UK Directors' Trading:

The Impact of Dealings in Smaller Firms

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Abstract

This paper reassesses the UK results of significant abnormal returns from directors' trading for a new sample of directors' trades 1984-1988, and finds that abnormal returns tend to be concentrated in smaller firms. When an appropriate benchmark portfolio is used, it is found that the significance of the abnormal returns is substantially reduced. The implication is that after

I I troductio

Recent studies by King and Röell (1988) and Pope, Morris and Peel (1990) have presented evidence, based on UK share price data, of the returns realised on securities following notification of a director's share dealing. These follow a sequence of studies[1] based on US data, which have examined the impact of `insider dealing' on share prices. Attention has focused particularly on whether non-insiders, observing only a notification of an insider trade, can still generate a positive abnormal return, which is a semi-strong form test of market efficiency. In this paper we follow Seyhun (1986) and see whether these abnormal returns are related to firm size. We then attempt to discover whether the reported excess returns earned from following directors' trades can be explained by the size effect, under which small firms perform differently from their larger counterparts [Fama and French (1992)].

In the next section we review details of the definition of directors' dealing, and Section III then summarises the findings of previous work in this area. Section IV describes the dataset used in this study, which is taken from the Stock Exchange reports of directors' trading in their own companies. The Cumulative Abnormal Returns (CAR) statistical methodology applied in this paper is discussed in section V, where we adjust the standardised abnormal returns to allow for the effect of multiple signals. In the following section we extend this methodology to allow for both a thin trading effect and the size effect inherent in small firms. Empirical results are presented in section VII, whilst section VIII sets out some concluding remarks.

[1] Jaffe (1974), Finnerty (1976), Givoly and Palman (1985), Seyhun (1986).

II Directors' Deali gs i the UK

There is nothing illegal about the employee of a company trading in that company's stock providing that the employee is not acting on price sensitive information. The requirements for directors are covered by the 1985 Companies Act, which requires the company to keep a public register of directors' share and debenture interests in the Stock Exchange `Yellow Book'. In addition, dealing on unpublished price sensitive information is prohibited by the Company Securities (Insider Dealing) Act 1985. The Companies Act requires that directors of a company must inform the company within five days of any transaction carried out for their personal account. In turn the company must enter this transaction in the Company Register which is available for public inspection within three days. Further, any listed company must inform the Stock Exchange of the transaction by the following day, and the Stock Exchange publishes this information immediately. Directors are prohibited from dealing in securities in their own companies for the period two months prior to the preliminary announcement of year end or half year results and at other times prior to the announcement of price sensitive information. The illegality of trading on price sensitive information does not preclude a director taking a long term view of the company's prospects, and trading on the basis of whether the company is fundamentally over or undervalued. It is exactly this kind of trading which we would expect to show up in long term abnormal returns to directors' dealings.

The data that we use in this study relates to a stratified sample of transactions

by UK corporate directors published in the London Stock Exchange Information Fiche Service over the period 1984-86. The UK data set has previously been examined by Pope, Morris and Peel (1990)[2] for the period 1977-84 and also King and Röell (1988) who used a filtered sample obtained from the transactions of directors published weekly in the Financial Times, 1986-87.

Our sample of 150 companies is constructed to give approximately equal numbers of large, medium sized and small companies. The null hypothesis is that firm size has no relationship with the size of any abnormal return which may be observed. However, it may be that the directors of smaller companies are more intimately in touch with the prospects of their firms than the directors of larger companies, perhaps because the latter tend to include more non-executive directors. It may also be the case that trades by the directors of large companies are more public, and that either the share price reaction is faster, or that directors modify their trading activities because of this. On the other hand if abnormal returns to directors' trading are concentrated in smaller companies then these excess returns may be the result of the well documented small firm effect, whereby small firms have earned consistently higher risk adjusted returns than their larger counterparts [Fama and French (1992)]. Examination of the returns on the Hoare Govett Smaller Companies (HGSC) Index relative to the FT All Share Index over the period of our study suggests the importance of recognising the likely impact of smaller companies' performance when analysing our sample.

[2] Pope, Morris and Peel used the summary of this information contained in the Stock Exchange's *Weekly Official Intelligence*.

From Table 1 it can be seen that the HGSC index shows higher returns than the FTA index in every year from 1984-1988.

III Previous Studies

The approach that we use to define directors' trades is similar to that of Jaffe (1974). Within our sample of firms we note each occasion that a director buys or sells his company's securities. The transaction acts as a signal and we calculate the subsequent monthly abnormal returns from the stock of this company after this signal for up to twenty four months. The abnormal return is calculated after deducting the expected return predicted by the market model for company i. Jaffe (1974) examined a random sample of 952 insiders' transactions which resulted in 362 net purchases plus net sales in the 200 large US companies during the period 1962-68. Jaffe found that the monthly cumulative average residuals were a significant 1.18 per cent after the first two months, though the abnormal return was dissipated by later months. These results suggested that insiders were able to predict and exploit residual returns in the near future. These findings were corroborated by Finnerty (1976) who used a much larger data source of over 30,000 insider transactions.

Finnerty examined the asymmetry in buy and sell trade information. He constructed 36 buy and 36 sell portfolios for each month over the period January 1969 to December 1971. He found an abnormal return of 3.68 per cent to the buy portfolios in the first month after the insider's transaction, and in subsequent months the abnormal returns were much lower, whereas the abnormal return to the sell portfolio was equally distributed across the

subsequent twelve months.

It may seem surprising that insiders do make large immediate gains when they buy stock since in the US insiders can be sued for violating their fiduciary responsibilities to their shareholders if they trade on private information prior to its public announcement. Givoly and Palman (1985) investigated whether the abnormal gain to insiders was realised by price changes resulting from the subsequent disclosure of information about the company. They examined 1,531 transactions from a random sample of 68 companies listed on the American Stock Exchange over the period 1973-75. They also classified subsequent news reports on earnings, dividends, operational plans and management forecasts into good, bad and neutral. They found that although insiders made positive abnormal returns in the days following their transaction this was unrelated to any subsequent news report. They found no association between the type of transaction and the classification of the news report. Givoly and Palman argued that the insiders were able to earn abnormal returns because their published actions were copied by investors who observed these insiders' activities, which then moved share prices in the market.

In the most comprehensive study to date, Seyhun (1986) examined the impact of size and liquidity, through the profitability of over 60,000 insider transactions between 1975 and 1981 for 769 companies. He found that insiders are able to predict abnormal future stock price changes and that most of the abnormal stock price adjustment occurs during the 100 days following an insider transaction. The abnormal return was 2.3 per cent for the first 100

days.

He also found that the expected loss by the uninformed to insiders is negatively correlated to firm size, and hence market makers set larger bid-ask spreads when dealing in smaller stocks. When these transactions costs are taken into account Seyhun claimed it is not possible for an outsider to take advantage of the knowledge of insiders' transactions to earn abnormal profits.

In the UK King and Röell (1988) used a sample of insider transactions reported in the Financial Times, 1986-87. They found that a buy portfolio replicating 109 insider purchases produced an abnormal return of 2.47 per cent after one month, and an exceptionally large and significant 53.05 per cent after twelve months. The sell portfolio of 269 insider sales produced a 1.18 per cent abnormal return after one month, and an insignificant 7.56 per cent return after twelve months.

Pope, Morris and Peel (1990) using a slightly larger sample of 275 buy and 289 sell signals over the period 1977-84 found that for up to six months after the signal there were significant abnormal returns of 4.85 per cent for the whole sample. When split into buy and sell signals, the sells were significantly negative, but the buys, though positive were not significant. Note that this is the opposite pattern to the findings of King and Röell. When Pope, Morris and Peel examined the behaviour of abnormal returns over three sub-periods, they were unable to detect any general pattern in the distribution of residual returns. However, it should be noted that the definition of a `signal' differs between these two UK studies. King and Röell

use all transactions reported in the Financial Times whilst Pope, Morris and Peel used only those events where two or more directors traded in the shares in the same week.

IV Data

The London Stock Exchange Companies' Information Fiche Service was used to extract data on all directors' trading activities for 150 listed non-financial companies for the period January 1984 to December 1986 inclusive. The sample was stratified so that 46 of our companies are in the largest decile by market values at January 1984, 56 between the second and fifth deciles, with 48 in the smallest 5 deciles. Three principal information services are available, a daily update service, an annual report and accounts service and the ad-hoc service.

The daily update service is split into four sections. Section A contains the annual report and accounts, Section B contains details of directorate changes, directors' dealings and disclosable shareholdings, Section C contains company circulars (including prospectuses, notices of EGMs, etc) and Section D contains any other material, such as preliminary and interim results. As disclosable shareholdings include information relating to stakes held in other companies and held by other companies, the volume of data to be scanned in order to establish directors' share dealings is considerable. Prior to the introduction of a Stock Exchange standard form (at the time of `Big-Bang') many companies communicated directors' dealings in a letter format, with some firms choosing to provide only sparse information. Our intention in looking at the fiche copy was to glean the maximum possible

information concerning the transaction, to assist in classifying all directors' beneficial dealings as: buy, sell, purchase/sale of rights or option exercise/subsequent sale. The latter categorisation is especially difficult as not all companies clearly indicate whether a trade relates to share options or not.[3] Accordingly, a purchase was judged to be an exercise of an option if a) the company indicated it was such, or b) the price (if disclosed) was substantially below that relating to any trades disclosed within the month of purchase or c) if the purchase was followed by the sale of shares by a director in the month of acquisition. Obviously, this approach may have led to the misclassification of option-based trades but the descriptions given in the weekly intelligence do sometimes have data missing from them.

The methodology used requires that all 150 companies are included on the LBS share price data base for the period January 1979 to December 1988 inclusive, and although this may imply a sample bias in the sell transactions because of the `survival' criterion this imposes, Loderer and Sheehan (1989) find no evidence of any significant reduction in stockholdings by insiders prior to bankruptcy for a sample of NYSE firms.[4]

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[3] Jaffe (1974), Finnerty (1976) and Pope, Morris and Peel (1990) specifically exclude all option trades.

[4] In fact when we analyzed the data set we discovered that 29 companies were removed from the LBS database between January 1984 and December 1988 due to entering receivership or being voluntarily liquidated. Of these 10 would not have qualified for our sample because either they were in the financial sector or they had less than sixty months returns available before our exclusion period. We examined the directors' trades in the remaining 19 companies and found 16 buy transactions and 12 sell transactions. This distribution is not significantly different from the sample distribution at the 5 per cent level. It therefore appears reasonable to assume that the effect of excluding these 19 companies from the universe from which our 150 firms were randomly selected is likely to be negligible. On the related issue of takeovers, we note that trading by directors in companies involved in takeovers violates the Insider Trading Act and is outside the scope of this study.

There were a total of 2,350 directors' trades identified in the sample of 150 companies, of which 1,653 were non-option related. Among these latter transactions sales outnumbered purchases by 213. Over half of the non-option transactions reported were in large stocks, with about 16% in the small stocks. Only in the small firm classification did buys outnumber sells. This compares with 564 trades examined by Pope, Morris and Peel (1990) who include only those cases where the net number of buyers or sellers was two or more. They also exclude cases where no trading occurred in any of the 60 months of the estimation period. By contrast we included all trades, and defined `buy' or `sell' signals with reference to the number of shares traded by insiders. We analyzed trades by quarter throughout the sample period and found no evidence of seasonality in directors' trading.

Having observed the directors' share dealing activities in each month, a signal is generated for that month according to the number of shares bought and sold by the directors. If they buy more shares than they sell, then a `buy' signal arises whereas a `sell' signal is triggered if sales exceed purchases. Months with no sales or purchases are deemed to give rise to a `neutral' signal.[5]

The date of the signal to the market is taken as being the date of receipt by the stock exchange of the documentation provided by the company. This date is clearly stamped on the trade notification; our original intention was to

[5] Finnerty (1976) considers "intensive" signals, when sales exceed purchases by some factor and vice versa.

record both this date and the date of the actual trade but unfortunately the quality of the documentation provided by the companies (particularly pre-`Big-Bang') did not always allow the latter to be distinguished.[6] Although the standards of reporting of trades has now improved this quality problem did cause difficulties in determining whether trades were option-based or not.

Previous studies have excluded the impact of options exercised by directors, but the exercise of options and subsequent transactions by directors may also reveal information about how the directors view the long term prospects of a company. We were interested to see if there was any information content in option related transactions and we therefore examined the effects on abnormal returns of classifying options in the following manner:

Strategy 1 (S1): Only sales or purchases of shares, excluding rights and options were considered.

Strategy 2 (S2): Option exercise followed by the sale of the entire acquisition is classified as a `neutral' signal, but exercise followed by no sale or a partial sale is classified as a `buy' signal.

Strategy 3 (S3): is similar to *S2*, but classifies the exercise of an option followed by sale as a `sell' signal.

V Statistical Methodology

[6] One company had to be dropped from the sample (and replaced) because the quality of information made it impossible to distinguish between those beneficial and non-beneficial trades. Furthermore, there were several cases in other companies where trades were conducted during proscribed periods. This appeared to draw a warning letter to the company from the Stock Exchange.

The approach to evaluating the impact of directors' trading uses the standardised market model residuals to evaluate the mean effect per signal. The following generating model for returns is assumed:

$$r_{j\tau} = \alpha_j + \beta_j r_{m\tau} + \varepsilon_{j\tau} \qquad \mathbf{1}$$

where $r_{j\tau}$ is the continuously compounded return to company j in month τ, taken from the London Business School Share Price Database, $r_{m\tau}$ is the return on an equity market index, which in this case the FT Actuaries All Share Index, and $\varepsilon_{j\tau}$ is an iid disturbance term, $\varepsilon_{j\tau} \sim N(O, \sigma_\varepsilon^2)$. The coefficients in the market model were estimated using data based on the 60 months up to and including the month 12 months prior to the month of the first signal. The 12 month `exclusion' period is used to take account of the fact that directors may trade following a period of abnormal performance by the company.

Initially abnormal returns, XM_{jt} , were computed monthly following each director's trade reported during the 36 month period January 1984 through to December 1986, as

$$XM_{jt} = r_{jt} - (\hat{\alpha}_j + \hat{\beta}_j r_{mt}) \qquad \mathbf{2}$$

These calculations represent a `naive' model, since there are no adjustments for thin trading, size considerations or overlapping signals. The usual consistent estimator, $\hat{\varepsilon}^2$ of σ_ε^2 was calculated from the market model regressions. Following Dodd and Warner (1983) the variance of XM_{jt}, $V(XM_{jt})$ was estimated as

$$V(XM_{jt}) = \hat{\sigma}_{\varepsilon}^{2}\left(1 + \frac{1}{N} + \frac{(r_{mt} - \bar{r}_{m})^{2}}{\sum_{\tau=1}^{N}(r_{m\tau} - \bar{r}_{m})^{2}}\right) \qquad \textbf{3}$$

where N is the number of observations over which equation (1) is estimated, equal to 60 here, andr $_{m}$ is the mean return on the market index over the estimation period. Standardised monthly abnormal returns, SM_{jt}, were calculated as

$$SM_{jt} = \frac{XM_{jt}}{\sqrt{V(XM_{jt})}} \qquad \textbf{4}$$

Under the usual assumptions regarding the normality, serial independence and homoscedasticity of the disturbance terms, ε_{jt} , SM_{jt} is asymptotically unit normally distributed. The overall mean of the standardised monthly abnormal returns is defined by:

$$\overline{SM} = \frac{1}{DL}\sum_{j=1}^{L}\sum_{t=1}^{D_j} SM_{tj} \qquad \textbf{5}$$

where L is the total number of companies and D_j is set of months in which directors' trades in company j were reported and D is the total number of signal months used in the study. Thus asymptotically, given the stationarity of equation (1) in all months,SM has a normal distribution with mean zero and variance 1/D. A test for a non-zero mean of the monthly abnormal returns can be based onSM by forming the summary test statistic, Z, where

$$Z = \overline{SM}\sqrt{DL} \qquad \mathbf{6}$$

Longer Period Abnormal Returns

The preceding section sets out the straightforward procedure used to arrive at simple test for a non-zero abnormal return in the month following a month in which a director's trade was reported. As argued earlier, and in Jaffe (1974) and King and Röell (1988), the information motivating a director's trade may not be impounded in the share price until some uncertain future time point. This may well vary between trades and companies. To allow for this we calculate abnormal returns over a variety of longer intervals (3, 12 and 24 months are quoted below). Relevant information can be absorbed into the share price at any point in these time intervals not just in a single month. The single month methodology can be applied to a multi-month return, with one important adjustment. If more than one month is used in calculating the return, the possibility arises that there may be more than one `signal month'. If this is the case, and all signal months are used, then plainly the multi-month returns cannot be independent. The dependence can however be adjusted for. If t is a month in which a director's trade signal occurs then

$$SM_{jt}(K) = \frac{1}{\sqrt{K}} \sum_{i=1}^{K} SM_{j,t+i} \qquad \mathbf{7}$$

is a K-month standardised return, where K will take on the values 3, 12 and 24 months. Now suppose another signal occurs in month t+h ($1<h<K$), then [assuming stationarity of equation (1)]

$$Cov\left(SM_{jt}(K),\ SM_{j,t+h}(K)\right) = \frac{1}{K} E\left(\sum_{i=1}^{K} SM_{j,t+i} \ ,\ \sum_{i=1}^{K} SM_{j,t+h+i} \right) = \frac{K - h}{K} \qquad \textbf{8}$$

since SM_j are serially independent with unit variance. Then as before,

$$\overline{SM}(K) = \frac{1}{DL} \sum_{j=1}^{L} \sum_{t=1}^{D_j} SM_{jt}(K) \qquad \textbf{9}$$

but now the variance of$\overline{SM}$ (K) is given by:

$$var\left(\overline{SM}(K)\right) = \frac{1}{D^2}\left(D + 2D_1\frac{(K-1)}{K} + 2D_2\frac{(K-2)}{K} + \ldots + 2D_{K-1}\frac{1}{K}\right) \qquad \textbf{10}$$

where D_i (i=1, … K-1) is the number of times an `overlap' of K-i months occurs. With this overlap adjustment made, a test statistic can be formed exactly as in the preceding section. When reporting our results from the application of the naive model, we do not make this overlap adjustment. This is to facilitate comparison with other UK studies of directors' trading.[7]

VI Impact of illiquid small compa ies

The analysis in section V assumed that there were no liquidity problems in the stocks in our sample, but we deliberately stratified our data to incorporate small companies. There are at least three difficulties raised by

[7] The overlap adjustment only affects the variance. Although we do not report its impact in Table 2, while in the case of all holding periods greater than one month significance is reduced, in no case does a significant return become insignificant when overlaps are allowed for.

including small firms in our sample. First, trades in small companies may occur only infrequently so that the monthly returns may be based on prices that were not effective for that month. Second it is well known that small firms consistently outperformed the market throughout the eighties so that abnormal returns attributable to following directors' trading may in fact be due to this small firm effect. Finally the liquidity problems of small firms may result in larger transactions prices due to wider bid-ask spreads [Glosten and Milgrom (1985)]. We were not able to obtain data on quoted spreads in these small stocks, since prior to `Big-Bang' this data was not documented, but we were able to allow for the other two issues.

Our first adjustment was to take account of the thin trading effect in the beta estimation. A test of market returns showed that no significant autocorrelation exists in the market index.[8] An appropriate benchmark return in the presence of thin trading can therefore be found by using the Dimson (1979) multiple regression methodology [Fama and French (1992)]. We use a single lead and lag model and assume the following return generating process:

$$r_{j\tau} = \alpha_j + \beta_j^{-1} r_{m,\tau-1} + \beta_j^{0} r_{m,\tau} + \beta_j^{+1} r_{m,\tau+1} + e_{j\tau} \qquad \textbf{11}$$

In which case abnormal returns are now computed from the projection of equation (11) and the appropriate test statistic is described in the Appendix.

We now turn to a second adjustment: the size effect on the benchmark

[8] The autocorrelation was a statistically insignificant -0.012 over the sample period.

return. It may be argued that such an allowance is implicit in the estimate of α_j, and that no further allowance needs to be made. However, such an approach results in bias "*because of exclusion period problems, variability and/or seasonality in the size effect, or non-stationarity in event security sizes*" [Dimson and Marsh (1986) p.137]. Accordingly, we follow Dimson and Marsh (1986) and Agrawal, Jaffe and Mandelker (1992) in using a benchmark portfolio constructed to take account of the size effect. Abnormal performance on a size and beta adjusted basis, XS_j, is computed as:

$$XS_{jt} = r_{jt} - r_{i(j)t} - (\hat{\beta}_j - \hat{\beta}_{i(j)})(r_{mt} - r_{ft}) \qquad \mathbf{1}$$

where $r_{i(j)t}$ is the return on the decile (control) portfolio, i, for security (j). The control portfolio is specified as the portfolio comprising the equally-weighted decile of all stocks to which security i belongs at the beginning of the year; $\beta_{i(j)}$ is the estimated beta of the control portfolio based on the preceding 60 monthly observations, whilst r_{ft} is the return on three month treasury bills both in the event month. Given the presence of thin trading at both company and decile portfolio levels (Dimson [1979]), expression (12) also needs to be further modified to allow for leads and lags in both decile and company betas. An appropriate test statistic can be formed from the residual variance, and a description is given in the Appendix.

VII Empirical Results

Table 2 reports the results using abnormal returns calculated from the `naive' market model in equation (2) and the Dodd-Warner test statistic (6)

unadjusted for overlaps. Generally, these figures appear to agree with the buy portfolio findings of King and Röell (1988) and the sell portfolio results reported by Pope, Morris and Peel (1990). If we exclude option related transactions (*S1*), we find significant returns (at the 5% level) on the buy portfolio for 6, 12 and 24 month holding periods, whilst we find strongly significant returns on the sell portfolio[9] from month 3 onwards under *S1*, where our six month holding period returns are similar to those reported by Pope, Morris and Peel in both magnitude and significance.

When we take into account option related trades (*S2* and *S3*), the results on the buy portfolio are in general, insignificant. However, this is not the case for the sell portfolio where the strongest results are obtained under *S3*[10].

We also report in Table 2 on the abnormal returns for the month of the trade itself (month 0) in order to throw some light on the question of strong form efficiency. No significant returns appear to occur in that month, suggesting that if directors are trading on the basis of inside knowledge of company prospects, it is not on the basis of immediately disclosed price-sensitive information (which would, of course, be illegal).

[9]Note that a negative return here indicates that an abnormal gain can be made by selling the share short following a sale by a director.

[10] Note that the number of 'sell' signals is generally lower under *S2* or *S3* because option 'buys' can swamp 'sell' signals. As an example, take the case of Allied Lyons in November 1984. One director sold some shares, whilst four bought shares (and did not resell) using options. Under *S1*, this results in a 'sell' signal, whereas under *S2* or *S3*, a 'buy' signal is the result.

We now wish to further examine these abnormal returns to see if they are size related. We divide the sample into three size categories on the basis of market capitalization at the beginning of the data period. Table 3 shows clearly that in the case of the buy signals, these excess returns are indeed related to firm size with highly significant CAR's concentrated in the small and medium company groups (60.7% and 22.47% after 24 months). By contrast the large company category shows significant negative CAR's of -14% after 24 months. Turning to the sell signals significant negative returns (-20.7% after 24 months) are obtained on the larger companies, but a surprisingly positive and significant abnormal return of 44.8% after 24 months is earned by the smaller group.

Table 4 reports the CARs calculated from (11), with the summary test statistic described in the appendix, which allows for overlaps and thin trading. For buy signals, these results lead to broadly similar conclusions to those suggested by Table 2, although results for month 6 become insignificant and, in general, the levels of the z-statistics (standardised returns) are reduced. For sell signals, returns and significance levels for all holding periods are substantially reduced for all strategies, becoming insignificant under *S1*, but remaining significant under *S2* and *S3* for 3 and 6 month holding periods.

Table 5 reports on the CARs calculated from equation (12), with the summary statistic derived from (A3) described in the Appendix, after allowing for overlaps. Whilst in general all the adjustments made (thin trading, overlaps and size control) have an impact in reducing the size of the

CARs, overall the greatest effect is produced by allowing for the influence of company size. The consequence of allowing for the size effect is to reduce the abnormal returns on directors' trading. These results are reported in Table 5. Turning to the buy portfolio under *S1*, significant abnormal returns (at the 5% level) remain, after 3, 12, and 24 months, although for longer periods the magnitude of the CAR's is substantially reduced by the size control methodology. Under *S2* and *S3* 1, 3, 6 and 12 month CAR's are all significant. However, none of the adjusted sell CARs are significant under any strategy. In common with Dimson and Marsh (1986) therefore, we find that the size and beta control model has a powerful role in explaining apparently large and significant CARs. Nonetheless, we find that in every case (except that of month 0), the sign of the average CARs is positive in the case of buy signals, and negative in the case of sell signals, implying that there are small abnormal returns to be made from dealing on the basis of signals generated by directors' trading activity, although given the magnitude of the CARs and the size of many of the companies involved, we might expect that these returns become insignificant once transactions costs and bid-ask spreads have been allowed for.

To check for the presence of serial correlation in the computed abnormal returns the `port-manteau' chi-square test statistic, based on 6 lags, was computed using the 24 returns following each signal [Harvey (1981)]. In every case only a relatively small proportion (hardly deviating from the naive 5% expected significant under the null hypothesis of no significance) was found. For instance the 278 signals used for the *S1* buy portfolio gave 10 significant results at the 5% level.

To check for evidence of any abnormal returns in the pre-signal period, in Tables 7 and 8 we report the CARs for 1 month and 12 months before the director's trading signal was identified. On a `naive' market model basis it appears that directors tend to sell following a period of unusually poor share price performance (significant at 1 month and 12 months pre-signal). This result becomes insignificant on a size adjusted basis, which suggests that past relative performance is not associated with directors' share dealings.

To check the consistency of our findings, we applied our model to the King and Röell (1988) data set[11]. First, we recalculated their results using our `naive' methodology. This resulted in a smaller data set as we required LBS data base returns to be available for the 72 months before January 1986 to estimate beta coefficients (King and Röell used LBS Risk Measurement Service betas). We also required market capitalizations to be available for companies at the beginning of each year for which returns were reported, which again reduced the sample size. Nonetheless, as we show in Table 6a, our results broadly agree with their findings; the buy portfolio results in significant gains after 12 months (we report 18.4% compared to their 53.05%) and 24 months, whilst the sell portfolio results are not significant. Applying our size and beta control model equation (12) to this data set results in the adjusted buy portfolio returns becoming insignificant (Table 6b); however, all of the returns for 3 to 12 month holding periods on the sell portfolio become significant at the 5% level, with the 12 month return being significant at the 1% level. This is somewhat surprising, although we

[11] We are grateful to Ailsa Röell for making this data available to us.

note the smaller sample size here (84 signals as opposed to our 431) and that the King and Röell sample is constructed from *Financial Times* reports which concentrates on particular dealings, and may serve to add emphasis to those directors' trades. In any event, both the size and significance of these CARs decline over the following 12 months, giving statistically insignificant returns after 24 months, in line with the findings from our own sample.

VIII Co clusio s

At first sight, it would appear that abnormal returns can be earned by a simple strategy of buying shares following the disclosure of directors' purchases, and selling short following the disclosure of sales of shares by the directors. Our results here confirm those of previous US and UK studies, which imply semi-strong form market inefficiency. However further investigation of our sample showed that a large proportion of these abnormal returns occurred in small and medium sized firms. It is well known that small companies generally outperformed the market index over the period of our data, and these abnormal returns could be explained by the size effect.

We go on to apply a thin trading and benchmark model which properly allows for overlaps between signals, and controls for both the beta and size of the companies for which buy and sell signals are generated. The conclusion is that once the size effect is allowed for, the apparently significant abnormal returns achievable from following directors' transactions become insignificant in the case of sell signals and less significant with buy signals, although the average abnormal returns have the sign predicted by such a `mimicking' strategy. However, these excess

returns may well be within the bounds defined by transactions costs. In conclusion, we have not found convincing evidence to reject the hypothesis of semi-strong form market efficiency.

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TABLE 1: RETURNS ON THE HOARE GOVETT SMALLER COMPANIES INDEX AND FT ALL-SHARE INDEX 1984-1988

	Annual Returns %	
Year	HGSC Index	FTA Index
1984	33.7	32.0
1985	25.2	20.4
1986	38.6	27.3
1987	21.1	7.9
1988	16.5	11.2

Source: Dimson and Marsh (1991)

Table 2. "NAIVE" MARKET MODEL: CUMULATIVE ABNORMAL RETURNS (CARs)

	No. of signals	Month 0	Month 1	Month 3	Month 6	Month 12	Month 24
Buy (S1)	278	-0.0011 0.2392	0.0066 0.6371	0.0224 1.9508	0.0351 2.2722**	0.0923 4.0695**	0.1451 4.2881**
Buy (S2)	406	-0.0042 -0.7174	0.0065 1.1208	0.0144 1.4896	0.0162 1.1038	0.0441 1.9509	0.0504 0.7191
Sell (S1)	431	0.0008 -0.4017	-0.0048 -1.5807	-0.0214 -3.2901**	-0.0362 -4.0417**	-0.0451 -4.3636**	-0.0650 -5.4050**
Sell (S2)	359	0.0010 -0.4623	-0.0061 -1.8773	-0.0246 -3.5382**	-0.0378 -3.9593**	-0.0400 -3.8853**	-0.0463 -4.2269**
Sell (S3)	401	0.0015 -0.1719	-0.0066 -1.9951*	-0.0246 -3.7995**	-0.0418 -4.6544**	-0.0460 -4.5763**	-0.0559 -4.9748**

TABLE 3. NAIVE MARKET MODEL BY SIZE: CARs

	No. of Signals	Month 0	Month 1	Month 3	Month 6	Month 12	Month 24
Buy: Small	49	0.0055 0.3754	0.0298 1.5824	0.1025 2.9395**	0.1407 3.0069**	0.3268 5.1410**	0.6073 6.9920**
(S1) Medium	117	0.0017 0.6025	0.0095 1.0957	0.0254 2.0882*	0.0613 3.3194**	0.1377 4.8183**	0.2247 5.3360**
Large	112	-0.0069 -0.4873	-0.0067 1.0305	-0.0157 -1.0052	-0.0386 -1.8098	-0.0578 -1.9137	-0.1402 -3.3228**
Sell:Small	53	0.0253 1.4478	0.0234 1.0381	0.0155 0.3218	0.0264 0.4497	0.1908 3.1978**	0.4447 5.5090**
(S1) Medium	149	0.0056 0.6786	-0.0124 -1.5208*	-0.0332 -2.5455*	-0.0510 -2.8274*	-0.0458 -1.8724	-0.0278 -1.0458
Large	229	-0.0079 -1.7950	-0.0065 -1.4482	-0.0222 -2.6152**	-0.0410 -3.4805**	-0.0993 -6.0145**	-0.2072 -9.2219**

*,** = Significant at 5% and 1% levels respectively.
In each pair of columns, the first number is the CAR and the second the test statistic, z.

The returns on the buy and sell signals represent the Cumulative Abnormal Return on a long holding of the portfolio. Hence a significant negative return on the sell signals implies a positive abnormal returns on a shortsold portfolio.

Table 4. MARKET MODEL ADJUSTED FOR OVERLAP AND THIN TRADING: CARs

	No. of signals	Month 0	Month 1	Month 3	Month 6	Month 12	Month 24
Buy (S1)	278	0.0005 0.4206	0.0048 0.6391	0.0146 1.4499	0.0195 1.3929	0.0715 2.6463**	0.1223 2.7489**
Buy (S2)	406	-0.0015 0.1662	0.0079 1.9137	0.0161 2.1491*	0.0197 1.8843	0.0538 2.4659*	0.0849 2.1353*
Sell (S1)	431	0.0016 0.1640	-0.0026 -0.7832	-0.0160 -1.6201	-0.0272 -1.6014	-0.0286 -1.2337	-0.0186 -0.6961
Sell (S2)	359	0.0012 -0.0757	-0.0042 -1.2672	-0.0203 -2.1011*	-0.0317 -1.9652*	-0.0278 -1.3489	-0.0101 -0.5902
Sell (S3)	401	0.0025 0.3858	-0.0047 -1.3186	-0.0196 -2.1417*	-0.0341 -2.2287*	-0.0320 -1.5178	-0.0154 -0.6978

Table 5. SIZE AND BETA CONTROL MODEL: CARs+

	No. of signals	Month 0	Month 1	Month 3	Month 6	Month 12	Month 24
Buy (S1)	278	0.0005 0.6775	0.0056 0.9617	0.0185 2.0788*	0.0229 1.9397	0.0601 2.6485**	0.0887 2.2651*
Buy (S2)	406	-0.0003 0.5448	0.0089 2.3039*	0.0202 2.8572**	0.0242 2.4962*	0.0507 2.6777**	0.0638 1.8156
Sell (S1)	431	0.0038 0.8556	-0.0002 -0.1438	-0.0096 -0.7121	-0.0167 -0.6741	-0.0154 -0.4517	-0.0214 -0.5889
Sell (S2)	359	0.0034 0.5812	-0.0019 -0.6723	-0.0135 -1.2293	-0.0206 -1.0403	-0.0161 -0.6097	-0.0167 -0.5180
Sell (S3)	401	0.0044 0.9918	-0.0024 -0.6854	-0.0130 -1.2722	-0.0229 -1.3066	-0.0200 -0.8061	-0.0209 -0.6440

+ After allowing for overlap compensation and thin trading adjustments.
*,** = Significant at 5% and 1% levels respectively.

In each pair of columns, the first number is the CAR and the second the test statistic, z.

DIRECTORS' TRADING RESULTS - KING and ROELL (1988) DATA:

Table 6a. MARKET MODEL: CARs

	No. of signals	Month 0	Month 1	Month 3	Month 6	Month 12	Month 24
Buy	31	0.0581 2.6268**	0.0037 0.2891	0.0191 0.5567	0.0700 1.5616	0.1838 2.5972**	0.3538 3.6317**
Sell	84	0.0286 2.4213*	0.0037 0.2891	-0.0183 -0.2836	-0.0424 -0.9803	-0.0575 -1.3647	-0.0424 -0.7626

Table 6b. SIZE AND BETA CONTROL MODEL: CARs+

	No. of signals	Month 0	Month 1	Month 3	Month 6	Month 12	Month 24
Buy	31	0.0357 1.3471	-0.0272 -1.3146	-0.0334 -0.8290	-0.0227 -0.3105	-0.0156 -0.1638	0.1043 1.0058
Sell	84	0.0092 0.3470	-0.0173 -1.2498	-0.0498 -2.1522*	-0.0789 -2.4102*	-0.1279 -3.24741**	-0.0601 -1.2700

+ After allowing for overlap compensation and thin trading adjustments.
*,** = Significant at 5% and 1% levels respectively.

In each pair of columns, the first number is the CAR and the second the test statistic, z.

TABLE 7. PRE-SIGNAL RETURNS. "NAIVE" MARKET MODEL: CARs

	No. of Signals	Month -1		Month -12	
Buy (S1)	278	0.0059	0.2389	0.0141	0.0762
Buy (S2)	406	0.0047	0.3999	0.0180	0.3234
Sell (S1)	431	-0.0066	-2.0461*	-0.0161	-2.3708*
Sell (S2)	359	-0.0077	-2.1859*	-0.0265	-2.9269*
Sell (S3)	401	-0.0071	-2.1254*	-0.0217	-2.6666**

TABLE 8. PRE-SIGNAL RETURNS. SIZE AND BETA CONTROL MODEL: CARs+

	No. of Signals	Month -1		Month -12	
Buy (S1)	278	0.0075	0.7495	-0.0195	-0.8693
Buy (S2)	406	0.0057	0.9980	0.0113	0.5591
Sell (S1)	431	-0.0081	-1.7564	-0.0180	-0.8310
Sell (S2)	359	-0.0072	-1.4904	-0.0331	-1.4665
Sell (S3)	401	-0.0042	-0.7487	-0.0247	-1.0965

+ After allowing for overlap compensation and thin trading adjustments.
*,** = Significant at 5% and 1% levels respectively.

In each pair of columns, the first number is the CAR and the second the test statistic, z.

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The computation of abnormal returns allowing for thin trading was performed as follows. In view of the insignificant serial correlation in the market index, the Dimson (1979) estimator is a consistent estimator of beta. Consequently, abnormal returns on share j after a thin trading adjustment are

$$XM_{jt} = (r_{jt} - \hat{\alpha}_j - \hat{\beta}_j^{-1} r_{m,t-1} - \hat{\beta}_j^{0} r_{m,t} - \hat{\beta}_j^{+1} r_{m,t+1}) \qquad \text{(A1)}$$

In addition, the usual error variance

$$\hat{\sigma}_e^2 = \sum_{\tau=1}^{N} \frac{(r_\tau - \hat{r}_\tau)^2}{(N-4)} \qquad \text{(A2)}$$

is a consistent estimator of the residual variance in (11).

In the case of the size and beta adjusted benchmark model, the abnormal returns in equation (12) were computed, after allowing for thin trading in the estimates of β_j and $\beta_{i(j)}$. Abnormal returns were

$$XS_{jt} = r_{jt} - r_{i(j)t} - (\hat{\beta}_j^{-1} - \hat{\beta}_{i(j)}^{-1})(r_{m,t-1} - r_{ft}) - (\hat{\beta}_j^{0} - \hat{\beta}_{i(j)}^{0})(r_{m,t} - r_{ft}) - (\hat{\beta}_j^{+1} - \hat{\beta}_{i(j)}^{+1})(r_{m,t+1} - r_{ft})($$

The residual variance of the regression of $r_{jt} - r_{i(j)t}$ on $r_{m,t-1}$, $r_{m,t}$ and $r_{m,t+1}$ was used to estimate the variance of returns in (A3).