

# Abnormal Returns in the Vicinity of Insider Transactions: Unbiased Estimates for Germany

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Key Words: Signaling, Insider Trading, Directors' Dealings

JEL Classification: G 14

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## Abstract

Several studies focusing on the US and the UK have shown, that abnormal returns tend to be negative on the days before insider purchases, positive on the transactions days and on the following days. For insider sales it is the other way around, but the absolute effects are smaller. Around the announcement days similar effects exist. In many cases more transactions and/or announcements take place on subsequent days, possibly having different directions and/or involving different buyers/sellers. We argue that because of the different signs of the abnormal returns before and after day 0, estimates based on all available observations could be biased. This is the first study to our knowledge which proposes and uses non-overlapping observations in this context.

We confirm the above findings using German data for the two year period following the introduction of insider regulations in Germany in July 2002. Like in the UK, the effects around the announcement date are considerably larger than in the US. Unlike in the US and the UK, the effects are much more pronounced around sales. Due to our use of non-overlapping data, we can show these effects much more clearly than prior studies of the German market.

In our cross-sectional regressions, net trading intensity on the announcement day, a variable suggested by Lakonishok/Lee (2001) is the most important explanatory variable for the cumulative abnormal returns from day  $-1$  to day  $+1$ . When we look at the days 0 to  $+5$ , the explanatory power of the net trading intensity (NI) is considerably smaller. We conclude that diversification and liquidity motives together with price pressure effects are mainly responsible for the results.

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## 1. Introduction

The existing empirical studies on the effects of insider transactions may be divided into two groups.<sup>1</sup> A number of studies, an important recent one is Lakonishok and Lee (2001), have focused on the long-run cumulative abnormal returns in the 6 to 12 months after the transaction. The other group focuses on the abnormal returns on the date of the announcement and during the following days. Recent contributions to this group include Friedrich et al. (2002) and Fidrmuc et al. (2005). Our research is part of the second group.<sup>2</sup> By our title we would like to emphasize, that the abnormal returns in the days before the announcement and the transaction date should be an important part of the analysis.<sup>3</sup>

For the US and the UK positive abnormal returns after the announcement day and after the transaction day have been identified for the case of insider purchases, negative abnormal returns for the case of insider sales. Lakonishok/Lee (2001), f. ex., reported cumulative average abnormal returns (CAARs) for the five-day window following purchase announcements in the US of .59 %, for sales announcements of .13 %. Economically this is not very significant. Because of their large data sample, both numbers are, on a statistical basis, significantly different from zero.

Fidrmuc et al. (2005) showed, that in the UK the CAARs are much higher, 1.65 % for purchase announcements, -.49 % for sales announcements, also for the five-day window. They also look at “large trades” (trades exceeding .1 % of the firm’s market capitalization) and find much higher and strongly significant (“whatever test statistic used”) two-day CAARs, 3.1 % for purchase announcements, -.37 % for sales. Fidrmuc et al. (2005) also look at the CAAR over the twenty days prior to purchase announcements (-1.27 %) and conclude (page 19): “This suggests that directors are able to time their purchases”. For sales they report a CAAR of about 3 % over the twenty days preceding the announcement and conclude “directors seem to be able to time their sales as well”.

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<sup>1</sup> See the more extensive literature review of Fidrmuc et al. (2005), p. 9.

<sup>2</sup> Early studies, f. ex. Lorie/Niederhoffer (1968), Jaffe (1974), and Finnerty (1976), used monthly data. They laid the ground work for both groups of studies.

<sup>3</sup> In long-run performance studies the chosen benchmark and the exact methodology of calculating returns are extremely important. These issues are not discussed in this paper.

Prior studies focusing on short-term effects, after looking at the over-all picture, typically look at different groups of insiders, either by calculating the individual CAARs for the different insider groups or by using cross-sectional regressions. Typical insider groups for the US are the type of director (executive directors vs. non-executive directors), other senior officers, chairpersons and large shareholders. Jeng et al. (1999), while concluding that in general insiders benefit ‘handsomely’ from their informational advantage, find that US CEOs realize lower abnormal returns than the other directors and officers in their company.<sup>4</sup> Fidrmuc et al. (2005) report that in the UK CEO transactions also result in lower CAARs than transactions made by other insiders and they discuss the possible reasons for this in detail. Betzer/Theissen (2005) arrive at the same conclusion for Germany. We build on these three studies and therefore do not search for a CEO effect.

In Germany, transactions by large shareholders and by officers are not covered by insider laws and are typically not reported. The German insider law focuses on just two groups of insiders, members of the executive board (Vorstand) and members of the supervisory board (Aufsichtsrat). Their spouses (or partners) and other family members also have to report their transactions. As a consequence, we just look at the three latter groups, but not at other officers and large shareholders. We especially do not distinguish between board members and the board chairpersons.

In addition to looking at the directions of the trades, the two relevant dates, and the different groups of insiders, prior studies look at other characteristics of the transactions and of the involved firms, and at the general situation of the stock market prior to the transaction. Typical conclusions of prior studies with regard to the transaction characteristics are:

- The size of the transaction in absolute terms is important,
- The size of the transactions in relative terms (relative to market capitalization) is important,
- The magnitude of reactions after announcements may depend on the time lag between the transaction and the announcement,
- The way in which sales and purchases, which are announced simultaneously or within a few days, are treated in the empirical study, matters crucially.

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<sup>4</sup> Earlier studies, on the other hand, support the ‘information hierarchy’ hypothesis, f. ex. Seyhun (1986).

Typical conclusions of prior studies with respect to firm characteristics are:

- In firms with a small market capitalization the reactions are in absolute terms typically larger,
- The reaction may depend on the magnitude of the free float and on the size, the ownership types (family) and the number of large shareholdings.

Because of data limitations, especially with respect to the ownership structures of the firms, we cannot include all mentioned characteristics in this version of our empirical study. We concentrate on the most important transaction characteristics and look at the data at a more basic level. Our most important methodological contribution is that because of the different signs of the abnormal returns before and after day 0, we must look at non-overlapping observations. To our knowledge, all prior studies look at possibly overlapping observations. A purchase which follows another purchase which happened five days ago, is, f. ex., treated as an independent observation. The use of overlapping data may result in all kind of biases, whose direction is difficult to forecast, not only with respect to the reported CAARs or the regression coefficients, but also with respect to the significance levels. In other words, we look at the stability of the results of prior studies on the German market when this obvious source of possible biases is eliminated.

To our knowledge, the first study of insider trades in Germany ( the German technical term is the English expression “Directors’ Dealings”) is the doctoral dissertation of Rau (2004). He observed different magnitudes of market reactions after purchases and sales. The magnitude of negative market reactions after sale announcements exceeds the magnitude of positive reactions after purchase announcements considerably. The 10-day CAAR after the announcement date is about 1% for purchases, -3% for sales. Rau concluded that in Germany insiders sales are more informative than purchases. This interesting result, which differs from the results of prior studies for the US market, is confirmed by Heidorn et al (2004), by Betzer/Theissen (2005) and by our study.

Heidorn et al. (2004) look at market model CAARs around insider transactions and after their announcements in Germany and calculate similar numbers for Italy and the Netherlands. They draw special attention to the fact that in Germany the five day CAAR before the transaction date is also significantly negative for purchases, positive for sales.

Betzer and Theissen (2005) practically look at the same set of raw data. In addition to looking at CAARs, also do cross-sectional regressions.

Our main results are:

- We can confirm the above findings using German data for the two year period following the introduction of insider regulations in Germany in July 2002. Like in the UK, the effects around the announcement date are considerably larger than in the US. Unlike in the US and the UK, the effects are much more pronounced around sales,
- Using all observations the [0;+1] CAAR is 0.554% for purchases, -0.925% for sales,
- Due to our use of non-overlapping data, we can show these effects much more clearly than prior studies of the German market. Using non-overlapping observations the [0;+1] CAAR is 0.990% for purchases, -3,469% for sales,
- In our cross-sectional regressions, net trading intensity on the announcement day, NI, a variable suggested by Lakonishok/Lee (2001) is the most important explanatory variable for the cumulative abnormal returns from day -1 to day +1. When we do not include this variable, the variable “logarithm of the absolute transaction volume in Euros” is economically and statistically highly significant. When we include it, the latter variable becomes insignificant and NI is highly significant (see tables 14 and 15).
- We conclude that diversification and liquidity motives together with price pressure effects are mainly responsible for the results.

The outline of the rest of the paper is as follows. In the next section the institutional settings of insider transactions in Germany (Directors' Dealings) are discussed and will be compared to the international settings. Section 3 contains a description of the data. In section 4 the results of our empirical analyses are presented and compared to prior results. Section 5 contains the cross-sectional analysis and section 6 the conclusions.

## 2. Institutional Settings of Director's Dealings in Germany

Most countries today do have restrictions to prevent insiders from making profit from their information advantage. In this paper we focus on the reported insider transactions ("Directors' Dealings") which are covered by §15a of the Wertpapierhandelsgesetz (WpHG), which became effective on July 1<sup>st</sup>, 2002. This law replaced former reporting requirements for firms of the "Neuer Markt".

As a matter of fact the reporting requirements related to insider trading differ throughout the world. Differences in those regulations can be observed in several aspects such as:

- (i) Definition of insiders required to report their transactions
- (ii) Threshold volume that must be reported
- (iii) Beneficial Owners
- (iv) Reporting obligations of resigning directors
- (v) Reporting periods
- (vi) Special rules (like: "Short-swing-rule")

The German regulation requires members of the executive board and members of the supervisory board of all corporations listed in Germany together with their relatives and partners to report their transactions in the shares or other equity related securities of their firm to the firm as well as to the German regulator, the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin). Other executives who are not board members or who do not have decision-making authorities (e.g. officers) are in contrast to many other countries excluded from the reporting requirements. The firms are required to publish these transactions either on their websites or alternatively in a nationally recognized newspaper with a good coverage of financial news. The BaFin provides a database with both the date of the transaction as well as the date of the publication of the transaction, which is available on their website.

In Germany insiders have to report all of their transactions if the volume of their trades exceeds 5000 Euro per year.<sup>5</sup> Beneficial owners must in contrast to the US not report their transactions. After resignation a director or member of the supervisory board is no longer required to report her transactions in the stock anymore. Additionally, there exists no short-swing rule in Germany as in the US. Until recently there was no explicit reporting period stated in Germany. Instead insiders were required to announce their transactions “without delay”. Since December 2004 insiders have to report their transaction within five days after execution while in the US the reporting period is two days.<sup>6</sup>

### 3. Data

Using standard event study approach we aim to capture the announcement-signaling effect of Directors' Dealings as well as factors that may explain the cross-sectional variation of those effects. We tried also to correct for several known methodological problems that exist, while applying event study methodology.

As mentioned before, the data is taken from the BaFin database, which contains the ISIN number, the kind of the transaction (buy/sell), the announcement and the transaction date, the type of the security, the type of insider and the number of shares traded.

We start our analysis with 4273 observations from 01 July 2002 until 30 June 2004. In a first step, we exclude all observations involving foreign corporations, derivatives as well as observations which are unclear in this respect. In a second step we exclude all observations with incomplete return data. The remaining sample, we call it the regular sample, contains 1434 purchase announcements and 1504 sales announcements. In a final step we eliminate overlapping observations. The number of non-overlapping purchase observations is 691, sales 726. Table 1 contains the generation of the final sample:

<<< Insert table 1 about here >>>

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<sup>5</sup> This new regulation replaced the old one which excepted deals exceeding 25000 Euros within one month from being published.

<sup>6</sup> Since the "Sarbanes-Oxley-Act" became effective on July 30 2002. Previously it was ten days.



To calculate rates of return we use daily *Datastream* return data from the Xetra system adjusted for dividends and capital changes.<sup>7</sup> Additionally, we assigned announcements occurring on Saturday or Sunday and on official public holidays to the next trading day. For the cross-sectional analysis we also extracted from *Datastream* the market value (MV), the market to book ratio (MTBV) and the number of shares outstanding (NOSH) for the involved firms, all on a daily basis.

We calculate the abnormal return using the market model, mean adjusted returns and market adjusted returns. The results are more or less stable even though market adjusted returns showed a positive drift which might be due to the fact that we used a value weighted index as a proxy for the market portfolio. Therefore we only report results from the market model. The market portfolio was approximated by the CDAX performance index. The results were tested for significance applying the t-test with Crude Dependence Adjustment because of several transactions for each corporation and therefore probably a high level of cross-sectional correlation.

Several event specific problems occurred. The true announcement date could differ from the one given in the BaFin database due to wrong data entries. We observed sometimes time differences of more than one year between the announcement and the trade. Additionally, we have to assume the same visibility for transactions of DAX-firm insiders as well as of insiders from firms in lower market segments. Since transactions may be published on the company's website we additionally have to assume that those are frequently checked for those announcements. This is a very problematic assumption, although there are news agencies, which systematically browse websites and news-groups for that kind of announcements. More than 99% of the announcements were initially made through websites. Another 0.52% of the announcements were published via newspaper while some newspapers obviously first examine the BaFin database and then report the respective transactions.

Finally, during the event period new information may have been announced or may have become publicly available. In a number of cases the announcements include new information in addition to the information about the insider trades. Such information may bias the result. However, due to the relatively large number of observations we did not control for contamination.

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<sup>7</sup> For reasons of data quality we checked the returns for inconsistencies comparing returns exceeding 100% with returns from the "Karlsruher Kapitalmarktdatenbank". One return had to be corrected (NUCLETRON AG).

## 4. Results

### a) Descriptive statistics

After adjusting for dual listed corporations and several transactions including options and other derivatives, we found a total of 3477 transactions in stocks from July 2002 until June 2004 (see table 1), 1856 purchases (53.4%) and 1621 sales (46.6%). This means an average number of 145 transactions per month. The chronological distribution of the aggregate insider transactions on monthly basis are presented in the following figure 1.  $NI_m$  represents the aggregate net trading intensity per month (number of purchases minus number of sales) over all days  $t$  and over all firms  $i$ :

$$NI_m = \sum_t \sum_i NI_{m,t,i}$$

As can be seen in figure 1, during the first year of the observation period insiders were net buyers while during the second year they were net sellers.

<<< Insert Figure 1 about here >>>

By looking at the transaction numbers and volumes presented in table 2, we find the total volume of the sales to be about twice as much as the volume of the purchases. Since the number of sales is smaller than the number of purchases, sales on the average are more than twice as large as purchases. For the members of the board of directors this ratio amounts to 4.5 (see table 3). One reason for this might be the desire for diversification or liquidity of this group as a result of stock and option based compensation plans as stated by Lakonishok/Lee (2001) or Rau (2004).

<<< Insert Table 2 about here >>>

In order to answer the question of who is purchasing or selling we present table 3. In this table the transactions per group are given. As can be seen the members of the board of directors are on average the most active traders with 51.9% of all transactions. Nevertheless, the members of the supervisory board trade on average higher volumes. But, while only about 12.4% of all transactions are implemented by other insiders, e.g. relatives, the average volume - especially the volume purchased - is highest. Furthermore, this is the only group, where the number of sales exceeds the number of purchases.

<<< Insert Table 3 about here >>>

The reporting delays of the insider transactions are presented in figure 2 and table 4. Note that the observation period of our study lies before the introduction of the 5 day reporting period in Germany. As can be seen, in the observation period only 55% of all purchases and 61% of all sales would have met the new reporting criteria.

<<< Insert figure 2 about here >>>

After 10 days, which was the former reporting period in the US, about 75% of all purchases and 85% of all sales were announced. It remains unclear why sales seem to be announced faster. An additional interesting detail is that members of the board typically announce their transactions faster than the other two groups. The supervisory board members and others are often lagging several days behind. However, the numbers presented in table 4 also indicate several large outliers as can be seen by the difference between the average and median values.

Nevertheless, we can conclude that the introduction of the new reporting regulation in Germany was a great step towards an increased market transparency of the German capital market.

	<b>Board of Directors</b>		<b>Supervisory Board</b>		<b>Others</b>		<b>Total</b>	
	<b>Buy</b>	<b>Sale</b>	<b>Buy</b>	<b>Sale</b>	<b>Buy</b>	<b>Sale</b>	<b>Buy</b>	<b>Sale</b>
Average	9.0	5.1	29.3	9.9	11.6	8.8	16.5	7.4
Median	4	3	6	5	5	5.5	5	4

In days.

*Table 4: Time difference in days between transaction and announcement grouped by traders.*

As a consequence, this could mean different quality or intensity of possible signals and therefore result in different market reactions. This will be analyzed in the next sections.

## b) Abnormal Returns around announcements and transactions

As mentioned above, insider transactions may represent costly and as a consequence credible signals. Purchases may be interpreted by the market as positive signals and result in positive abnormal returns. Sales may be interpreted as negative signals by market participants.

In order to compare our results to those of prior studies for the German market we start by reporting the abnormal returns for the “regular” sample, that is the sample containing overlapping observations. The abnormal returns for purchases and sales around the transaction day are presented separately in tables 5 and 6.

<<< Insert Table 5 about here >>>

<<< Insert Table 6 about here >>>

For the purchase sample, we find a significant positive abnormal return on the day of the transaction which may partly be a price pressure effect. For the sales we also find a positive abnormal return which is insignificant. Table 5 shows that the average abnormal return (AAR) in 8 out of 10 days before purchase announcements is negative, thereof on several days significantly. In 8 out of 10 days after the announcement, the AAR is positive. For sales it is the other way round, the pattern is even stronger.

Very interesting are the results for the cumulative abnormal returns around the transaction day as presented in table 7 and in figure 3. These are consistent with the prior studies of the German market. Figure 3 may be interpreted in several, non-exclusive ways:

- Insiders have outstanding timing abilities. They buy when prices are low and sell when prices are high,
- Insiders possess information that the market does not have and the market accepts the signal after the transaction is announced,
- Insiders simply buy after their stock exhibited a negative abnormal return for several days. They sell, after their stock had a positive abnormal performance for several days. After being informed, the market believes that insiders possess valuable information.

<<< Insert Figure 3 about here >>>

<<< Insert Table 7 about here >>>

As a conclusion, these results do not support the strong market efficiency hypothesis for the German capital market.

The abnormal returns around the announcement of insider transactions are presented in table 8 (purchases) and table 9 (sales). As can be seen, the abnormal return on the announcement day for purchases is positive but not statistically significant, while for sales it is significantly negative.

Looking at the cumulative abnormal returns presented in table 10 and figure 4 we also find evidence for market responses to the new information being revealed by the insider trading signals.

<<< Insert Table 8 about here >>>

<<< Insert Table 9 about here >>>

<<< Insert Table 10 about here >>>

We document significant abnormal returns for both the purchasing and the selling group in a three-day window around the announcement day. Also remarkably, the significant cumulative abnormal return for a longer time period after the announcement is positive for purchases and negative for sales. The magnitude of the cumulative abnormal returns after the announcements of insider's transactions indicates that sales transactions represent more intensive signals than insider purchases.

<<< Insert figure 4 about here >>>

However, one basic problem of earlier studies is, that the results may be in general biased because each insider transaction may represent one observation. Considering the fact, that insiders do realize an undervaluation of the company, usually more than one insider starts buying the stock in a certain period of time. As a consequence the abnormal returns calculated using the total sample might be biased due to overlapping event periods. Therefore, in order to isolate announcements and to measure unbiased signaling effects, we excluded all observations, with more than one announced transaction per firm within an 11-day-window around the announcement day. Several announcements on the same day were however not excluded from the sample since their announcement effect would not be biased.

The final adjusted sample consisting of 1417 announcements also represents our basis for the cross-sectional analysis.

Table 11 shows the cumulative abnormal returns for the adjusted sample.

<<< Insert table 11 about here >>>

As a result we find economically and statistically more significant cumulative abnormal returns around the announcement day, which may demonstrate the true signaling character of these announcements. So the quality of the results could be significantly improved.

Nevertheless, one of the main differences between our results and the results of other studies is the fact that insider sales in Germany seem to imply more intense signals than purchases. International studies generally document opposite results as e.g. Seyhun (1992) or Lakonishok/Lee (2001). As a conclusion investors in Germany seem to be more attracted by negative news or at least attach more importance to them. This behavior is possibly due to aftermaths of the speculative "Neuer Markt" bubble which was accompanied by many fraud scandals. As a result outsiders became much more sensitive to negative news or signals.<sup>8</sup>

### c) Insider Trading – only anti-cyclical investing?

As proposed in the earlier sections some results may indicate insiders to adopt some anti-cyclical strategies. So we try to answer the question, whether directors or insiders may be guided by motives other than signaling like macroeconomic trends. According to Seyhun (1986) when aggregating insider trading activity over all firms, idiosyncratic components of insider's activity should cancel out. In order to analyze this issue we calculated the aggregated monthly net trading intensity ( $NI_m = \text{No. of all insider purchases per month} - \text{No. of insider sales per month}$ ).

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<sup>8</sup> According to the bill of the fourth financial markets promotion law (Viertes Finanzmarktförderungsgesetz), p. 245, one of the major reasons for the implementation of the new insider reporting regulation in Germany was to increase market transparency and to prevent illegal insider trading.

Then we calculated the monthly net trading intensity ratio by dividing the aggregated monthly net trading intensity through the number of all transactions that occurred in this month:

$$NIV_m = \frac{NI_m}{\sum_i \sum_j |TKZ_{i,m,j}|},$$

Then we compared the  $NIV_m$  ( $-1 \leq NIV_m \leq 1$ ) with the market index approximated by the CDAX performance index. Figure 5 presents the results. Positive values of  $NIV_m$  induce more insiders on the purchasing side and vice versa. Thus, the higher the  $NIV_m$ , the more insiders trade in the same direction. As can be seen in figure 5, in 12 months of the 24 month observation period (50%) the  $NIV_m$  exceeded 0.5. This means in absolute terms that in these months more than 75% of all transactions were made in the same direction. In 19 Months of our observation period the  $NIV_m$  still exceeded 0.25 meaning that 62.5% of the transactions exhibited analog trading behavior.

<<< Insert figure 5 about here >>>

In order to analyze the relation between aggregated insider trading activity and past as well as future market movements we calculated the correlation matrix of  $NIV_m$  with past and future market performance. We got similar results like Lakonishok/Lee (2001) and Seyhun (1988a) (see Table 12). Aggregated insider trading activities are strongly and significantly negatively correlated with the past market performance indication that insiders indeed act contrarian. Insiders thus may be influenced to some extend by the market and the negative signs may imply anti-cyclical strategies to some extend.

<<< Insert table 12 about here >>>

While several papers document aggregate insider transactions to be a good indicator for future market performance, we fail.<sup>9</sup> The correlation coefficient for the  $NIV_m$  and the market return of the following 6 months is very close to zero and showing no statistical significance. This may due to the relatively short observation period of 2 years. However as Lakonishok/Lee (2001) point out the implied ability of insiders to predict future market movements may simply be due to the fact that they are contrarian. When adjusting their analysis for the contrarian nature of insiders the predictive abilities of insiders substantially shrinks.

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<sup>9</sup> See Seyhun (1988a/1998), Lakonishok/Lee (2001) and related studies.

## 5. Cross-Sectional Analysis

### a) The model

To see which factors actually may drive or influence the signal or the quality of the signal, we implement a cross-sectional analysis. We are not aware of any study analyzing different signaling determinants for the German capital market before. While in the event study all transactions are included equally weighted, some of the transaction may in fact be more significant than others, both in the point of view of the insiders as well as of the market. As Jaffe (1974) stated, it is also possible that insiders try to mask the true signaling character of their transactions.

Therefore, we regress the following factors on the cumulated abnormal return around the announcement day:

$$CAR_i = \alpha_i + \sum_{\rho} \beta_{i,\rho} \cdot PROXY_{i,\rho} + \varepsilon_i$$

$$\text{With } PROXY_j \in \left\{ \begin{array}{l} LM2B, LMCAP, SHARE, \\ LTW, NI, VSD, ARD, MR_m \end{array} \right\}$$

Although, this methodology is generally accepted and implemented in several studies throughout the world we want to emphasize the problems concerning the quality of data of the factors used. Especially variables extracted from financial reports should be treated carefully because of different accounting principles applied in Germany. For example, German corporations are allowed to report according to US-GAAP, IFRS as well as HGB. Another problem arises when trying to approximating unobservable factors through proxy variables.<sup>10</sup> Finally, data availability can be another problem for empirical studies in Germany. *Datastream* like many other data vendors sometimes show missing values. Nevertheless we prefer using *Datastream* data due to the broader range of data available in contrast to the German capital market database.<sup>11</sup>

We included the following measures in our analysis:

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<sup>10</sup> E.g. using the transaction value as a proxy for the costs of a signal might be problematic if insiders have different levels of wealth and therefore a given transaction value causes different risk to them (see also Hillier/Marshall, 2002).

<sup>11</sup> The German capital market database, located in Karlsruhe, mainly provides returns of assets that are traded on all German stock exchanges.



### **Historical return of the market ( $MR_m$ )**

Many studies documented anti-cyclical strategies of insiders to some extent. Similar conclusions could be drawn from our own analysis. Therefore, we include the historical market return approximated by the CDAX performance index to confirm those results for the German market.

### **Logarithm of market value of equity ( $LMCAP$ )**

To control for size effects for the German market we use the market value of equity as a proxy for size. Smaller corporations are assumed to have higher levels of asymmetric information. As a consequence, the signaling power of transactions by insiders of smaller firms should be stronger. Larger Corporations are assumed to be better covered by analysts and therefore have a better flow of information. The signals from larger firms should not result in equally strong market reaction as the ones from smaller firms.

### **Market to book ratio ( $M2B$ )**

In general firms with a high market to book ratio are assumed to be growth stocks. If insiders are selling those stocks the market reaction should be more negative than if selling stocks of firms with a low market to book ratio (value stocks) since this may be due to changing growth expectations.

### **Logarithm of insider transaction value in Euros ( $LTW$ )**

The credibility and the signaling character may strongly depend on the size of the transaction. The more stock is purchased the more intense the signal should be since the insider is exposed to more risk resulting in higher costs for a false signal. This variable represents the natural logarithm of the absolute value of the transaction.

### **Relative size of the transaction ( $SHARE$ )**

This variable represents the relative size of the transaction compared to the total equity. The higher the insider's share in the company, the higher her commitment and therefore the stronger the signal and vice versa.

### **Position of the insider in the firm ( $VSD, ARD$ )**

In contrast to other studies we differentiate between insider transactions of directors and members of the supervisory board. Directors often or at least to some extent receive part of their compensation in company's stock, while members of the supervisory board

are usually not or at least on a relatively low level.<sup>12</sup> Therefore, part of the transactions of managers might be due to liquidity and diversification needs while transactions of the members of the supervisory board should rather be free of those motivations. Therefore one can expect the transactions of the latter to represent stronger signals. Note that our sample in contrast to datasets of the US does not include large blockholders.

### **Net intensity per firm (*NI*)**

Several studies document a strong influence of intensive trading criteria on the signaling character of insider transactions. A positive net intensity usually strengthens the signal. In other words, the more insiders purchase the stock on a given day the stronger the signal will be. To our knowledge this is the first study that includes the actual net trading intensity on daily basis in the analysis of market reactions to announcements of insider transactions.

### **Dependent variable: cumulative abnormal return (*CAR<sub>T</sub>*)**

As the dependent variable we choose the cumulative abnormal return around the announcement day. Intervals of three [-1;+1] and six [0;+5]) days were chosen to ensure to capture the entire signaling effect.

In order to ensure independence of the explanatory variables included in our model we calculated the correlation between those variables. The results are presented in table 13.

<<< Insert table 13 about here >>>

As expected, some factors exhibit high correlations like *LTW* and *SHARE* as well as the measures of market performance for the previous 6 and 12 months. In order to ensure independence of the explanatory variables we decided to analyze those factors in different regression models. Since *LMCAP* and *M2B* also showed a significant positive correlation of 0.225 we choose to run different regressions but results turned out to be similar. Therefore we only present the joint analysis.

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<sup>12</sup> As recommended by the German “Corporate Governance Kodex”, which was released in the year 2002.

## b) Results

The results of the cross-sectional regressions are presented in the following tables.

<<< Insert table 14 about here >>>

<<< Insert table 15 about here >>>

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As a first main result we can confirm some anti-cyclical investing by insiders. Purchases seem to be followed by a previous negative short term market return ( $MR_{.6}$ ), while for sales a positive long term market return seems to be one relevant factor ( $MR_{.12}$ ). As a consequence we conclude the intensity of the signal to be inversely dependent from past market performance.

The net trading intensity on daily basis turned out to be a highly significant indicator for the signaling intensity as well. Consequently, the more insider purchase transactions are announced on a given day the stronger the signal and therefore the higher the positive abnormal return. Remarkably, the net trading intensity seems to have a higher influence on sales than on purchases. This result is even more remarkable since we calculated the net trading intensity on a daily basis.

Looking at firm specific factors, we observe a significant size effect as documented by other studies. The negative sign clearly indicates a decreasing intensity of the signal for firms with increasing market capitalizations. This confirms the hypothesis that smaller firms are usually confronted with higher levels of information asymmetry and that the announcement of insider transactions thus reveals more information to the market.

The results for the M2B variable are not consistent throughout the models. Only in model three we find a significant negative impact which however is as hypothesized.

Additionally, only a relative decrease in the insider's ownership stake seems to have a significant influence on the intensity of the signal. Comparing the results to the absolute value of the transaction we get completely different results. Throughout all models the absolute value of the transaction has a significant influence on the CAR. But surprisingly, inconsistent with the signaling hypothesis, an increase in the absolute transaction value seems to lower the intensity of the signal. In other words the higher the transac-

tion value the lower the quality of the signal. Similar results can be observed for the US market but those results are usually related to transactions of large blockholders as in Seyhun (1988b), which are not included in our sample. Therefore, our results are contrary to those of the US.

Even more remarkable is the result that announcements of transactions of members of the German supervisory board seem to represent a stronger signal than announcements of the board of directors. The market reaction for announced purchases and sales by members of the supervisory board indicate a significant 4.5 times stronger signal than announcements by the board of directors. Please note in this context that the members of the supervisory board are usually not paid in stocks or at least on a very low level in Germany. We interpret this as a strong evidence for the wide acceptance of the diversification and liquidity hypothesis by the German capital market for the transactions of management with stock based compensations.

## **6. Conclusion**

As a first conclusion, we find evidence that the German capital market is semi-strong efficient.

We can conclude that the results of prior studies of insider trading on several international capital markets can in general be confirmed with German data. Although the German data differs in several respects to those of other countries like the US, the results are quite similar. Due to regulatory differences our dataset does not include large blockholders or other officers. It does include only members of the board of directors (Vorstand), of the supervisory board (Aufsichtsrat), their relatives and partners.

Especially, after adjusting for overlapping observations we find significant positive abnormal returns around the announcement of insider purchases and significant negative abnormal returns around the announcement of insider sales. This strongly indicates the signaling character of these events.

In addition, we also found several contrary results that are inconsistent with the signaling hypothesis as well as with results of studies from other countries. Thus, an increase

in the value of the transaction seems to lower the intensity of the signal. While for example for the US those results are only related to transactions by large blockholders (Seyhun (1988b)), this explanation does not hold for Germany since our insider definition does not include large blockholders or beneficial owners. Therefore, further detailed analysis is required in order to solve this puzzle.

Furthermore, we show that the net trading intensity calculated on daily basis has strong and significant influence on the signaling character of the event independent of the cross sectional regression model applied.

Finally, as a major result, the diversification and liquidity hypothesis for the management with stock based compensations seem to be generally accepted by the German capital market. In Germany the supervisory board usually is not paid in stocks or at least on a very low level. We show that the market reaction to insider trading announcements by members of the supervisory board has a much higher signaling character as announcements made by members of the board of directors, which are in general paid in stock to some extend.

Thus, the new §15a WpHG commenced in July 2002 was a favorable step forward to increase the transparency of the German capital market.

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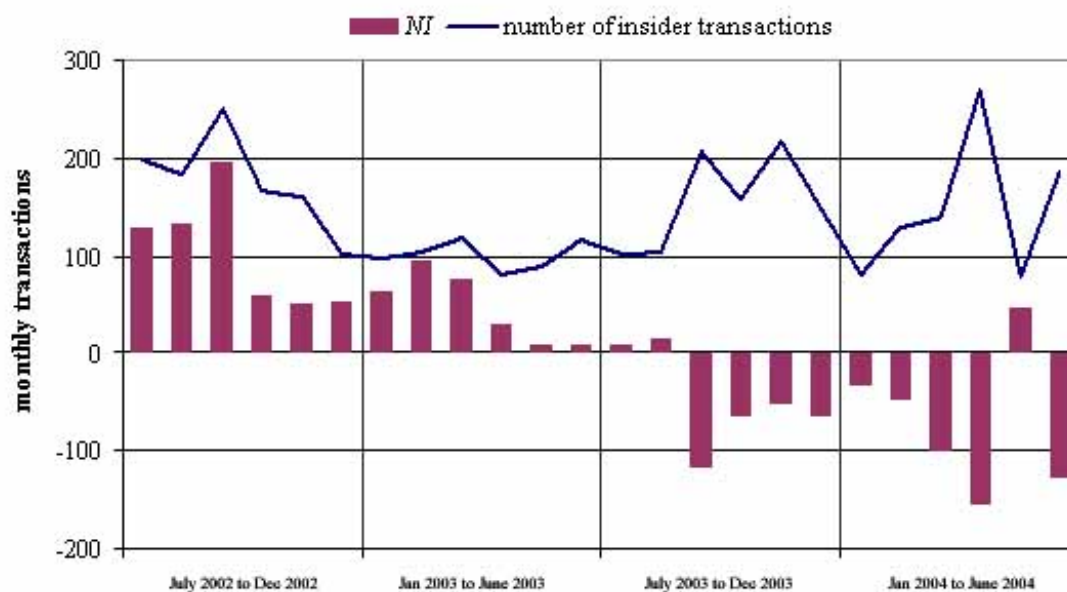


**Table 1: Sample Description**

<b>All announcements reported by the BaFin (between July 1<sup>st</sup> 2002 and June 30<sup>th</sup> 2004)</b>	<b>4.273</b>
- Foreign corporations which are dual listed in Germany	509
<b>Directors' Dealings in German corporations</b>	<b>3.764</b>
- Miscellaneous transactions	
Miscellaneous transactions increasing positions („SE“)	56
Miscellaneous transactions decreasing positions ("SV")	20
- Transactions with derivatives (purchase, exec.)	85
- Other transactions	126
<b>Directors' Dealings involving stocks of German corporations</b>	<b>3.477</b>
- No return data available	4
- Incomplete return data	535
<b>Transactions included in the regular sample</b>	<b>2.938</b>
Purchase-sample	1.434
Sales-sample	1.504
<b>Non-overlapping transactions for the cross-sectional analysis</b>	<b>1.417</b>
Non-overlapping purchases	691
Non-overlapping sales	726

**Figure 1: Chronological distribution of the events on a monthly basis**

This figure presents the total number of all insider transactions and the aggregate net trading intensity both on a monthly basis (NI: number of purchases minus number of sales).



**Table 2: Transaction volumes**

Transaction volume <sup>a</sup>	Number		Total Volume	
	Purchases	Sales	Purchases	Sales
0 - 5.000	631	241	1.342.502	604.492
5.001 - 25.000	540	518	6.669.145	7.138.615
25.001 - 100.000	423	389	20.804.366	18.290.915
100.001 - 250.000	116	175	18.705.977	28.576.770
250.001 - 500.000	53	90	18.589.488	31.703.372
500.001 - 1.000.000	44	54	30.499.512	38.301.143
1.000.001 - 10.000.000	39	134	98.275.957	455.007.434
10.000.001 and more	10	20	350.501.633	575.034.823
<i>Sum</i>	<i>1.856</i>	<i>1.621</i>	<i>545.388.581</i>	<i>1.154.657.563</i>

<sup>a</sup>In Euro.

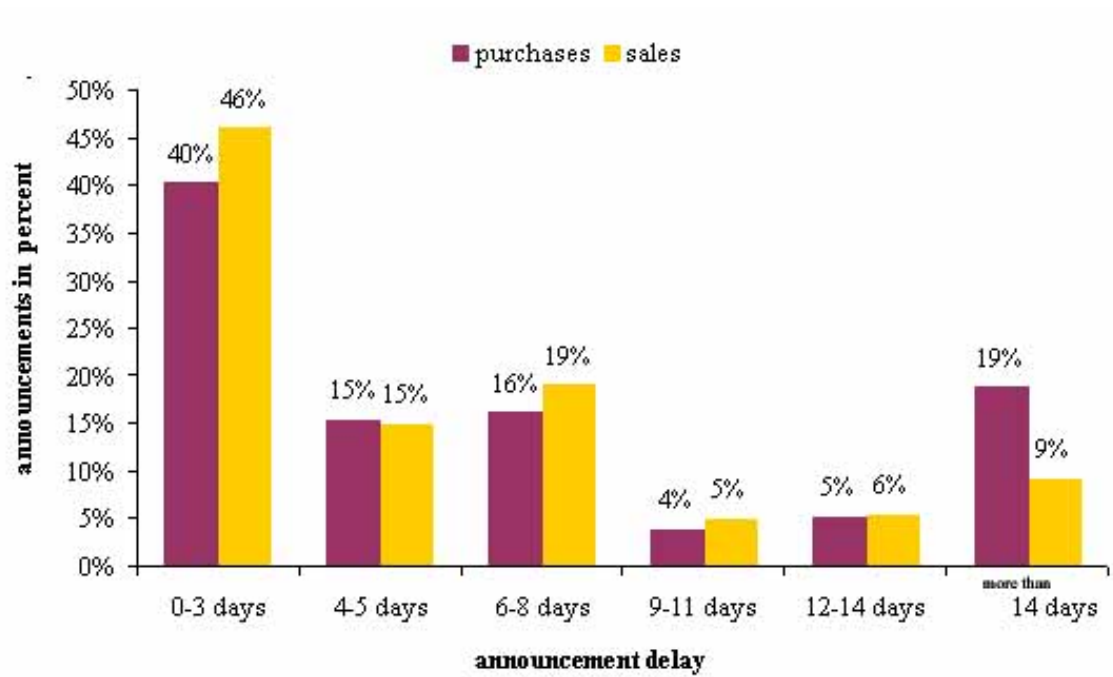
This table presents the transaction volumes of all 3477 Directors' Dealings involving stocks of German corporations between July, 1<sup>st</sup> 2002 and June 30<sup>th</sup> 2004.

**Table 3: Transactions separated by group membership**

	Member of the board of directors	Member of the supervisory board	Other insider
Number transactions	1.806	1.240	431
Thereof purchases	1.021	666	169
Thereof Sales	785	574	262
Transaction volume <sup>a</sup>			
Purchases	92.084.987	291.717.136	161.586.458
Sales	420.984.285	498.861.061	234.812.216
Average transaction volume <sup>a</sup>			
Purchases	90.191	438.014	956.133
Sales	536.286	869.096	896.230

<sup>a</sup>In Euro.

This table presents the transaction numbers and volumes of all 3477 Directors' Dealings involving stocks of German corporations for different groups of insiders.

**Figure 2: Time difference between transaction and announcement**

**Table 5: Daily abnormal return around the transaction dates of purchases**

Day	AAR	t-Statistics	Day	AAR	t-Statistics
-20	-0,167%	-0,989602	0	0,429%	2,537990 **
-19	-0,160%	-0,944898	1	0,203%	1,199583
-18	0,038%	0,225595	2	-0,042%	-0,247593
-17	-0,006%	-0,033247	3	0,249%	1,476212
-16	0,124%	0,735385	4	0,208%	1,232869
-15	-0,112%	-0,664896	5	0,044%	0,259061
-14	0,062%	0,364930	6	0,052%	0,310040
-13	0,002%	0,009293	7	0,445%	2,631708 ***
-12	0,015%	0,087564	8	0,130%	0,771484
-11	0,027%	0,158087	9	0,320%	1,892086 *
-10	-0,315%	-1,865285 *	10	-0,259%	-1,531903
-9	-0,039%	-0,228829	11	0,107%	0,631105
-8	0,135%	0,796779	12	-0,015%	-0,087903
-7	-0,075%	-0,443579	13	0,025%	0,147076
-6	-0,167%	-0,986349	14	0,399%	2,363853 **
-5	-0,198%	-1,174047	15	0,316%	1,870333 *
-4	-0,364%	-2,153216 **	16	-0,072%	-0,426731
-3	-0,313%	-1,852995 *	17	-0,039%	-0,229893
-2	-0,150%	-0,887991	18	0,143%	0,847935
-1	0,237%	1,402986	19	0,130%	0,768966
			20	-0,056%	-0,330344

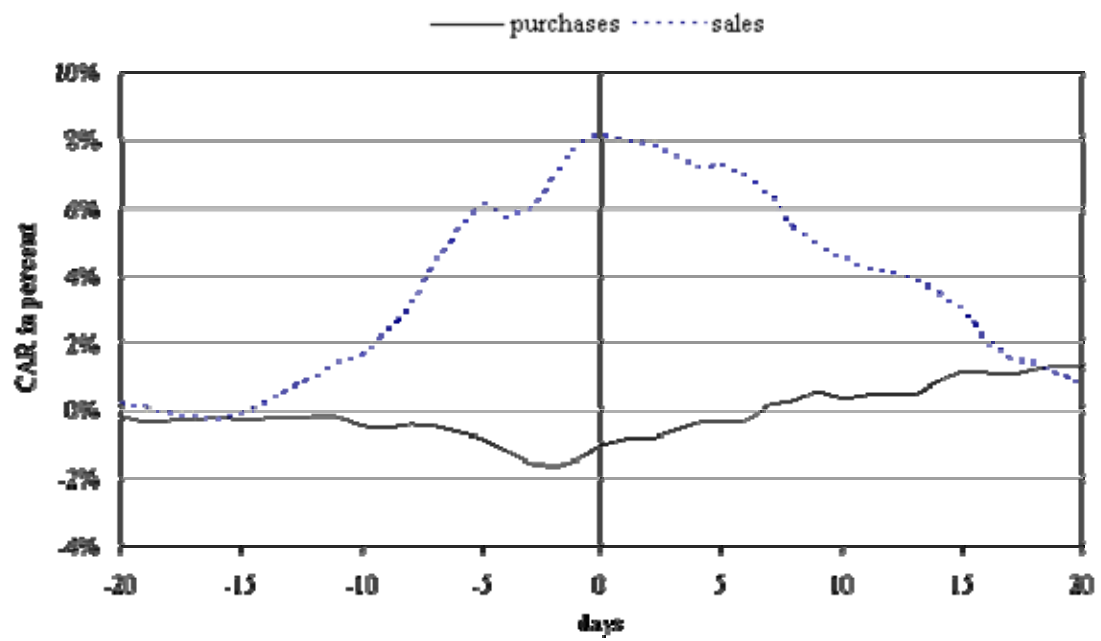
This table presents the AAR (average abnormal return) of the regular purchase-sample around the transaction day. (without adjusting for overlapping observations); n = number of observations; t-Statistics = Value of the parametric t-Test; \*\*\*, \*\*, \* = level of significance 99%, 95% and. 90% , respectively.

**Table 6: Daily abnormal return around the transaction dates of sales**

Day	AAR	t-Statistics	Day	AAR	t-Statistics
-20	0,187%	0,464709	0	0,179%	0,443695
-19	-0,092%	-0,228898	1	-0,125%	-0,310623
-18	-0,178%	-0,442395	2	-0,105%	-0,261716
-17	-0,049%	-0,122349	3	-0,350%	-0,870711
-16	-0,167%	-0,415185	4	-0,331%	-0,823574
-15	0,195%	0,484342	5	0,030%	0,074392
-14	0,272%	0,675832	6	-0,271%	-0,672969
-13	0,450%	1,119403	7	-0,576%	-1,431199
-12	0,316%	0,786215	8	-0,957%	-2,378808 **
-11	0,471%	1,171747	9	-0,479%	-1,191731
-10	0,260%	0,645679	10	-0,414%	-1,028831
-9	0,641%	1,592989	11	-0,354%	-0,880491
-8	0,669%	1,662894 *	12	-0,050%	-0,124776
-7	1,365%	3,391402 ***	13	-0,245%	-0,608017
-6	0,930%	2,310400 **	14	-0,395%	-0,980728
-5	0,839%	2,085697 **	15	-0,462%	-1,149369
-4	-0,416%	-1,032688	16	-0,946%	-2,351496 **
-3	0,273%	0,677637	17	-0,514%	-1,277361
-2	0,957%	2,377904 **	18	-0,113%	-0,280860
-1	0,993%	2,467541 **	19	-0,406%	-1,008721
			20	-0,344%	-0,855938

This table presents the AAR (average abnormal return) of the regular sales-sample around the transaction day. (without adjusting for overlapping observations); n = number of observations; t-Statistics = Value of the parametric t-Test; \*\*\*, \*\*, \* = level of significance 99%, 95% and 90% , respectively.

Figure 3: Cumulative abnormal returns around the transaction day: purchases vs. sales



**Table 7: Cumulative abnormal returns around the transaction day**

Sample	Purchases (n=1.434)		Sales (n=1.504)	
	CAAR	t-Statistics	CAAR	t-Statistics
[-20;+20]	1,291%	1,193421	0,685%	0,265971
[-20;-1]	-1,427%	-1,888206 *	7,915%	4,398989 ***
[-10;-6]	-0,461%	-1,219669	3,864%	4,294755 ***
[-5;-1]	-0,788%	-2,086369 **	2,646%	2,940918 ***
[-1;+1]	0,869%	2,967903 ***	1,046%	1,501465
[-1;0]	0,666%	2,786691 ***	1,171%	2,058555 **
[0;+1]	0,632%	2,642864 ***	0,054%	0,094096
[0;+2]	0,590%	2,014941 **	-0,052%	-0,074273
[0;+3]	0,839%	2,483097 **	-0,402%	-0,499678
[0;+4]	1,048%	2,772305 ***	-0,733%	-0,815239
[0;+5]	1,091%	2,636518 ***	-0,704%	-0,713837
[+6,+10]	0,688%	1,821686 *	-2,697%	-2,997913 ***
[+6,+20]	1,627%	2,485890 **	-6,527%	-4,188320 ***
[+1,+20]	2,290%	3,029413 ***	-7,409%	-4,117390 ***
[+1,+30]	2,899%	3,131396 ***	-9,706%	-4,404217 ***
[+1,+60]	5,259%	4,017201 ***	-12,563%	-4,031107 ***
[+1,+100]	7,594%	4,493615 ***	-18,995%	-4,721039 ***

This table presents the CAAR (cumulative average abnormal return) of the regular purchase- and the sales-sample around the transaction day. (without adjusting for overlapping observations); n = number of observations; t-Statistics = Value of the parametric t-Test; \*\*\*, \*\*, \* = level of significance 99%, 95% and 90%, respectively.

**Table 8: Daily abnormal returns for purchases around the announcement date**

Day	AAR	t-Statistics	Day	AAR	t-Statistics
-20	-0.025%	-0.101603	0	0.173%	0.692261
-19	-0.270%	-1.079055	1	0.380%	1.518100
-18	-0.035%	-0.137712	2	0.123%	0.492743
-17	-0.040%	-0.161448	3	0.119%	0.474798
-16	-0.075%	-0.300382	4	-0.046%	-0.183796
-15	-0.036%	-0.142431	5	-0.153%	-0.610110
-14	0.037%	0.145951	6	0.265%	1.058051
-13	-0.268%	-1.067703	7	-0.057%	-0.226172
-12	0.084%	0.335815	8	-0.035%	-0.138037
-11	0.155%	0.617217	9	-0.097%	-0.387321
-10	-0.198%	-0.788386	10	-0.022%	-0.087645
-9	-0.099%	-0.393836	11	0.028%	0.113633
-8	-0.103%	-0.411807	12	0.277%	1.103469
-7	-0.404%	-1.613257	13	0.220%	0.876146
-6	0.165%	0.659809	14	0.148%	0.591204
-5	0.167%	0.666728	15	-0.239%	-0.954057
-4	0.085%	0.340899	16	0.053%	0.210283
-3	-0.406%	-1.621386	17	-0.147%	-0.585792
-2	0.430%	1.715570 *	18	0.602%	2.403949 **
-1	0.517%	2.063013 **	19	-0.004%	-0.016260
			20	-0.129%	-0.515130

This table presents the AAR (average abnormal return) of the regular purchase-sample around the announcement day 0. (without adjusting for overlapping observations); n = number of observations; t-Statistics = Value of the parametric t-Test; \*\*\*, \*\*, \* = level of significance 99%, 95% and 90% , respectively.



**Table 9: Daily abnormal returns for sales around the announcement date**

Day	AAR	t-Statistics	Day	AAR	t-Statistics
-20	0.055%	0.124130	0	-0.935%	-2.093507 **
-19	0.308%	0.688726	1	0.010%	0.022130
-18	0.128%	0.287699	2	-0.315%	-0.705949
-17	-0.201%	-0.448980	3	-0.262%	-0.585497
-16	0.767%	1.718165 *	4	0.026%	0.058537
-15	0.681%	1.525792	5	-0.436%	-0.975201
-14	0.665%	1.489891	6	-0.371%	-0.829728
-13	-0.205%	-0.458698	7	-0.661%	-1.479653
-12	1.206%	2.700652 ***	8	0.121%	0.271818
-11	1.417%	3.173348 ***	9	-0.140%	-0.312651
-10	2.024%	4.531530 ***	10	-0.311%	-0.695185
-9	0.019%	0.043185	11	-0.598%	-1.339929
-8	-0.486%	-1.087336	12	-0.313%	-0.701762
-7	0.303%	0.678439	13	-0.822%	-1.839600 *
-6	0.248%	0.555453	14	-0.746%	-1.670573 *
-5	-0.586%	-1.311056	15	-0.274%	-0.613136
-4	0.532%	1.191169	16	0.066%	0.146669
-3	0.788%	1.765071 *	17	-0.262%	-0.587204
-2	-0.111%	-0.248588	18	-0.461%	-1.032844
-1	-0.767%	-1.716376 *	19	-0.728%	-1.629541
			20	-0.616%	-1.379169

This table presents the AAR (average abnormal return) of the regular sales-sample around the announcement day 0. (without adjusting for overlapping observations); n = number of observations; t-Statistics = Value of the parametric t-Test; \*\*\*, \*\*, \* = level of significance 99%, 95% and. 90% , respectively.

**Table 10: Cumulative abnormal returns around the announcement date**

Sample	Purchases (n=1.434)		Sales (n=1.504)	
	CAAR	t-Statistics	CAAR	t-Statistics
[-20;+20]	1,142%	0,711577	-1,237%	-0,432564
[-20;-1]	-0,319%	-0,284875	6,790%	3,399319 ***
[-10;-6]	-0,638%	-1,139266	2,109%	2,111416 **
[-5;-1]	0,793%	1,415353	-0,143%	-0,143010
[-1;+1]	1,071%	2,467234 **	-1,692%	-2,186860 **
[-1;0]	0,690%	1,948274 *	-1,702%	-2,693994 ***
[0;+1]	0,554%	1,562961	-0,925%	-1,464685
[0;+2]	0,677%	1,560638	-1,240%	-1,603490
[0;+3]	0,796%	1,588951	-1,502%	-1,681411 *
[0;+4]	0,750%	1,339005	-1,476%	-1,477722
[0;+5]	0,597%	0,973262	-1,911%	-1,747093 *
[+6,+10]	0,055%	0,097885	-1,360%	-1,361944
[+6,+20]	0,864%	0,889836	-6,116%	-3,535385 ***
[+1,+20]	1,287%	1,148904	-7,092%	-3,550533 ***
[+1,+30]	1,832%	1,334666	-8,364%	-3,418750 ***
[+1,+60]	4,488%	2,312307 **	-12,599%	-3,641632 ***
[+1,+100]	6,752%	2,694668 ***	-18,583%	-4,160566 ***

This table presents the CAAR (cumulative average abnormal return) of the regular purchase- and the sales-sample around the announcement day 0. (without adjusting for overlapping observations); n = number of observations; t-Statistics = Value of the parametric t-Test; \*\*\*, \*\*, \* = level of significance 99%, 95% and 90%, respectively.

Figure 4: Cumulative abnormal returns around the announcement date

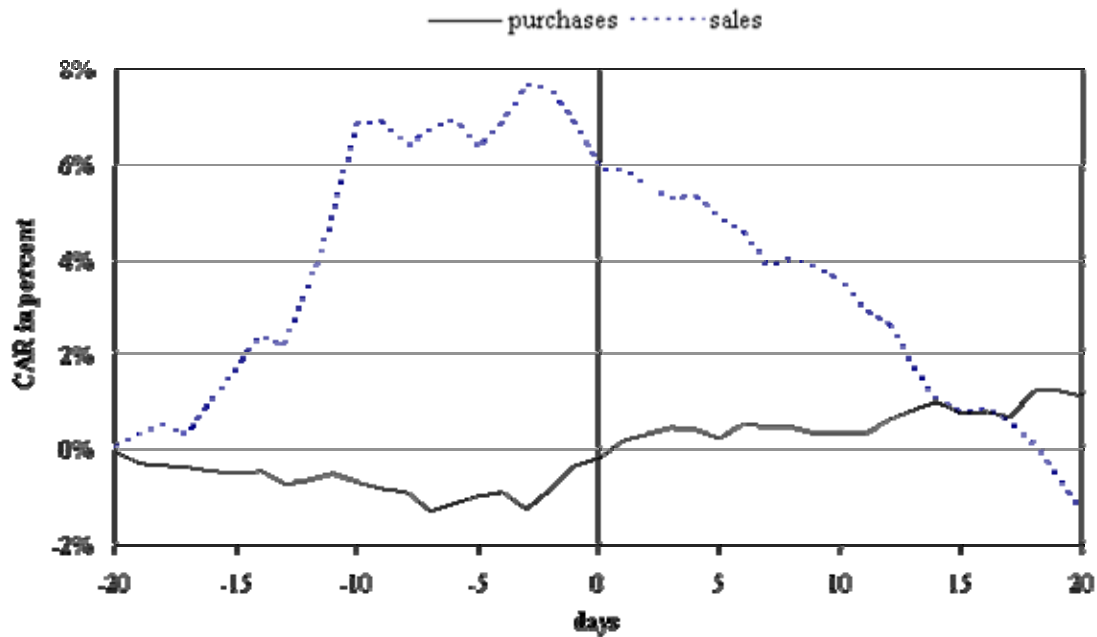


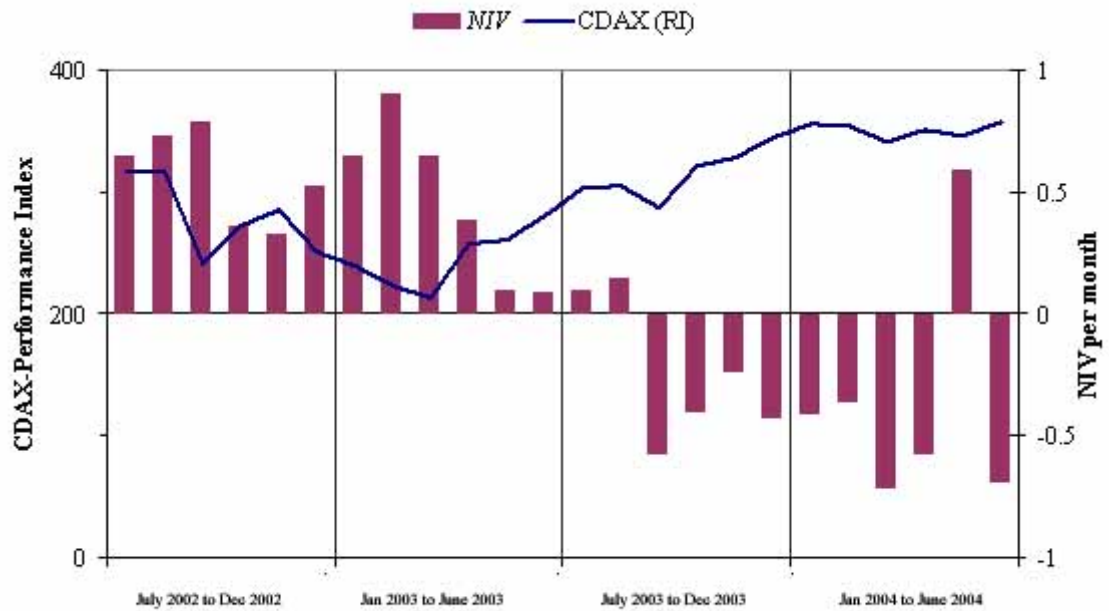
Table 11: Cumulative abnormal return for non-overlapping observations around the announcement date

Sample	Purchases (n=691)		Sales (n=726)	
	CAAR	t-Statistics	CAAR	t-Statistics
[-5;+5]	1,367%	1,324685	-1,490%	-0,543734
[-5;-1]	0,681%	0,978846	0,550%	0,297919
[-1;+1]	1,955%	3,628395 ***	-3,889%	-2,717261 ***
[-1;0]	0,990%	2,250132 **	-3,469%	-2,969201 ***
[0;+1]	1,301%	2,956507 ***	-1,943%	-1,662788 *
[0;+2]	1,361%	2,526213 **	-2,585%	-1,806553 *
[0;+3]	1,469%	2,361004 **	-2,514%	-1,521439
[0;+4]	1,157%	1,663779 *	-1,717%	-0,929178
[0;+5]	0,686%	0,900071	-2,040%	-1,008181

This table presents the CAAR (cumulative average abnormal return) of the purchase- and the sales-sample around the transaction day 0 adjusted for overlapping observations in a time interval of 11 days; n = number of observations; t-Statistics = Value of the parametric t-Test; \*\*\*, \*\*, \* = level of significance 99%, 95% and . 90%, respectively.

**Figure 5: Insider trading intensity ratio compared with the level of the CDAX**

This figure presents the aggregate net trading intensity ratio per month (NIV: net trading intensity ratio, calculated, dividing the aggregated monthly net trading intensity through the number of all transactions that occurred in this month) in comparison with the CDAX performance index.



**Table 12: Pearson correlation coefficients of net trading intensity ratio (NIV) and market returns around insider transactions.**

	<b>NIV</b>	<b>MR<sub>-1</sub></b>	<b>MR<sub>-6</sub></b>	<b>MR<sub>-12</sub></b>	<b>MR<sub>+6</sub></b>
<b>NIV</b>	1.0000	-0.4305 (0.0357)	-0.7696 (<.0001)	-0.7981 (<.0001)	0.0116 (0.9571)
<b>MR<sub>-1</sub></b>		1.0000	0.4029 (0.0509)	0.1781 (0.4051)	0.1927 (0.3669)
<b>MR<sub>-6</sub></b>			1.0000	0.7105 (0.0001)	0.2105 (0.3235)
<b>MR<sub>-12</sub></b>				1.0000	-0.2958 (0.1606)
<b>MR<sub>+6</sub></b>					1.0000

This table presents the Pearson Correlation coefficients (N=14). Significance levels are in brackets.

NIV= net trading intensity ratio, MR<sub>-1</sub>=monthly buy-and-hold-return of the CDAX performance index, MR<sub>-6</sub>/MR<sub>-12</sub>=Buy-and-hold-return of the CDAX of the last 6 and 12 months, MR<sub>+6</sub>=buy-and-hold-return of the CDAX for the next 6 months.

**Table 13: correlation analysis of the factors included in the cross-sectional regressions.**

	MR <sub>6</sub>	MR <sub>12</sub>	LTW	M2B	LMCAP	SHARE	NI
MR <sub>6</sub>	1	0.662 (<.0001)	-0.032 (0.2388)	0.071 (0.0082)	-0.121 (<.0001)	0.009 (0.748)	-0.369 (<.0001)
MR <sub>12</sub>		1	0.003 (0.9099)	0.086 (0.0014)	-0.081 (0.0026)	0.001 (0.9842)	-0.315 (<.0001)
LTW			1	0.120 (<.0001)	0.266 (<.0001)	0.399 (<.0001)	-0.103 (0.0001)
M2B				1	0.225 (<.0001)	-0.043 (0.1075)	0.106 (<.0001)
LMCAP					1	-0.137 (<.0001)	0.047 (0.082)
SHARE						1	-0.001 (0.979)
NI							1

The table presents the Pearson correlation coefficients of all factors, included in the cross-sectional analysis, excluding dummies. The level of significance is presented in brackets. MR<sub>m</sub> = Buy-and-hold-return of the CDAX index of the previous m months; LTW = logarithm of transaction value in Euros, M2B = Market-to-Book ratio, LMCAP = Logarithm of the market value of equity; SHARE = Percentage increase/decrease of ownership of total equity per transaction; NI = net trading intensity on the day of the announcement.

**Table 14: Results of the cross-sectional regressions of the purchase announcements using the cumulative abnormal return in the [-1;+1] time interval as indicator for the signaling character.**

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
MR <sub>6</sub>	-0.052 *** -3.405			-0.050 *** -3.208		
MR <sub>12</sub>		-0.014 -1.061			-0.014 -1.079	
NI			0.226 *** 11.521			0.229 *** 10.574
LMCAP	-2.273 *** -5.688	-2.393 *** -5.952	-1.474 *** -3.937			
M2B	-0.020 -0.097	-0.060 -0.294	-0.506 *** -2.712			
LTW				-1.847 *** -4.206	-2.046 *** -4.663	0.038 0.084
SHARE	0.166 0.750	0.123 0.553	0.379 * 1.857			
VSD	0.293 0.232	0.192 0.151	0.343 0.296	0.493 0.386	0.357 0.278	0.776 0.652
ARD	3.565 *** 2.726	3.369 ** 2.558	0.164 0.133	3.694 *** 2.774	3.449 *** 2.577	0.878 0.697
R <sup>2</sup>	0.115	0.101	0.251	0.087	0.074	0.208
Adj. R <sup>2</sup>	0.107	0.092	0.244	0.081	0.069	0.203

This table presents the results of the cross-sectional regressions of the for overlapping observations adjusted purchase announcement sample using the cumulative abnormal return in the [-1;+1] time interval as dependent variable. Level of significance underneath the values; \*\*\*, \*\*, \* = level of significance of 99%, 95% or. 90% respectively.

MR<sub>m</sub> = Buy-and-hold-return of the CDAX index for the previous m months; NI = net trading intensity on the announcement day; LTW = Logarithm of the absolute transaction value in Euros; M2B = Market-to-Book ratio, LMCAP = Logarithm of the market value of equity, SHARE = Percentage increase/decrease of ownership of total equity per transaction, VSD/ARD = Dummies for transactions made by a member of the board of directors (VSD) or of the supervisory board (ARD); R<sup>2</sup> and Adj. R<sup>2</sup>.

**Table 15: Results of the cross-sectional regressions of the sales announcements using the cumulative abnormal return in the [-1;+1] time interval as indicator for the signaling character.**

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
MR <sub>-6</sub>	-0.090 *** -4.728			-0.078 *** -4.002		
MR <sub>-12</sub>		-0.100 *** -7.855			-0.097 *** -7.610	
NI			0.560 *** 15.349			0.588 *** 14.734
LMCAP	3.650 *** 5.827	3.638 *** 6.073	1.548 *** 2.739			
M2B	0.070 0.278	0.011 0.047	-0.427 * -1.927			
LTW				3.046 *** 6.799	2.997 *** 7.132	-0.038 -0.084
SHARE	0.350 *** 3.231	0.338 *** 3.205	0.093 0.964			
VSD	-0.261 -0.215	-1.053 -0.918	-4.613 *** -4.383	-1.980 * -1.647	-2.566 ** -2.290	-5.238 *** -5.126
ARD	-4.724 *** -3.671	-5.665 *** -4.651	-7.157 *** -6.506	-5.935 *** -4.711	-6.637 *** -5.613	-7.669 *** -7.145
R <sup>2</sup>	0.169	0.211	0.357	0.168	0.213	0.348
Adj. R <sup>2</sup>	0.162	0.205	0.352	0.163	0.209	0.345

This table presents the results of the cross-sectional regressions of the for overlapping observations adjusted sales announcement sample using the cumulative abnormal return in the [-1;+1] time interval as dependent variable. Level of significance underneath the values; \*\*\*, \*\*, \* = level of significance of 99%, 95% or 90% respectively. MR<sub>-m</sub> = Buy-and-hold-return of the CDAX index for the previous m months; NI = net trading intensity on the announcement day; LTW = Logarithm of the absolute transaction value in Euros; M2B = Market-to-Book ratio, LMCAP = Logarithm of the market value of equity, SHARE = Percentage increase/decrease of ownership of total equity per transaction, VSD/ARD = Dummies for transactions made by a member of the board of directors (VSD) or of the supervisory board (ARD); R<sup>2</sup> and Adj. R<sup>2</sup>.



**Table 16: Results of the cross-sectional regressions of the purchase announcements using the cumulative abnormal return in the [0;+5] time interval as indicator for the signaling character.**

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
MR6	-0.004 -0.286			-0.016 -0.995		
MR12		-0.018 -1.358			-0.028 ** -2.163	
NI			0.044 ** 2.111			0.044 * 1.911
LMCAP	-2.011 *** -5.089	-1.975 *** -5.026	-1.827 ***			
M2B	-0.531 *** -2.700	-0.485 ** -2.437	-0.618 ***			
LTW				-0.672 -1.540	-0.622 -1.443	-0.336 -0.699
SHARE	-0.064 -0.298	-0.049 -0.225	-0.017 -0.080			
VSD	0.100 0.081	0.141 0.115	0.126 0.103	0.462 0.365	0.531 0.421	0.492 0.390
ARD	0.591 0.461	0.621 0.486	-0.048 -0.037	1.320 1.001	1.349 1.028	0.739 0.553
CAR <sub>5,-1</sub>	-0.115 *** -4.124	-0.117 *** -4.238	-0.109 *** -3.941	-0.097 *** -3.440	-0.103 *** -3.663	-0.094 *** -3.333
R <sup>2</sup>	0.078	0.080	0.084	0.028	0.033	0.032
Adj. R <sup>2</sup>	0.068	0.070	0.074	0.020	0.026	0.024

This table presents the results of the cross-sectional regressions of the for overlapping observations adjusted purchase announcement sample using the cumulative abnormal return in the [0;+5] time interval as dependent variable. Level of significance underneath the values; \*\*\*, \*\*, \* = level of significance of 99%, 95% or. 90% respectively.

MR<sub>m</sub> = Buy-and-hold-return of the CDAX index for the previous m months; NI = net trading intensity on the announcement day; LTW = Logarithm of the absolute transaction value in Euros; M2B = Market-to-Book ratio, LMCAP = Logarithm of the market value of equity, SHARE = Percentage increase/decrease of ownership of total equity per transaction, VSD/ARD = Dummies for transactions made by a member of the board of directors (VSD) or of the supervisory board (ARD);, CAR<sub>5,-1</sub> = Cumulative abnormal return in percentage points during a time interval of 5 days before the announcement; R<sup>2</sup> and Adj. R<sup>2</sup>

**Table 17: Results of the cross-sectional regressions of the sales announcements using the cumulative abnormal return in the [0;+5] time interval as indicator for the signaling character.**

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
MR6	-0.058 *** -3.386			-0.038 ** -2.179		
MR12		-0.122 *** -11.323			-0.115 *** -10.603	
NI			0.173 *** 4.500			0.083 * 1.892
LMCAP	0.087 0.156	-0.507 -0.988	-0.482 -0.825			
M2B	-0.425 * -1.827	-0.298 -1.377	-0.472 ** -2.041			
LTW				1.475 *** 3.737	0.957 *** 2.681	1.207 ** 2.562
SHARE	0.091 0.947	0.055 0.617	0.037 0.379			
VSD	-3.216 *** -2.991	-3.307 *** -3.406	-4.946 *** -4.686	-3.521 *** -3.325	-3.097 *** -3.265	-4.403 *** -4.324
ARD	-2.093 * -1.832	-2.378 ** -2.311	-3.328 *** -3.017	-1.773 -1.596	-1.655 * -1.658	-2.492 ** -2.330
CAR <sub>-5,-1</sub>	-0.073 *** -3.438	-0.114 *** -5.878	-0.116 *** -5.310	-0.081 *** -4.033	-0.115 *** -6.186	-0.105 *** -4.858
R <sup>2</sup>	0.077	0.207	0.088	0.089	0.209	0.088
Adj. R <sup>2</sup>	0.068	0.199	0.079	0.083	0.203	0.081

This table presents the results of the cross-sectional regressions of the for overlapping observations adjusted sales announcement sample using the cumulative abnormal return in the [0;+5] time interval as dependent variable. Level of significance underneath the values; \*\*\*, \*\*, \* = level of significance of 99%, 95% or. 90% respectively.

MR<sub>m</sub> = Buy-and-hold-return of the CDAX index for the previous m months; NI = net trading intensity on the announcement day; LTW = Logarithm of the absolute transaction value in Euros; M2B = Market-to-Book ratio, LMCAP = Logarithm of the market value of equity, SHARE = Percentage increase/decrease of ownership of total equity per transaction, VSD/ARD = Dummies for transactions made by a member of the board of directors (VSD) or of the supervisory board (ARD); CAR<sub>-5,-1</sub> = Cumulative abnormal return in percentage points during a time interval of 5 days before the announcement; R<sup>2</sup> and Adj. R<sup>2</sup>