of analyst forecasts available for a company at the end of a calendar year. *BAS* is the natural logarithm of the average bid-ask spread during a given firm-year.

The market value of equity for our sample is distributed with an arithmetic mean of NZ$520 million and a median of only NZ$82 million, indicating that the sample comprises both the smallest and largest firms listed on the NZX. The Bid-Ask spread has a mean of 4.31% and a median of 2.44%. The relatively high magnitude of spreads is likely attributable to the poor liquidity of the New Zealand market. To reduce the excess skewness in these two variables a log transformation of the data was used. There was at least one analyst following a company in 51% of the firm-years and in total 60% of the firms were followed in at least one year. The disclosed trades of insiders make up 4.4% of the total volume traded and 2.9% of the volume traded each year appears to be informed trading by insiders. The summary statistics for the variables employed in our study are shown in Table 1.

The cross-sectional correlations between variables are also presented. While neither size nor analysts following is significantly related to insider trading, its association with bid-ask spreads is positive and statistically significant. This conforms with the well-established

finding that market makers increase spreads in response to active insider trading in order to avoid considerable losses (Glosten and Milgrom (1985), Kyle (1985) and Copeland and Galai (1988)). Furthermore, the information asymmetry proxies are strongly interrelated in the expected directions. Larger companies and companies with smaller bid-ask spreads for instance are covered by more analysts while size and bid-ask spreads are inversely related.

3. Methodology and Empirical Findings

To calculate the value of trade-generated return autocorrelation we apply two LMSW empirical specifications, the second of which removes the impact of market-wide variations from the analysis:

$$R_{i,t+1} = C_0 + C_1 R_{i,t} + C_2 R_{i,t} V_{i,t} + \varepsilon_{i,t+1} \quad [1]$$

$$R_{i,t+1} = C_0 + C_1 R_{i,t} + C_2 R_{i,t} V_{i,t} + C_3 R_{m,t+1} + \varepsilon_{i,t+1} \quad [2]$$

where $R_{i,t}$ and $R_{m,t}$ denote the continuously compounded return on security i and the NZSE ALL index on day t, respectively. $V_{i,t}$ is the log, detrended turnover at date t, such that

$$V_{i,t} = \ln((Vol_{i,t} / N_{i,t}) + c) - (1/200)\sum_{j=1}^{200} \ln((Vol_{i,t-j} / N_{i,t-j}) + c)$$

where $Vol_{i,t}$ and $N_{i,t}$ are the number of shares traded and the total number of shares outstanding on day t for company i, respectively. Following LMSW we add a small constant c = 0.00000255 to the turnover ratio in order to avoid the problem of zero trading volume days. The detrending procedure accounts for the fact that daily turnover series tend to be nonstationary.

The parameter of interest, C_2, has been deemed to indicate whether the trading is dominated by portfolio rebalancing or private information trades. To verify this assertion we estimate the C_2 coefficient for each of the firm-years available in sample and regress it on the insider trading variable and information asymmetry proxies. The findings are reported below.

Table 2

Empirical determinants of the C_2 coefficient

Panel A: Regressions on the Volume-Induced Return Autocorrelation Coefficient					
Variable	Predicted Sign	(1)	(2)	(3)	(4)
Intercept		-0.0012 (0.0035)	0.0960*** (0.0278)	0.0162*** (0.0046)	0.0510*** (0.0156)
INS	+	0.0745** (0.0343)	0.0755** (0.0314)	0.0602* (0.0316)	0.0551* (0.0304)
Size	-	_	-0.0085*** (0.0025)	_	_
Analysts	-	_	_	-0.0069*** (0.0014)	_
BAS	+	_	_	_	0.0142*** (0.0044)
Adj. R-squared		0.68%	4.23%	7.19%	3.17%
No. of obs.		577	577	577	464
Panel B: Regressions on the Market-Adjusted Volume-Induced Return Autocorrelation Coefficient					
Variable	Predicted Sign	(1)	(2)	(3)	(4)
Intercept		-0.0016 (0.0036)	0.0927*** (0.0285)	0.0145*** (0.0046)	0.0482*** (0.0158)
INS	+	0.0727** (0.0341)	0.0737** (0.0313)	0.0588* (0.0317)	0.0542* (0.0304)
Size	-	_	-0.0083*** (0.0026)	_	_
Analysts	-	_	_	-0.0064*** (0.0014)	_
BAS	+	_	_	_	0.0135*** (0.0045)
Adj. R-squared		0.46%	3.89%	6.08%	3.17%
No. of obs.		577	577	577	464

Note - ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.
The White (1980) heteroscedasticity-consistent standard errors are shown in parentheses. *INS* is the absolute value of net insider trading volume (volume of purchases minus volume of sales) scaled by the total volume of trading in a given company-year. *Size* is the natural logarithm of the average market value of equity during a given firm-year. *Analysts* is the number of analyst forecasts available for a company at the end of a calendar year. *BAS* is the natural logarithm of the average bid-ask spread during a given firm-year.

The results in Table 2 Panel A examine the relationship between insider trading and volume-induced return autocorrelation measured by the C_2 coefficient from equation [1]. The results show a significant relationship between the insider trading variable and the regressant indicating that the C_2 coefficients increase monotonically with the degree of speculative trading on nonpublic information. This supports the prediction of Lorente et al (2001) that positive C_2 coefficients are symptomatic of prevalent private information trading. The

robustness of the results to inclusion of other information asymmetry variables is verified in specifications (2), (3) and (4). Since all the informational asymmetry measures are highly cross-correlated they are not bundled together into one regression due to potential multicolinearity problems. Insider trading retains its predictive power in all of the models considered, however, inclusion of bid-ask spreads or analyst following reduces its significance level. This could be due to the fact that bid-ask spreads partially reflect the degree of informed trading and analysts condition their investment decisions on the subset of information available to insiders.

Panel B in Table 2 presents the determinants of the C_2 coefficient from a model incorporating the overall movement of the market. This specification takes into account a possible cross-equation correlation of errors arising from sensitivity to common factors. The magnitude and statistical significance of the coefficients is directly comparable with the findings reported in Panel A. Moreover, the sensitivity of results to the exclusion of outliers has been examined by eliminating observations for which the absolute value of the fitted residual exceeded three times the estimated residual standard deviation. The results were not materially altered. Lastly, we retest the model using an alternative definition of volume, where volume is defined as $(\ln(1+\text{number of shares traded}))^2$. This specification reduces the discrepancy between the theoretical and empirical representation of the LMSW model. The use of alternative volume definition, however, does not affect the conclusions drawn.

IV. Conclusions

This study investigated the connection between volume-induced return autocorrelation and the relative significance of private information trading versus trading for portfolio rebalancing reasons. Insider transactions disclosed to the NZX have been used to construct a measure of informed trading prevalence. The findings validate the theoretical predictions of the LMSW model in that the return continuations following high volume days appear to be

more likely for stocks with high degree of insider dealing. Consequently, the volume-induced autocorrelation coefficient could be helpful in identifying periods in which ordinary shareholders are at a great disadvantage, especially in markets in which insiders are not required to report their transactions.

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Conclusions

Main Findings

This thesis investigated the patterns of insider trading and outlined the implications it has for capital markets. The conclusions presented here are of potential relevance both to market practitioners and policy makers. Although the empirical analysis focused predominantly on the Polish capital market, certain inferences were based on the New Zealand data. These two stock markets are comparable in terms of their capitalization, prevalence of informed dealing, and enforcement of the enacted insider trading regulations. The fraction of volume generated by the disclosed corporate insider trades on the Warsaw Stock Exchange was historically in the neighborhood of 2%, whereas in the case of the New Zealand market this figure exceeded 4%. Both of the estimates emerge as exceptionally large, especially when confronted with results for the U.S. market where the proportion of disclosed insider dealing would typically not exceed 0.7% (see Bettis, Coles, and Lemmon (2000)). In other words, insider trading appears to be pervasive and rampant in these markets, which poses a problem to outside investors and authorities.

The first part of the empirical inquiry evaluated the undue gains reaped by executive and supervisory board members and the next of kin of these individuals. Transactions reported to the Polish Security and Exchange Commission were used in this study. The average cumulative abnormal returns accruing to insiders within 100 days following the trade amounted to 9.04% and to 12.63% within a calendar year of the trade. The profitability of transactions was declining over time and the most lucrative deals were attributed to the family members of insiders. It has been also shown that, due to the strict reporting requirements set by the Polish SEC, the gains to outsiders mimicking insiders' actions were nearly as pronounced as those realized by insiders themselves. Consequently, the reports filed with the

SEC can be deemed a rich source of intelligence about companies and a valuable input into outside investors' stock-picking strategies.

Not only does the reported insider trading allow identifying companies that are going to offer high returns, but it is also a useful predictor of future stock market performance and macroeconomic development. In particular, the aggregate insider dealing indicator Granger-caused the overall market returns and real growth in industrial production. At a horizon of six months, a one standard deviation shock in an artificially constructed measure of aggregate insider dealing induced a rise in the real stock market prices of 4.27%, which tended to be accompanied by increased productivity. These results lend support to the cash flow hypothesis propounded by Seyhun (1988, 1992a) in that the insiders exploit privileged information about future company cash flows which, to a certain extent, are influenced by economy-wide fluctuations. Accordingly, the analysis of insider trading data can help market observers both with the decisions on which stocks to pick and on when to exit/enter the market.

The following chapter examined insider trading activity prior to quarterly earnings announcements. The findings indicated that although insiders exploited their foreknowledge of accounting disclosures, they refrained from aggressive trading immediately before the publication date. Abstaining from the most blatant form of material nonpublic information misuse may be motivated by their fear of potential legal hazards. The strategic timing of trades is likely to pose challenges to authorities that seek to prosecute violators of security regulations. Furthermore, the market reaction to earnings announcements is not diminished by instances of prior insider trading. The beneficial effect of information transmission is offset by the adverse effect insiders have on private information acquisition by market professionals. It has been shown that analysts are disinclined to follow companies with historically high levels of insider dealing.

Finally, the theoretical predictions of the Llorente, Michaely, Saar, and Wang (2001, henceforth LMSW) model are tested using the New Zealand data. LMSW argue that the dynamic relationship between returns and volume is determined by the relative significance of speculative trades versus hedging trades. The rationale behind this argument is that private information trading typically precedes information announcements which, in turn, generates return continuations. Conversely, dealings driven by allocational motives tend to induce return reversals. The stock price will initially move in the direction of the hedging transaction in order to encourage other market participants to take the other side, but it is likely to rebound in the next period, as the trade had no information content. The results presented here substantiate the claim that returns of companies in which insiders trade actively are more sustainable. Consequently, the volume-induced autocorrelation coefficient could be helpful in identifying periods of heavy information trading.

The overall evidence takes a lot of ground from the proponents of insider trading deregulation. The argument that insider dealing can benefit society by providing more accurate pricing of assets proved to be illusive and fallacious. Instead, frequent law infringements are likely to erode the confidence in capital markets, deter the general public from investing in stocks and expending their resources on equity research. For these reasons, any cases of illegal insider dealing should be pursued and prosecuted to the full extent of the law. It has to be noted, however, that the crime of insider trading could be difficult to repress, as is often the case with other types of white collar or commercial crime.

Policy Directions

Regulatory Standards

The Polish *Law on the Public Trading of Securities of 1997* sets severe penalties for exploiting material nonpublic information (Art. 176 section 2): “Whosoever in securities trading uses inside information shall be subject to a fine of up to 5,000,000 PLN and

imprisonment from 6 months to 5 years.“ Insider trading is also banned under the New Zealand Securities Market Act of 1988, however the liability is not criminal. The insider is liable for any loss incurred to any person from whom the securities were bought or sold and to the issuer for the amount of any gain made or loss avoided as well as a pecuniary penalty. The amount of the pecuniary penalty is determined by the Court considering all relevant matters, but it may not exceed three times the amount of the gain made or the loss avoided.

Although the current regulations leave no ambiguities with respect to the legalistic interpretation, passing new laws in the spirit of Section 16(b) and Section 16(c) of the US Securities and Exchange Act of 1934 may further restrict insiders' propensity to speculate and reduce perverse managerial incentives. The short-swing profit restriction, which prohibits insiders from exploiting short-term price fluctuations, could be an effective weapon against stock price manipulation. Similarly, the prohibition of short sales of stocks by corporate insiders could eliminate cases of deliberate mismanagement. Should these laws be enacted, their phrasing should be general, as to leave no room for evasion by applying cunning financial engineering techniques. It has to be stressed, however, that the sole existence of adequate regulations by no means guarantees the resolution of the insider trading problem. As pointed out by Bhattacharya and Daouk (2002) what really matters to agents dealing on the basis of their private information is the level of law enforcement.

Enforcement of Insider Trading Sanctions

The enforcement of sanctions is central to the issue of eradicating insider trading. Thus far, there has been only one case of successful prosecution on insider trading charges in Poland and none in New Zealand. The enforcement efforts in Poland have long been characterized by dissents between the SEC and the public prosecution.[1] More recently, a joint

[1] See for instance “Co Prokuratura sadzi o Problemie Przestepstw na GPW”, *Parkiet* 9 Dec. 2002 and “Wladze Gieldy zaniepokojone Postawa Prokuratury w Sprawie Insider Trading”, *Parkiet* 20 Mar. 2003.

declaration has been issued by these two authorities indicating that their collaboration is increasing and more indictments are likely to follow.[2] If this is indeed going to be the case remains to be seen. An interesting alternative to the Polish system is the New Zealand system where under the Securities Market Amendment Act of 2002 the Securities Commission may alone exercise the right to prosecute insiders if the public issuer or another person has not yet the commenced proceedings.

With an adequate legal structure the enforcement efforts can be successfully reinforced by private policing. The U.S. market can serve as a good example. In 1988 Congress passed the Insider Trading and Securities Fraud Enforcement Act (ITSFEA), which authorizes the SEC to pay a bounty to any person who provides information that leads to the recovery of a civil penalty from those who violate insider trading laws. The bounty may be awarded to informants from the civil penalties actually recovered and may total up to ten percent of the insider trading profits. The financial incentives oftentimes encourage members of the general public to supply evidentiary material. As reported by Meulbroek (1992), 41 percent of SEC insider trading investigations in the U.S. came from public complaints. In many of the public complaints the informants knew the defendant personally (e.g. ex-spouses, employees, or a neighbor). Furthermore, the passage of ITSFEA motivated many bounty hunter attorneys to pursue any instances of illegal dealing on material nonpublic information. The introduction of a bounty program in the context of the Polish and New Zealand markets would undoubtedly increase the detection rates of insider trading crimes.

Firm-level Restrictions

Since the reputation of the issuer can be seriously injured by any documented acts of illegal insider dealing, firms are well-advised to take appropriate steps to prevent such acts before they actually occur. In particular, public companies should design compliance policies

[2] "Prokuratorzy Scigaja Gieldowych Przestepcow", *Parkiet* 12 Aug. 2003.

tailored to the particular business environment in which they operate. One of the most commonly employed procedures establishes fixed time intervals during which trading by corporate insiders is disallowed (blackout periods). A typical prohibition period runs from one month preceding the quarterly earnings announcement until the publication date. However, the evidence presented in this thesis hints that insiders' knowledge of company affairs could be far more advanced and mechanically set blackout periods alone may not deliver the desired result.

For this reason, additional and more flexible compliance schemes are advisable. For instance, some ad hoc insider trading restrictions could be imposed prior to extraordinary corporate events, such as dividend initiations, prospective acquisitions or an impending R&D breakthrough. Simultaneously, the company may require pre-clearance of all trades by its employees. It is vital, however, that the designated clearance official is well acquainted with the firm's operations. Any compliance programs should be communicated to all the members of the staff through orientation sessions or other training. Alternatively, the companies could require a signed affidavit from their employees and take a disciplinary action should they not abide by the code.

Seyhun (1992b) scrutinized a randomly selected sample of code of ethics documents and found that about 25% of the firms explicitly warned against insider trading. In a more comprehensive and up-to-date analysis, Bettis, Coles and Lemmon (2000) surveyed member firms of the American Society of Corporate Securities. Of the 626 sample companies, 92% had internal policies restricting or regulating insider trading activities. Furthermore, nearly three-quarters of the firms required approval of insider transactions prior to their execution. The reported discrepancy between these two studies reflects the recent tendency of US companies to adopt procedures preventing the misuse of confidential information. Firm-level insider trading restrictions have become an integral part of the US corporate landscape and hopefully that the companies listed on the WSE and NZX will follow this good example.

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