CARDIFF BUSINESS SCHOOL
WORKING PAPER SERIES

Cardiff Economics
Working Papers

Kyriacos Kyriacou, Kul B Luintel and Bryan Mase

Private Information in Executives' Option Trades: Evidence from the UK

E2008/4

Cardiff Business School
Cardiff University
Colum Drive
Cardiff CF10 3EU
United Kingdom
t: +44 (0)29 2087 4000
f: +44 (0)29 2087 4419
www.cardiff.ac.uk/carbs

ISSN 1749-6101
February 2008

PRIVATE INFORMATION IN EXECUTIVES' OPTION TRADES:

EVIDENCE FROM THE UK

Kyriacos Kyriacou
Brunel University, United Kingdom.

Kul B Luintel
University of Cardiff, United Kingdom.

Bryan Mase*
Brunel University, United Kingdom.

Abstract

This paper investigates whether UK executives use private information in the trading decisions associated with the exercise of their executive stock options. We find that UK executives' exercise and sell decisions are motivated by their private information but not by their anticipation of future return volatility. These findings appear robust when we control for additional motivating factors that include option moneyness, the previous stock return and the value of the exercise. We argue that the disparity in the informativeness of US and UK executives' trades at exercise is related to important differences in executive remuneration, and in the regulation and taxation of executive stock options.

Keywords: Executive remuneration, executive stock options, trade informativeness.

JEL: G14, G18.

*Dr. Bryan Mase, Economics and Finance, Brunel University, Uxbridge, Middlesex UB8 3PH, United Kingdom.
Tel: +44 (0) 1895 - 266647;
e-mail: bryan.mase@brunel.ac.uk

PRIVATE INFORMATION IN EXECUTIVES' OPTION TRADES: EVIDENCE FROM THE UK

I. INTRODUCTION

This paper examines the information contained in the trades associated with option exercises by UK executives. There are significant differences in the remuneration of US and UK executives that makes an analysis of the UK an interesting test case. In contrast to the US where executives sell almost all the stock acquired at exercise, we find that UK executives sell less than one half, on average. Our main hypothesis is that, if executives incorporate their private information in their trading decisions, then the proportion of acquired stock that is sold will be related to, or influenced by, the executives' expectations about future stock return performance.

In both a univariate analysis, and a multivariate analysis that controls for the additional factors that might motivate their trading decisions including previous stock returns, option moneyness, firm size and exercise value, we show that the proportion of stock sold by UK executives at option exercise contains significant information for future stock returns. In addition, we find some limited evidence that is consistent with dividend capture being a motive for some trading decisions. We do not, however, find any evidence that is consistent with UK executives' trading decisions being informed about future stock return volatility.

The finding of an information content in UK executives' trades at option exercise is in contrast to previous studies based on US data that concludes that these are uninformed trades. We propose several reasons that explain why such

trades in the UK are informed. We suggest that our findings can be explained by differences in executives' remuneration, regulation and the taxation of option gains in the two countries. In the US, executives' remuneration has been much more closely linked to shareholder wealth. As a result, US executives hold relatively undiversified personal portfolios, to the extent that they will be prepared to exercise and sell irrespective of their private information. We argue that UK executives have greater personal portfolio diversification (compared to their US counterparts), which reduces their need to exercise and sell in order to diversify. However, UK executives will still be motivated to exercise their options prior to expiration because of the four times emoluments rule that restricts the total value of their options to four times their pay plus bonus. Exercising their options early therefore facilitates the granting of additional options (see section III). Finally, UK executives are more likely to hold the acquired shares, not only because their need to diversify is less pressing, but also because sales bring forward a tax liability associated with option gains. Hence, UK executives' decisions to exercise and sell are more likely to contain executives' negative private information.

The existing research on the informativeness of insiders' trades examines, for the most part, the information contained in executives' non-option related purchase and sale decisions. Whilst there is evidence that such trades are informed, there is little support for informed trading in executives' option related trades. Our findings therefore extend this research, and show that executives' use of their private information extends to trades associated with their option exercise decisions.

The remainder of the paper is organised as follows. Section II outlines the existing literature on informed trading by executives. In section III we discuss the remuneration of UK and US executives and their diversification needs, as well as the

tax and regulatory regime in the UK. Section IV covers data sources, measurement and descriptive statistics. Section V discusses calendar time excess returns and the results of univariate tests. In section VI we present our multivariate analysis, whilst section VII concludes.

II. LITERATURE

The main focus of the literature on the informativeness of insiders' trades has been on standard purchase and sale decisions. The research concludes that there is information content in these trades, most significantly in relation to stock purchases, and has been documented both for the US and the UK. The general consensus emerging from US research is that purchases have predictive ability for up to a year, but that sales have little information for future stock returns (see, Lakonishok and Lee (2001) and Jeng et al. (2003)). Research on UK executives by Friederich et al. (2002) confirms that purchases are much more informative than sales. There is also evidence that insider trade profitability declines as the information asymmetry between insiders and outsiders falls (Frankel and Li (2004)), implying that the profitability stems from executives' use of their inside information. This information could be knowledge of future earnings (Ke et al. (2003) and Piotroski and Roulstone (2005)), or executives' contrarian view of firm value (Jenter (2005)).

As remuneration has become increasingly performance based, of which a very significant component comprises executive stock options, so attention has begun to focus on the motives for the trading behaviour associated with option exercise decisions. Option exercise decisions are normally regarded as being uninformed due to the restrictions imposed upon executives as to when they can

exercise. However, the apparent lack of an information content in option exercises contrasts with the consistent evidence that executives appear to use their inside information, particularly when buying shares. If executives are able to make informed decisions regarding their standard transactions, it follows they should also be able to make informed option exercise decisions. Where executives are free to sell the stock acquired at exercise, Carpenter and Remmers (2001) find that post-exercise returns are marginally positive, but insignificant, except for a very small sub-sample of top managers in the smaller firms where post-exercise abnormal returns are negative. Core and Guay (2001) confirm the general absence of information content for US non-executives' option exercise decisions.

Despite the existing lack of evidence to confirm the use of their private information in determining the timing of an exercise decision, there is increasing evidence that executives use their information to influence the gains that they can earn from their options. This includes executives' ability to profit from their ability to time the option grant (Yermack (1997)), as well as their ability to increase option value by timing the disclosure of voluntary announcements (Aboody and Kaznik (2000) and Chauvin and Shenoy (2001)). Further, there is evidence that executives manage the timing of option repricing events to take advantage of their private information (Callaghan et al. (2004)). However, it is increasingly apparent that US executives use more than simple timing ability. There is evidence that they back-date the option grant date to take advantage of a lower stock price (Narayanan and Seyhun (2005) and Lie (2005). This backdating is confirmed by Heron and Lie (2006), who show that the pattern of stock returns around the grant date is less pronounced since the SEC required option grants to be reported within two working days.

The features of executive stock options complicate the analysis of executives' exercise behaviour. In contrast to standard tradable options, executive stock options are nontradable, and the assumption that the investor is risk neutral does not apply. Executives are unable to hedge by short-selling the underlying stock,[1] and are therefore unlikely to hold a well-diversified portfolio. The combination of nontradability, risk-aversion and the desire to diversify should result in early option exercise (Huddart (1994), Huddart (1999) and Hall and Murphy (2002)). The more risk-averse an executive, the earlier he will exercise in order to 'lock-in' a gain.[2] Moreover, the decision to exercise is likely to be at the expense of the executive's private information. The empirical literature confirms the prevalence of early exercise (see Heath at al. (1999) and Bettis et al. (2005) in the US, and Main (1999) in the UK)).

Risk-aversion and a lack of diversification will also drive a wedge between the executive's valuation of an option and its market value (often regarded as a measure of the efficiency of stock-based compensation). A number of studies have calibrated valuation models, based on plausible levels of executive risk aversion, and show that the discount can be significant.[3] Alternative approaches, however, stress that the disparity in subjective and objective valuations is overstated. One reason is the additional effort induced by options (Lambert and Larcker (2004)), another is the ability to trade the market portfolio and remove exposure to market risk (Jenter (2002)).

III. REMUNERATION AND DIVERSIFICATION IN THE US AND UK

Whilst the above literature provides little evidence of informed option related trading by executives, it also suggests that their exercise decisions sacrifice a large portion of the option value. If executives are prepared to lose option value in order to diversify, then it is logical that they will also be prepared to ignore the smaller potential gains to be earned from incorporating their inside information in their exercise decisions. An additional impediment faced by US executives in the use of their inside information are the blackout period restrictions on when they can trade (Bettis et al. (2000)). However, UK executives are prohibited only from trading during the two months prior to the announcement of year-end or half-year results, affording them a greater opportunity to exploit their private information.[4]

Despite the early exercise of executive options being a feature of both the US and the UK, we argue that UK executives' need to diversify is less pressing. This is because the structure of their remuneration differs significantly from US executives. Whilst executive remuneration is lower in the UK, a large portion of the difference is due to the aggressive linking of remuneration to their firm's stock market performance in the US. Specifically, UK CEOs receive a much smaller proportion of their total remuneration from options, possibly due to greater sensitivity in the UK to the level of executive remuneration in general, and option gains in particular.[5] This is demonstrated by Conyon and Murphy (2000), who show that in 1997 the median base salary was £317,000 and £240,000 for US and UK CEOs, respectively. Further, given that the median option grant for US CEOs was approximately 16 times that for UK CEOs, the option grant comprised 42% (10%) of total remuneration among US (UK) CEOs, respectively, a contrast that is unlikely to have diminished since that time (Hall and Murphy (2003)). As a result, Conyon and Murphy estimate that the effective value of CEOs' own-firm shareholdings (including unexercised stock

options and incentive plans) is approximately ten times larger in the US. The similarity in median base salaries combined with the substantial difference in own firm shareholdings implies a significant distinction in their exposure to the value of their firm's shares, and hence in their need to diversify. Additionally, vesting periods are significantly longer in the UK, reducing the grant value of options (see Huddart (1999), Meulbroek (2001) and Hall and Murphy (2002)) and further mitigating UK executives' need to diversify.[6]

We find that executives in the UK sell on average approximately 44% of the stock acquired (table 1), compared to near-total selling among US employees (Heath et al. (1999)) and US executives (Ofek and Yermack (2000)). The significant disparity in trading behaviour is consistent with the need to diversify being less acute among UK executives, and raises the possibility that their trades will incorporate their inside information. However, since it is cheaper to hold the option, there must be good non-information reasons for the early exercise of executive stock options in the UK (Main (1999)). We hypothesise that an important factor motivating executives in the UK to exercise early is the regulatory regime, in the form of the four times emoluments rule. In addition, we suggest that the tax rules relating to executive stock options provide a subsequent incentive to hold the stock acquired at exercise.

The four times emoluments rule specifies that the amount of options (number times exercise price) held by a UK executive be limited to four times emoluments (base salary plus bonuses). Introduced by the Finance Act 1984, the rule was designed to restrict the value of options that UK executives could hold because of the tax advantages associated with approved option schemes. The rule was incorporated into the guidelines developed by the Association of British Insurers (ABI)[7], and persisted even after one of the tax advantages was removed in 1988.

Main (1999) states that 'by this time, the ABI guidelines had assumed a statute like status and the four times emoluments rule continued to be implemented.' Moreover, 'very few companies deviated from the strict interpretation of the ABI guidelines.' Exercising therefore provides space for the granting of additional options.

Once an option has been exercised, the tax framework that applies to executive options in the UK gives the executive an incentive to hold the stock acquired. The four times emoluments rule was introduced because at that time, gains made by executives on approved share options had been taxed at the capital gains tax rate (30%), rather than at the income tax rate (60%). Although the two tax rates were equalised in 1988, executives in the UK continued to benefit from the ability to defer their tax liability by holding the shares acquired at exercise, since they paid capital gains tax only when they realised the gain (sold the shares), rather than when they exercised their options. Executive options granted in the UK are approved share options since they are discretionary and have the associated tax advantage. The equivalent tax treatment applies to qualified options in the US. However, most options granted in the US are nonqualified (requiring the executive to pay income tax on the gain at exercise, whether or not the shares are sold) because nonqualified options allow the firm to treat the gain at exercise as a tax-deductible expense. This means that, whereas US executives then have an incentive to diversify by selling, UK executives have an incentive to postpone their tax liability by holding the acquired stock.

For options granted in the UK after July 1995, however, the executive's tax position is the same as applies to nonqualified options in the US, i.e. tax must be paid on the gain made at exercise, whether or not the gain is realised.[8] Thus for options granted after July 1995, there is no longer a tax incentive to hold stock after

exercising. Since executive options in the UK have three-year vesting periods, this means that all option exercises up to July 1998 will have benefited from the tax regime that was in place before July 1995, and which provided an incentive to defer the tax liability by holding at exercise. For example, in March 1997, an executive at EMAP Plc exercised options and acquired stock with a value of £900,671. The cost of exercising was £222,402, implying a gain at exercise of £678,269. The executive held the stock, allowing him or her to defer the associated tax liability of £271,307 that would be payable on the gain once the stock was sold. Alternatively, from table 1, the mean exercise value is £128,900. Given a mean moneyness of 3.19, the average value of stock acquired at exercise is £411,191, yielding an average gain of £282,291 and with it an associated tax liability of £112,916. It is this tax liability that the executive is able to defer by holding, rather than selling, the stock acquired at exercise.

IV. DATA, MEASUREMENT AND DESCRIPTIVE STATISTICS

The data include all executive transactions in the UK and are provided by Directus Ltd.[9] Stock options in the UK are granted only to senior executives, not non-executives. We analyse the period from 17 July 1995 to 3 July 1998. We exclude the period prior to July 1995 because there was an expectation that the tax change would be recommended, and that it could be retrospective (i.e. it could apply to options granted before July 1995). Exercises immediately prior to July 1995 might have been motivated by an attempt to avoid the expected change in tax regime. Indeed, during the three months prior to the change, the proportion sold is marginally higher, at 51 per cent.

Our sample runs to July 1998 because, with a three-year vesting period, we can be sure that all options exercised up to July 1998 were granted before July 1995, and therefore before the change in tax rule introduced in July 17 1995. Option exercises after July 1998 could be subject to either tax rule, depending on whether they were granted before or after July 1995.[10] There are 3629 executive option exercises recorded during the period. Where an executive exercises more than once on the same day, we aggregate to yield just one exercise per executive per day, since we are unable to match an executive's sale with a specific exercise. Similarly, we aggregate the sales (classified as 'sale post exercise') where the executive sells more than once. Of the resulting sample of 3392 executive stock option exercises, 513 are excluded due to missing data (most commonly the moneyness of the option at exercise). The remaining 2879 exercises comprise our sample.

Standard event study methodology examines the impact of an event on a firm's returns by calculating post-event abnormal returns using a market model. The estimation of a market model is inappropriate since option exercise takes place only when an option is in the money, and is therefore dependent on previous stock returns (for more on this, see Heath et al. (1999)). We compute individual firm abnormal returns by comparing their returns with the returns to a benchmark portfolio, composed according to size, book-to-market ratio and momentum. Adjusting for size and book-to market is important given the evidence that these two factors can explain some of the cross-section of average stock returns.[11] As a result, measuring abnormal returns through the use of matching benchmark portfolios sorted by size and book-to-market is common in the literature (see, for example, Gregory (2005)).

The likelihood that exercise follows a period of superior returns suggests a further sort by momentum, given consistent evidence that stocks exhibit medium term return persistence (Jegadeesh and Titman (1993 and 2001) and Rouwenhorst (1998)). Lyon et al. (1999) argue that ignoring pre-event return performance induces a positive (negative) bias in tests of abnormal returns where firms had high (low) pre-event returns. Matching firms to benchmark portfolios based on pre-event return performance can control for this bias.

Firms are allocated to one of forty-eight benchmark portfolios on the basis of size, book-to-market and previous return (or momentum). We create a set of 4×4 portfolios based on a ranking by size and book-to-market ratio. Each portfolio is then subdivided in three based on a ranking of momentum - the firms' cumulative returns over the year preceding the exercise, measured from t - 12 months to t - 31 days (t denoting the exercise day). The abnormal return for a firm on a particular day around an exercise is the difference between the firm's return and the equally-weighted return to its matching benchmark portfolio. The results reported below are qualitatively the same if we create benchmark portfolio returns that are value-weighted,[12] or are based only on size or book-to-market. However, the abnormal returns increase when we drop the additional subdivision for momentum effects, a finding also reported by Carpenter and Remmers (2001).[13]

Table 1

Table 1 presents summary statistics for our data. The number of event days is the number of days on which at least one exercise takes place, and the number of firms represents those having at least one exercise. Overall, there are 2879 exercises relating to 714 firms on 691 days within the period. These 714 firms represent just less than one half of the total number of firms (approximately 1500)

listed on the London Stock Exchange at the end of the period. The average number of exercises per firm is four, the median three. 206 firms have just one exercise, 132 have two. The maximum number per firm is 65 (spread among 18 executives), although this is an outlier, the next largest having 33 and 22 exercises. A total of 44 firms have more than 10 exercises during this period. The average proportion of stock sold is 44%.[14] Below we also distinguish between dividend and non-dividend related exercises, of which there are 964 and 1915, respectively. A dividend related exercise is one that might be motivated to capture a forthcoming dividend. If dividend capture is an important motive for exercise, we would expect the proportion sold to be significantly lower among dividend related exercises, yet the average proportion sold is only marginally lower at 41.5%.

Table 1 also reports associated statistics for six cuts of the sample based on the proportion sold at exercise. Two are where the executive exercises and holds or exercises and sells all the stock acquired, the remaining four represent quartile cuts where the executive sells, but does not sell all the stock acquired. The use of four intermediate cuts of the sample is designed to provide additional insight into the relation between the proportion sold and subsequent returns. The decisions to exercise and hold (47%) or exercise and sell all the stock acquired (28%) are most common, whilst there are 729 exercises (25% of the sample) where the executive sells a proportion less than 1.

There are systematic differences between the various sub-samples. The mean value of exercise for the hold sample (£48,611) is just 38% that of the complete sample (£128,912), suggesting that executives are more likely to hold all the shares they acquire when the cost of acquiring these shares is relatively small. Furthermore, there is some evidence that as the proportion sold at exercise

increases, the market capitalisation increases and the moneyness falls. In addition, the variations in the previous stock return imply that the proportion of stock sold is related to the short-term stock price movement immediately prior to exercise.

Table 2

Table 2 presents quartile sorts of the exercises by the respective variables that might influence exercise and sell decisions. Again, the proportion sold increases with the value of the exercise, firm size and the previous abnormal stock return, and declines with moneyness. There appears to be no relation between the proportion sold and subsequent return volatility (relative to the market), which would be the case if executives' trades were influenced by their expectations of future volatility. The moneyness of the option declines with firm size and value of the exercise, and increases with the previous abnormal return and future return volatility. Whilst low return volatility exercises are relatively small, when ranked by size there is no consistent relation between size and return volatility.

V. CALENDER TIME ABNORMAL RETURNS AND UNIVARIATE ANALYSIS

The event clustering and overlapping returns that are apparent in the data raise an additional methodological issue. Both event clustering and overlapping returns induce cross-sectional dependence among the exercises. As a result, we are unable to assume that the abnormal returns associated with the exercises are independent, and therefore we cannot aggregate the abnormal returns in event time. We overcome this by using a calendar-time approach (see, for example, its application in Brav and Gompers (1997)). Lyon et al. (1999) show this approach is particularly suited to a study in which cross-sectional dependence is induced by

overlapping return calculations. Under these circumstances, a traditional event study framework would yield misspecified test statistics.[15]

The abnormal return (AR_{it}) associated with a particular day for an exercise is:

$$AR_{it} = R_{it} - E(R_{it}), \tag{1}$$

where R_{it} is the return for firm i on day t and $E(R_{it})$ is the firm's expected return, given by the equally weighted return to its matching benchmark portfolio. From the abnormal returns to each exercise, we derive a time series of abnormal returns for a particular event window. For any event window, the abnormal return each day in calendar time (AR_t) is the mean abnormal return to the portfolio of firms n_t with an exercise in the preceding event period:

$$AR_t = \frac{1}{n_t} \sum_{i=1}^{n_t} AR_{it} . \tag{2}$$

Thus, for example, the abnormal return for a 1 to 30 day post-event window on day j is composed of the mean abnormal return to the portfolio of firms with an exercise during the 30 days prior to day j. The portfolio components change each day. The mean abnormal return (MAR) associated with an event window is the mean of the calendar time abnormal returns:

$$MAR = \frac{1}{T} \sum_{t=1}^{T} AR_t \quad , \tag{3}$$

where T is the total number of days within our sample. To test the null hypothesis that the mean abnormal return (MAR) is zero, we use a t-statistic derived from the time series standard deviation of the abnormal returns $\sigma(AR)$:

$$t(MAR) = \frac{MAR}{\sigma(AR_t) / \sqrt{T}} \quad . \tag{4}$$

We choose a range of event windows, including a pre-event window from day t-30 to day t (to measure the immediate pre-exercise returns), and post-event windows up to nine months after exercise. London Stock Exchange rules do not permit insider transactions during the two months prior to the year-end or half-year earnings announcements. Thus event windows of several months might best capture the ability of executives to trade on the basis of information relating to forthcoming earnings announcements (see Piotroski and Roulstone (2005) for the importance of this as a motivating factor for executives' trades).

Our central hypothesis is that the proportion sold reflects the information contained in option exercises. Specifically, we hypothesise that the proportion sold will be negatively related to post-exercise stock returns.[16] We examine this by breaking down our sample into six subsamples based on this proportion. Table 3 presents the resulting calendar time abnormal returns. There is clear evidence in table 3 that the proportion sold at exercise increases with the pre-exercise abnormal returns, consistent with executives attempting to lock-in short-term gains (Hall and Murphy (2002)). There is also evidence that post-exercise return performance worsens as the proportion sold increases. Post-exercise abnormal returns are significantly negative measured over the 3, 6 and 9-month windows where the executive sells between 50-75%, 75-100% and 100% of the stock acquired at exercise. This is consistent with our a priori expectations. The tax regime provides a strong incentive to hold after exercising. This, together with the diminished need to diversify (compared to the US) implies that executives in the UK are more likely to exercise and sell if they have negative expectations about the future performance of the stock.

Table 3

Also evident from the results in table 3 is that the post-exercise return performance does not decrease monotonically with the proportion sold. This would be a concern if the proportion sold were regarded purely as a reflection of executives' information about the firm. However, as noted above, there are other motivating factors behind their trades, including the need to diversify, which although is less important among UK executives could nevertheless still be a reason to sell the acquired stock. Executives who are exercising to diversify will, by definition, sell most (if not all) of the stock they acquire at exercise. These uninformed trades will therefore reduce the extent to which the proportion sold reflects the informativeness of the exercise, particularly where executives sell all the stock,[17] and explain why the relation between returns and proportion sold is not monotonic.

Table 4

An important motive that we are able to control for is the desire by executives to capture a dividend. Since an option holder is not entitled to the dividend, a non-information motive for exercising is to capture a dividend that has already been announced, but not yet paid. We therefore sub-divide our sample of exercises into those that occur prior to the payment of a dividend (the ex-dividend date), and those that do not. However, as noted above, if dividend capture is an important motive for exercise, executives should hold a larger proportion of the stock acquired when capturing a dividend. The sale proportion is indeed lower, but at 41.5% the difference is not significant. Despite this, the results presented in table 4 are consistent with dividend related exercises being uninformed relative to non-dividend related exercises. It is only the exercises categorised as non-dividend related that yield abnormal returns, particularly where the executive sells in excess of 50% of the stock acquired.

Table 5

In addition to executives' expectations regarding the future direction of the stock price, option exercise could also be informative about future return volatility. An important factor in determining option value is stock return volatility. All option pricing models stress a positive relation between expected volatility and the value of the option. In related research, there is evidence that firms' put option sales precede falls in volatility (Jenter et al. (2006)), consistent with executives having information about future return volatility. An expectation of a fall in future return volatility could therefore also be a motive for the decision to exercise, irrespective of an executive's expectations regarding the direction of subsequent stock price movements. Table 5 presents the associated results, using a similar approach to that in Jenter et al. (2006). We use three different measures of volatility; the daily standard deviation of raw returns, the daily standard deviation of market adjusted returns (market adjusted 1), and the daily standard deviation of raw returns minus the daily standard deviation of market returns (market adjusted 2).

However, rather than there being a reduction in return volatility after exercise consistent with exercise being motivated by the desire to avoid an expected decline in option value, there is some evidence of increased volatility, particularly over a 200 trading day window. The 'Market Adjusted 2' measure yields significant increases in volatility after exercise over the 200-day window for all but the hold and sell 75-100% samples. One explanation for these results is that executives' trading decisions are motivated by the need to diversify, since an undiversified executive will be sensitive to increases in expected future stock volatility. The evidence to support a lack of diversification argument is weak, however, since this view would predict an

increasing relation between the proportion of stock sold at exercise and post-exercise return volatility.

VI. MULTIVARIATE ANALYSIS

The results presented in tables 3 through 5 are consistent with executives' trades at exercise incorporating their negative information about their firm's future return performance. Yet two issues remain. First, the analysis of table 3 is based on a univariate approach, and does not allow for the additional factors that might motivate, or impact upon, their trading decisions. Accounting for these factors is clearly important, and requires a multivariate analysis. Second, as noted above, option valuation models propose a strong positive relation between stock return volatility and option value. Executives' trading decisions might therefore be motivated by their expectations of future return volatility. Specifically, a reduction in future return volatility reduces the value of the options they hold, making it more likely that they will exercise. Again, as noted above, the analysis is not straightforward, since a reduction in future return volatility also mitigates the need to diversify. Nevertheless, this offers an interesting testable proposition of whether executives' trading decisions are informative about future stock return volatility. We test for both of these issues, viz., the hypotheses of negative private information and anticipation of future volatility, in multivariate regression settings. In order to conduct the multivariate analyses we have to use event time abnormal returns rather than the calendar time abnormal returns of table 3.

We test if executives' private negative information about their firm's future return performance motivates their trades at exercise by estimating the following regression:

$$AR_i = \beta_1 H_{ALL} + \beta_2 S_1 + \beta_3 S_2 + \beta_4 S_3 + \beta_5 S_4 + \beta_6 S_{ALL} + \gamma_1 M_t + \gamma_2 PR_t + \gamma_3 VE_t + \gamma_4 Z_t + e_t \qquad (5)$$

where AR_i (i = 1,.., 4), the dependent variable, represents abnormal returns measured over 30-day, 3, 6 and 9-month windows following option exercise. The use of private information in executives' trading decisions implies negative subsequent abnormal returns. A sub-set of regressors in (5) precisely captures the different proportions sold at exercise. The variable H_{ALL} captures exercises that are all (100%) hold; S_1 captures $0 < \text{sell} \leq 0.25$ proportion; S_2 covers $0.25 < \text{sell} \leq 0.5$; S_3 captures $0.50 < \text{sell} \leq 0.75$; S_4 when $0.75 < \text{sell} < 1$; and S_{ALL} when all (100%) of the stock acquired at exercise is sold. The other regressors – M_t, VE_t and Z_t denote the option moneyness, value of the exercise and firm size respectively. Likewise, PR_t denotes the previous short-term abnormal return measured over 30 days prior to exercise and e_t is the regression error term.

If executives' trading decisions are motivated by their negative private information about their firm's future return performance, then the parameters β_i, (i=2,..,6), in equation (5), and particularly those associated with a high sale proportion, must be negatively signed and significant. The moneyness of the option is the ratio of the stock price to the exercise price, and is an important consideration for executives when exercising. The only cost incurred when holding an option is the dividends foregone. In contrast, exercise requires payment of the exercise price, together with the implicit cost of the loss of the option's time value. This time value falls with moneyness, making exercise of near-the-money options relatively

expensive. Therefore, if an executive does not need to exercise to diversify, a near-the-money exercise is more likely to be driven by negative information. Hence, if loss of time value is important, we expect γ_1 to be positive and significant.

The previous stock return is an important factor since risk-averse employees will exercise early to lock in gains following a period of abnormal stock returns (Hall and Murphy (2002)). This is supported by evidence that option exercise is positively related to previous short-term returns (Heath et al. (1999) and Bettis et al. (2005)). Similar results are obtained by Core and Guay (2001) for options held by non-executive employees and by Poteshman and Serbin (2002) for traded options. If the motive to capture gains is strong (irrespective of any private information that they possess), then γ_2 should be positive and significant. This also implies that these positive returns continue after exercise, suggesting they exercise prematurely.

The value of the exercise is important given evidence that trade size is an indicator of trade informativeness (Friederich et al. (2002)). They find that for standard executive transactions in the UK, relatively low value trades (£5,000 - £70,000) are more informative than larger ones. A negative relation between trade size and trade informativeness implies a positive coefficient on the value of the exercise; hence we expect $\gamma_3 > 0$.

The decisions taken by executives in smaller firms will be more profitable (and therefore more informed) if investors are at a greater informational disadvantage in these firms.[18] This could be driven, in part, by a lower level of analyst following in smaller firms (Frankel and Li (2004)). We include the market value of the firm to capture the impact of firm size. Given that executives' information advantage is likely to be negatively related to firm size, we expect S_t to assume positive and significant

coefficients (i.e., $\gamma_4 > 0$). Equation (5) is our basic specification. It is also likely that option exercise might be timed to capture a dividend payment. In our estimations, we allow for this issue by conducting separate analyses for dividend and non dividend related exercises.

Stock return volatility can have a significant impact on both the option value and the overall risk of an undiversified executive's position in the stock. Therefore, option exercise could be motivated by an expectation of a change in volatility. We test if executives' trading decisions are motivated by their perceptions about future stock return volatility as follows:

$$VOL_j = \theta_1 H_{ALL} + \theta_2 S_1 + \theta_3 S_2 + \theta_4 S_3 + \theta_5 S_4 + \theta_6 S_{ALL} + \psi_1 VOL_{t-p} + \varepsilon_t \qquad (6)$$

where the dependent variable, VOL_j, (j=1,2,3) is the volatility of future stock returns. Future volatilities are measured over 50, 100 and 200 days following exercise. The regressor, VOL_{t-p}, (p=1,2,3) denotes past volatility measured over 50, 100 and 200 days prior to exercise. We follow Jenter et al. (2006), and compute return volatility as the daily standard deviation of raw returns minus the daily standard deviation of market returns (denoted as the 'market adjusted 2' measure in table 5). The remaining regressors in (6) are the different proportions sold at exercise, which are defined as above. If executives' trading decisions are influenced by their expectation that future returns will be less volatile, then we expect θ_k (k= 2,..,6) to be significantly negative. Following the ARCH and GARCH literature, we expect past volatility to impact positively on future volatility and hence, $\psi_1 > 0$. In order to confirm the robustness of our results, we also allow for option moneyness (M_t), value of the exercise (VE_t), firm size (S_t) and the abnormal return measured over the 30 days prior to exercise (PR_t).

In equations (5) and (6) the dependent variables, respectively, are future abnormal returns and future stock return volatility. Hence endogeneity is not an issue. The standard OLS estimator maintains its consistency. However, heteroscedasticity and possible multicollinearity could prove problematic and we address them in our estimation.

Table 6

Table 6 reports a correlation matrix of regressors. Of the possible thirteen regressors in the two models, only one variable, H_{All}, shows some degree of correlation with the other regressors. Its highest correlation is with 'S_{All}' (-0.583). It is also mildly correlated with VE (-0.349) and S_4 (-0.322). Of course, as expected, the three measures of volatility are highly correlated amongst themselves but we only require one measure of volatility at a time in the regression model and so this does not pose a problem. For all other pairs, the magnitude of the correlation coefficient is very small indeed. We address the collinearity problem associated with H_{All} by capturing its effect through an overall constant term in the regression. We include a constant and all the other regressors except H_{All} in the regression. The constant, by definition, is uncorrelated with any of the other regressors. Subsuming H_{All} into a constant term implies that the coefficients of the other proportions represent differences from the coefficient of H_{All}.

In table 7 we report the results obtained from model (5). Panel A contains results based on equally weighted abnormal returns for the 30-day, 3, 6 and 9-month windows after exercise.

Table 7

These results echo the message presented in table 3. All sale proportions of 50% or more are negatively signed and highly significant across all the windows

under analysis (the exception being S_4 which is significant at 10% for the 30-day return). The reported t-ratios are based on heteroscedasticity consistent standard errors.[19] All exercises where 50% or less is sold are insignificant, the exception being S_2 (0.25< sell ≤ 0.5), which is negative and significant at 10% for the 30-day window. Overall, exercises where more than 50% is sold are followed by significant negative abnormal returns, whereas those where less than 50% is sold are not. The constant term captures the effect of an exercise and hold (H_{ALL}) and, as expected, appears insignificant throughout. Consistent with the results reported in table 3, the regression results do not support a monotonic relation between the proportion sold and post-exercise abnormal return. As before, we suggest that as the proportion sold increases, so it is more likely that the trade is motivated by the need to diversify. As a result, the informativeness of exercises accompanied by total or near-total selling of the acquired stock will be reduced.

Amongst the control variables, moneyness is insignificant throughout, implying that the loss of time value is not an important consideration among UK executives. The coefficient on the previous abnormal stock return is positively signed and significant across all horizons. Although tables 1 and 2 indicate that the proportion sold increases with the previous return, the positive γ_2 implies that high previous returns continue after exercise, suggesting executives exercise prematurely to lock-in short-term gains. Finally, the coefficients on both firm size and value of the exercise are as expected. Firm size is positive and significant for all windows, whilst the value of the exercise is significant and positive, except for the nine-month window.

In panel B, we report results for value weighted abnormal returns. The results are qualitatively similar to those for equally weighted abnormal returns, the exception

being that S_{All} is the only variable that is significant in explaining 30-day post-exercise abnormal returns. However, exercises associated with the sale of more than 50% are all significantly negative for the 3, 6 and 9-month windows, implying that these trades are motivated by executives' negative private information about their firm's future return performance. As before, the constant term (hold) as well exercises with sales of less than 50% are all insignificant. The control variables show qualitatively similar results to those reported in panel A.[20]

In panels C and D we report results pertaining to dividend and non dividend related exercises. We do not report results for the 30-day and 9-month windows to conserve space. Exercises that occur after the announcement but prior to the payment of a dividend (the ex-dividend date) are classed as dividend related, whilst those that do not are classed as non dividend related. Dividend related exercises might be motivated by dividend capture rather than by negative private information alone. For the non dividend related exercises, we find that for the 3-month window, the constant term, which captures an exercise and hold, as well as exercises where more than 50% is sold, are negative and significant. Amongst the control variables, only the value of exercise is significant. These results are qualitatively similar to those for the 3-month windows in panels A and B, except that here the constant term is negative and significant and both firm size and previous abnormal stock return are insignificant.

For the 6-month window, exercises where more than 50% are sold are negative and significant. The constant term and remaining proportions sold are insignificant. Amongst the control variables, moneyness is insignificant whereas previous return, the value of exercise and firm size are positive and significant. The non dividend results for the 6-month (and 9-month) window are qualitatively identical

to the equivalent results in panels A and B. However, for the 30-day window the constant term and S_{All} are negative and significant, S_1, S_2, S_3 and S_4 are insignificant, whilst amongst the control variables, all but the previous return are significant.

With regard to our central hypothesis that the proportion sold reflects executives' private information, the dividend related results are somewhat weaker and therefore lend some support to the univariate results in table 4. Unlike the other results in table 7, S_4 is not significant in explaining 6-month post-exercise abnormal returns. Amongst the control variables only the previous return appears significant. The results for the 9-month window (not reported in the table) are qualitatively identical to those for 6-months, the exception being that firm size is significant. For the 3-month window, the constant is positive and significant whereas exercises where 50% or more is sold are negative and significant. The previous return is highly significant, moneyness and firm size are marginally significant, and the value of exercise is insignificant. For the 30-day window (not reported), the constant term is positive and significant and S_{All} is negative and significant.

The dividend related results confirm that whilst executives appear to be acting on their negative private information, dividend capture might be an additional motivating factor for some trading decisions. Of particular note is the contrast in the 30-day and 3-month windows vis-à-vis the constant term, which captures the effects of an exercise and hold. This effect is positive for dividend related exercises and negative for non dividend related exercises. This supports dividend capture as a motive where the executive exercises and holds prior to a dividend payment, which is what an executive would do if capturing a dividend. We are unable, however, to explain the negative coefficient for an exercise and hold for non dividend related

exercises. The constant term for the 6- and 9-month windows is insignificant in both (dividend and non dividend) cases. Again, this is in line with what we would expect, since dividend capture is a relatively short-term strategy that should not be evident in the longer windows. The evidence, albeit limited, of dividend capture contrasts with the results in Carpenter and Remmers (2001). However, their conclusion that dividend capture is not important among US executives is perhaps not surprising given that US executives sell almost all the stock acquired at exercise.

We now test whether executives' trading decisions are informed by their expectations regarding future stock return volatility. An expected reduction in return volatility reduces option value, providing executives with a motive to exercise their options. Model (6) is estimated to test this hypothesis, the results being reported in table 8.

Table 8

We measure past and future volatility over three alternative windows, 50-days, 100-days and 200-days. For all three windows, the proportion sold is not significant in explaining future volatility. The exceptions are the significance of S_1 and S_2 in explaining future 200-day volatility. The sold proportions, S_3, S_4 and S_{ALL}, which contain executives' negative private information with respect to their firm's future returns, are all insignificant in explaining future return volatility. The constant is positive and significant across all specifications, implying the executive exercises and holds prior to increased future volatility. This is difficult to justify, since the exercise sacrifices a potential increase in option value, whilst holding the stock still exposes an undiversified executive to the risk associated with the increased volatility. Finally, past 50-day volatility appears highly significant in explaining future volatility over all the three windows considered. Likewise, past 100- and 200-day

volatilities appear significant, mostly at 10%. The significance of past return volatilities in explaining future return volatilities are as expected.

The insignificance of the proportion sold in explaining future volatility remains robust to two alternative specifications. When we estimate model (6) with a constant term and the five different proportions sold only (i.e., we drop the lagged volatility term from equation (6)), all proportions sold appear statistically insignificant across all specifications. Likewise, the results in table 8 remain qualitatively similar when equation (6) is augmented by option moneyness, previous 30-day abnormal return, value of the exercise and firm size. Overall, the results robustly indicate that UK executives' exercise and sale decisions are not motivated by their anticipation of future volatility.[21]

VI. CONCLUSION

Our analysis provides consistent and clear evidence that UK executives' exercise and sell decisions are driven by their private information. Their exercise decisions lock-in previous short-term gains, and are followed by negative abnormal returns where they decide to sell more than 50% of the stock acquired at exercise. This finding is robust to the inclusion of several other factors that might influence executives' exercise and sell decisions, including the value of the exercise, option moneyness and firm size. Further, we provide some limited evidence that the decision to exercise and hold might also be motivated by dividend capture. However, we find no support for executives' trading decisions being informed about future stock return volatility.

Our finding that executives appear to exploit their information advantage when selling the stock purchased at exercise contrasts with the existing research that finds little evidence of an information content in standard sell transactions. Two possible reasons for this are the tax treatment of option gains in the UK, and the way UK executives are remunerated. During the period studied, executives were able to defer the payment of tax on their option gains if they held the shares acquired. This, together with UK executives' diminished need to diversify (compared to US executives), means that selling at option exercise by UK executives is not uninformed, but is a decision taken if they expect negative future returns.

REFERENCES

Aboody, D., and R. Kaznik, 2000, CEO Stock Option Awards and the Timing of Voluntary Corporate Disclosures, *Journal of Accounting and Economics* 29, 73-100.

Association of British Insurers, 1995, *Share Option and Profit Sharing Incentive Schemes*, ABI, London.

Association of British Insurers, 2002, *Guidelines for Share Incentive Schemes*, ABI, London.

Bettis, J., Bizjak, J. and M. Lemmon, 2001, Managerial Ownership, Incentive Contracting, and the Use of Zero-Cost Collars and Equity Swaps by Corporate Insiders, *Journal of Financial and Quantitative Analysis* 36, 345-370.

Bettis, J., Bizjak, J. and M. Lemmon, 2005, Exercise Behavior, Valuation, and the Incentive Effects of Employee Stock Options, *Journal of Financial Economics* 76, 445-470.

Bettis, J., Coles, J. and M. Lemmon, 2000, Corporate Policies Restricting Trading by Insiders, *Journal of Financial Economics* 57, 191-220.

Brav, A. and P. Gompers, 1997, Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies, *Journal of Finance* 52, 1791-1821.

Brooks, R., Chance, D. and B. Cline, 2006, Executive Stock Option Exercise, Insider Trading, and Abnormal Stock Returns: Firm Characteristics, *Working Paper*.

Callaghan, S., Saly, J. and C. Subramaniam, 2004, The Timing of Option Repricing, *Journal of Finance* 59, 1651-1676.

Carpenter, J. and B. Remmers, 2001, Executive Stock Option Exercises and Inside Information, *Journal of Business* 74, 513-532.

Chan, L.K.C., Jegadeesh, N. and J. Lakonishok, 1996, Momentum Strategies, *Journal of Finance* 51, 1681-1713.

Chauvin, K. and C. Shenoy, 2001, Stock Price Decreases Prior to Executive Stock Option Grants, *Journal of Corporate Finance* 7, 53-76.

Christie, A., 1982, The Stochastic Behavior of Common Stock Variances, Journal of Financial Economics, 10, 407-432.

Conyon, M. and K. Murphy, 2000, The Prince and the Pauper? CEO Pay in the United States and United Kingdom, *Economic Journal* 110, 640-671.

Core, J. and W. Guay, 2001, Stock Option Plans for Non-Executive Employees, *Journal of Financial Economics* 61, 253-287.

Dimson, E. and P. Marsh, 1999, Murphy's Law and Market Anomalies, *Journal of Portfolio Management* 25, 53-69.

Fama, E. and K. French, 1998, Value versus Growth: The International Evidence, *Journal of Finance* 53, 1975-1999.

Fama, E. and K. French, 2006, The Value Premium and the CAPM, *Journal of Finance* forthcoming.

Frankel, R. and X. Li, 2004, Characteristics of a Firm's Information Environment and the Information Asymmetry between Insiders and Outsiders, *Journal of Accounting and Economics* 37, 229-259.

Friederich, S., Gregory, A., Matatko, J. and I. Tonks, 2002, Short-Run Returns around the Trades of Corporate Insiders on the London Stock Exchange, *European Financial Management* 8, 7-30.

Greenbury, R., 1995, Directors Remuneration: Report of a Study Group Chaired by Sir Richard Greenbury. London: Gee Publishing.

Gregory, A., 2005, The Long-Run Abnormal Performance of UK Acquirers and the Free Cash Flow Hypothesis, *Journal of Business, Finance and Accounting* 32, 777-814.

Hall, B. and K. Murphy, 2000, Optimal Exercise Prices for Executive Stock Options, *American Economic Review* 90, 209-214.

Hall, B. and K. Murphy, 2002, Stock Options for Undiversified Executives, *Journal of Accounting and Economics* 33, 3-42.

Hall, B. and K. Murphy, 2003, The Trouble With Stock Options, *Journal of Economic Perspectives* 17, 49-70.

Heath, C., Huddart, S. and M. Lang, 1996, Psychological Factors and Stock Option Exercise, *Quarterly Journal of Economics* 114, 601-627.

Heron, R. and E. Lie, 2006, Does Backdating Explain the Stock Price Pattern around Executive tock Option Grants? *Journal of Financial Economics*, forthcoming.

Huddart, S., 1994, Employee Stock Options, *Journal of Accounting and Economics* 18, 207-231.

Huddart, S., 1999, Patterns of Stock Option Exercise in the United States, In: Carpenter, J., Yermack, D., Eds., Executive Compensation and Shareholder Value, Kluwer Academic Publishers, 115-142.

Ingersoll, J., 2002, The Subjective and Objective Evaluation of Incentive Stock Options, *Yale Working Paper*.

Jegadeesh, N. and S. Titman, 1993, Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency, *Journal of Finance* 48, 65-91.

Jegadeesh, N. and S. Titman, 2001, Profitability of Momentum Strategies: An Evaluation of Alternative Explanations, *Journal of Finance* 56, 699-720.

Jeng, L., Metrick, A. and R. Zeckhauser, 2003, Estimating the Returns to Insider Trading: A Performance-Evaluation Perspective, *Review of Economics and Statistics* 85, 453-470.

Jenter, D., 2002, Executive Compensation, Incentives and Risk, *MIT Sloan School of Management Working Paper*.

Jenter, D., 2005, Market Timing and Managerial Portfolio Decisions, *Journal of Finance* 60, 1903-1949.

Jenter, D., Lewellen, K. and J. Warner, 2006, Security Issue Timing: What Do Managers Know, and When Do They Know It? *William E. Simon Graduate School of Business Administration Working Paper*.

Ke, B., Huddart, S. and K. Petroni, 2003, What Insiders Know about Future Earnings and How They Use It: Evidence from Insider Trades, *Journal of Accounting and Economics* 35, 315-346.

Kole, S., 1997, The Complexity of Compensation Contracts, *Journal of Financial Economics* 43, 79-104.

Lakonishok, J. and I. Lee, 2001, Are Insiders Trades Informative? *Review of Financial Studies* 14, 79-111.

Lambert, R. and D. Larcker, 2004, Stock Options, Restricted Stock and Incentives, University of Pennsylvania.

Lambert, R., Larcker, D. and R. Verrecchia, 1991, Portfolio Considerations in Valuing Executive Compensation, *Journal of Accounting Research* 29, 129-149.

Lie, E., 2005, On the Timing of CEO Stock Option Awards, *Management Science* 51, 802-812.

Lyon, J., Barber, B. and C. Tsai, 1999, Improved Methods for Tests of Long-Run Abnormal Stock Returns, *Journal of Finance* 54, 165-201.

Main, B., 1999, The Rise and Fall of Executive Share Options in Britain. In: Carpenter, J., Yermack, D., Eds., *Executive Compensation and Shareholder Value*, Kluwer Academic Publishers 83-113.

Meulbroek, L., 2001, The Efficiency of Equity-Linked Compensation: Understanding the Full Cost of Awarding Executive Stock Options, *Financial Management* 30, 5-30.

Narayanan, M. and N. Seyhun, 2005, Do Managers Influence their Pay? Evidence from Stock Price Reversals around Executive Option Grants, *Ross School of Business Working Paper*, No. 927.

Ofek, E. and D. Yermack, 2000, Taking Stock: Equity-Based Compensation and the Evolution of Managerial Ownership, *Journal of Finance* 55, 1367-1384.

Piotroski, J. and D. Roulstone, 2005, Do Insider Trades Reflect Both Contrarian Beliefs and Superior Knowledge about Future Cash Flow Realisations, *Journal of Accounting and Economics* 39, 55-81.

Poteshman, A. and V. Serbin, 2003, Clearly Irrational Financial Market Behaviour: Evidence from the Early Exercise of Exchange Traded Stock Options, *Journal of Finance* 58, 37-70.

Rouwenhorst, G., 1998, International Momentum Strategies, *Journal of Finance* 53, 267-284.

Strong, N., and G. Xu, 1997, Explaining the Cross-Section of UK Expected Stock Returns, *British Accounting Review* 29, 1-23.

Tian, Y., 2004, Too Much of a Good Incentive? The Case of Executive Stock Options, Journal of Banking and Finance 28, 1225-1250.

Yermack, D., 1997, Good Timing: CEO Stock Option Awards and Company News Announcements, *Journal of Finance* 52, 449-476.

Table 1 UK Executive Stock Option Exercises - Summary Statistics

	No. of Firms	No. of Event Days	Mkt. Cap. £m	Value of Ex. £000's	Moneyness	Stock Return Volatility	Previous Return %
			All (n = 2879)				
			Average Proportion Sold at Exercise = 43.8%				
	714	691					
mean			2945	128.9	3.19	0.0082	2.10
median			538	48.8	2.17	0.0072	1.96
min			1.03	0.3	1.03	-0.0092	-68.70
max			52451	3478.7	47.50	0.0684	66.70
std			5955	216.5	3.74	0.0071	9.64
			Hold (n = 1353)				
	495	542					
mean			2762	48.6	3.31	0.0081	0.62
median			416	11.2	2.29	0.0070	0.24
min			1.03	0.3	1.04	-0.0092	-68.70
max			52451	2357.7	43.65	0.0684	66.70
std			6052	120.5	3.71	0.0075	10.65
			0< Sell = 0.25 (n = 71)				
	62	58					
mean			1992	151.1	4.48	0.0091	1.85
median			468	98.1	3.02	0.0084	2.18
min			14.56	11.1	1.03	-0.0013	-18.23
max			40868	1170.2	17.78	0.0321	29.66
std			5434	174.6	3.80	0.0063	8.47
			0.25< Sell =0.50 (n = 152)				
	118	124					
mean			1966	191.1	3.60	0.0086	2.57
median			378	97.6	2.62	0.0077	1.64
min			7.20	8.2	1.12	-0.0050	-22.62
max			34432	2230.7	19.46	0.0358	30.99
std			3997	260.6	3.07	0.0064	8.10
			0.50< Sell =0.75 (n = 203)				
	145	158					
mean			2924	206.1	3.03	0.0086	3.05
median			548	106.2	1.98	0.0073	2.18
min			11.86	9.4	1.15	-0.0033	-19.21
max			49808	2561.4	40.67	0.0394	37.69
std			6202	288.6	4.23	0.0075	8.15

(continued)

			0.75< Sell <1 (n = 303)				
	183	205					
mean			3343	265.1	2.70	0.0076	3.42
median			935	183.0	1.88	0.0069	3.11
min			4.29	9.8	1.04	-0.0053	-13.99
max			50915	3478.7	26.57	0.0449	54.58
std			6343	312.3	3.24	0.0068	7.77
			Sell All (n = 797)				
	318	418					
mean			3380	180.0	3.00	0.0082	3.78
median			887	111.5	2.04	0.0075	3.23
min			2.44	1.5	1.07	-0.0069	-20.47
max			49863	1858.8	47.50	0.0503	62.92
std			5900	219.5	3.92	0.0067	8.78

All represents the complete sample of exercises occurring between July 1995 and July 1998 for which we have the associated data. The sample is broken down into six subsamples according to the proportion of stock sold at exercise. No. of firms is the number of firms for which there is at least one option exercise in the respective categories. No. of Event Days denotes the number of days during the sample period on which at least one exercise occurs. Value of Ex. is the value of the exercise (number of shares times the exercise price). Mkt. Cap. is the market capitalisation of the firm at the time of exercise. Moneyness is the ratio of the stock price to the exercise price at the time of exercise. Stock return volatility is the daily standard deviation of raw returns minus the daily standard deviation of market returns, estimated over 200 trading days after an exercise. The previous return is the stock's abnormal return measured over the 30 days up to the exercise.

Table 2 UK Executive Stock Option Exercises – Trade Distribution

	Prop. Sold	Mkt. Cap. £m	Value of Ex. £000's	Moneyness	Stock Return Volatility	Previous Return %
Exercises sorted by Market Capitalisation						
Small Mkt. Cap.	0.33	55	54.2	3.75	0.0083	2.44
	0.43	295	101.1	3.70	0.0071	1.48
	0.50	1472	153.0	2.77	0.0084	2.05
Large Mkt. Cap.	0.49	9978	207.6	2.52	0.0090	2.42
Exercises sorted by Value of Exercise						
Low Value Ex.	0.11	3128	5.9	3.21	0.0082	0.22
	0.33	1931	23.6	3.89	0.0086	1.80
	0.61	2240	97.6	3.11	0.0075	3.40
High Value Ex.	0.71	4483	389.4	2.53	0.0084	2.97
Exercises sorted by Moneyness						
Low Moneyness	0.49	2456	136.8	1.38	0.0073	1.40
	0.49	3537	161.9	1.88	0.0076	1.39
	0.40	3268	121.0	2.58	0.0074	2.11
High Moneyness	0.37	2516	95.9	6.92	0.0104	3.49
Exercises sorted by Stock Return Volatility						
Low Volatility	0.44	609	98.0	2.76	0.0011	1.54
	0.42	3316	140.0	2.76	0.0057	2.07
	0.45	4516	146.4	2.97	0.0087	1.49
High Volatility	0.44	3333	131.2	4.26	0.0172	3.28
Exercises sorted by Previous Return						
Low Prev. Return	0.30	2365	93.7	2.96	0.0088	-8.82
	0.45	3276	137.6	2.87	0.0072	-0.65
	0.49	3095	142.1	3.38	0.0074	4.31
High Prev. Return	0.51	3043	142.2	3.54	0.0093	13.54

This table presents the distribution of trades for exercises sorted by the factors that impact on executives' exercise and sell decisions. Prop. Sold is the proportion of the stock acquired at exercise that is sold. Value of Ex. is the value of the exercise (number of shares times the exercise price). Mkt. Cap. is the market capitalisation of the firm at the time of exercise. Moneyness is the ratio of the stock price to the exercise price at the time of exercise, whilst stock return volatility is the daily standard deviation of raw returns minus the daily standard deviation of market returns, estimated over 200 trading days after an exercise. The previous return is the stock's abnormal return measured over the 30 days up to the exercise.

Table 3 Abnormal Returns Around Option Exercises Categorised by Proportion Sold

Stock Option Exercises July 1995 – July 1998					
	-30 to 0	+30 days	+3 months	+6 months	+9 months
Hold n=1353	0.66 [1.74]	0.35 [1.23]	0.52 [1.13]	0.83 [1.16]	1.39 [1.42]
0< Sell = 0.25 n=71	2.16 [1.77]	0.11 [0.10]	2.36 [1.47]	1.65 [0.69]	4.15 [1.42]
0.25< Sell =0.50 n=152	2.90 [3.73]	-1.26 [-1.67]	-0.47 [-0.39]	1.83 [1.09]	1.85 [0.84]
0.50< Sell =0.75 n=203	4.11 [6.19]	-0.60 [-1.02]	-4.32 [-3.66]	-4.84 [-3.25]	-6.14 [-3.06]
0.75< Sell <1 n=303	4.19 [5.82]	0.12 [0.24]	-2.02 [-2.43]	-3.59 [-2.84]	-5.04 [-3.05]
Sell All n=797	4.48 [9.76]	-1.04 [-2.49]	-1.76 [-2.77]	-1.83 [-1.86]	-3.28 [-2.53]
Difference in Means					
Hold v. Sell All	-3.83 [-6.43]	1.39 [2.74]	2.28 [2.91]	2.66 [2.19]	4.67 [2.88]

This table presents the mean percentage abnormal return for samples of exercises categorised by the proportion sold at exercise. Hold represents the abnormal return for exercises not accompanied by a sale, while Sell All represents abnormal returns for exercises accompanied by the sale of all exercised stock. The remaining four sub-divisions represent samples based on partial sales of stock exercised. Thus 0< Sell =0.25 denotes exercises accompanied by a sale of between 0 and 25% of the stock purchased at exercise. Hold v. Sell All is the difference between the Hold and Sell All abnormal returns. Mean percentage abnormal returns are measured over the respective windows using a calendar time methodology. Calendar day abnormal returns are the mean abnormal returns to all those firms that have an event such that they lie within the particular window on that day. A firm's abnormal return each day is that firm's return minus the firm's respective benchmark portfolio return. The corresponding t-statistics, measuring significance from zero, are in brackets.

Table 4 Abnormal Returns Around Dividend and Non Dividend Related Option Exercises Categorised by Proportion Sold

Stock Option Exercises July 1995 – July 1998					
	-30 to 0	+30 days	+3 months	+6 months	+9 months
			Dividend Related		
Hold n=485	0.93 [1.22]	1.70 [3.57]	0.89 [1.18]	0.84 [0.75]	0.76 [0.50]
0< Sell = 0.25 n=20	1.98 [1.01]	0.19 [0.11]	0.75 [0.27]	4.12 [0.88]	-3.19 [-0.54]
0.25< Sell =0.50 n=40	1.58 [1.32]	1.28 [0.74]	1.20 [0.53]	-1.30 [-0.46]	-1.44 [-0.41]
0.50< Sell =0.75 n=66	3.97 [2.46]	0.91 [0.73]	-5.73 [-1.54]	-5.67 [-1.32]	-9.36 [-1.54]
0.75< Sell <1 n=101	4.40 [3.89]	0.90 [0.28]	-0.56 [--0.46]	0.33 [0.18]	0.54 [0.23]
Sell All n=253	4.30 [5.43]	0.05 [0.08]	-2.08 [-1.88]	-0.33 [-0.24]	-1.09 [-0.56]
			Non Dividend Related		
Hold n=868	0.42 [0.94]	-0.27 [-0.73]	0.16 [0.27]	0.64 [0.73]	1.54 [1.15]
0< Sell = 0.25 n=51	2.13 [1.51]	-0.93 [-0.67]	-0.20 [-0.09]	-1.71 [-0.52]	3.62 [1.03]
0.25< Sell =0.50 n=112	3.74 [3.89]	-1.59 [-1.80]	-0.31 [-0.22]	3.79 [1.84]	3.32 [1.24]
0.50< Sell =0.75 n=138	3.85 [5.27]	-0.96 [-1.32]	-3.63 [-2.90]	-4.63 [-2.83]	-5.38 [-2.40]
0.75< Sell <1 n=202	4.56 [4.96]	-0.91 [-1.46]	-3.09 [-2.88]	-6.05 [-3.51]	-8.16 [-3.61]
Sell All n=544	4.02 [7.71]	-1.29 [-2.27]	-1.90 [-2.43]	-2.71 [-2.22]	-4.55 [-2.96]

This table presents the mean percentage abnormal return for samples of dividend and non dividend related exercises, categorised by the proportion sold at exercise. Hold represents the abnormal return for exercises not accompanied by a sale, while Sell All represents abnormal returns for exercises accompanied by the sale of all exercised stock. The remaining four sub-divisions represent samples based on partial sales of stock exercised. Mean percentage abnormal returns are measured over the respective windows using a calendar time methodology. Calendar day abnormal returns are the mean abnormal returns to all those firms that have an event such that they lie within the particular window on that day. A firm's abnormal return each day is that firm's return minus the firm's respective benchmark portfolio return. The corresponding t-statistics, measuring significance from zero, are in brackets.

Table 5 Changes in Stock Return Volatility Around Option Exercises Categorised by Proportion Sold

	Raw Returns			Market Adjusted 1			Market Adjusted 2		
Trading Window	50	100	200	50	100	200	50	100	200
Hold	0.00	0.09	0.24	0.00	0.11	0.27	-0.03	0.01	0.06
N=1353	[0.02]	[1.79]	[4.66]	[0.14]	[2.51]	[6.78]	[-0.58]	[0.25]	[1.16]
0< Sell = 0.25	-0.04	0.20	0.46	-0.06	0.18	0.42	-0.05	0.15	0.31
n=71	[-0.30]	[1.62]	[3.41]	[-0.50]	[1.56]	[3.31]	[-0.32]	[1.32]	[2.55]
0.25< Sell =0.50	0.13	0.21	0.35	0.12	0.21	0.34	0.10	0.15	0.20
N=152	[1.25]	[2.14]	[3.41]	[1.24]	[2.34]	[3.61]	[1.00]	[1.58]	[2.17]
0.50< Sell =0.75	0.17	0.21	0.36	0.14	0.19	0.35	0.11	0.10	0.20
N=203	[1.41]	[2.22]	[4.05]	[1.27]	[2.23]	[4.35]	[0.96]	[1.13]	[2.34]
0.75< Sell <1	-0.03	0.07	0.21	-0.02	0.09	0.23	-0.06	0.00	0.07
N=303	[-0.39]	[0.97]	[3.02]	[-0.23]	[1.37]	[3.56]	[-0.71]	[0.06]	[1.06]
Sell All	0.00	0.12	0.28	0.02	0.13	0.29	-0.04	0.02	0.11
N=797	[0.14]	[2.38]	[5.69]	[0.46]	[2.79]	[6.67]	[-0.70]	[0.45]	[2.47]

This table presents the mean percentage change in volatility around exercises categorised by the proportion sold at exercise. Hold represents exercises not accompanied by a sale, while Sell All represents exercises accompanied by the sale of all exercised stock. The remaining four sub-divisions represent samples based on partial sales of stock exercised. Thus 0< Sell =0.25 denotes exercises accompanied by a sale of between 0 and 25% of the stock purchased at exercise. The three volatility estimates, Raw Returns, Market Adjusted 1 and Market Adjusted 2 are: The daily standard deviation of raw returns, the daily standard deviation of market adjusted returns, and the daily standard deviation of raw returns minus the daily standard deviation of market returns, respectively. These volatilities are estimated over three trading windows (50 days, 100 days and 200 days) before and after an exercise. The corresponding t-statistics are in brackets.

Table 6 Correlation Matrix of Regressors

	M_t	VE_t	Z_t	S_{All}	S_1	S_2	S_3	S_4	H_{All}	PR_t	Vol-50	Vol-100	Vol-200
M_t	1												
VE_t	-0.090	1											
Z_t	-0.049	0.161	1										
S_{All}	-0.030	0.146	0.045	1									
S_1	0.055	0.000	-0.033	-0.088	1								
S_2	0.028	0.072	-0.035	-0.144	-0.033	1							
S_3	-0.017	0.100	0.000	-0.169	-0.039	-0.064	1						
S_4	-0.042	0.211	0.021	-0.211	-0.049	-0.079	-0.094	1					
H_{All}	0.032	-0.349	-0.029	-0.583	-0.135	-0.219	-0.258	-0.322	1				
PR_t	0.069	0.062	0.007	0.108	-0.011	-0.016	0.030	0.047	-0.144	1			
Vol-50	0.154	0.014	0.070	0.020	-0.018	-0.043	-0.016	0.005	0.008	0.170	1		
Vol-100	0.129	-0.006	0.042	0.007	-0.019	-0.027	-0.017	-0.008	0.024	0.078	0.624	1	
Vol-200	0.134	-0.021	0.025	-0.006	-0.024	-0.019	-0.021	-0.014	0.039	0.063	0.512	0.946	1

M_t is the ratio of the stock price to the exercise price at the time of exercise. VE_t is value of the exercise (number of shares times the exercise price). Z_t is the market capitalisation of the firm at the time of exercise. The variable S_{ALL} captures exercises that are all (100%) sold; S_1 captures $0 < \text{sell} \leq 0.25$ proportion; S_2 covers $0.25 < \text{sell} \leq 0.5$; S_3 captures $0.50 < \text{sell} \leq 0.75$; S_4 when $0.75 < \text{sell} < 1$; and H_{ALL} when all (100%) of the stock acquired at exercise is hold. PR_t is the stock's abnormal return measured over the 30 days preceding exercise. Vol-50, Vol-100 and Vol-200 are the stock return volatilities estimated over 50, 100 and 200 days before exercise. Volatility is the daily standard deviation of raw returns minus the daily standard deviation of market returns.

Table 7 Multivariate Analysis of Abnormal Returns after Exercise

	Panel A: Equally Weighted Abnormal Returns Full Sample				Panel B: Value-Weighted Abnormal Returns Full Sample				Panel C: Non Dividend Related Exercises		Panel D: Dividend Related Exercises	
Expl. Variables	30 Days	3Months	6 Months	9 Months	30 Days	3 Months	6 Months	9 Months	3 Months	6 Months	3 Months	6 Months
Constant	-0.002 (-0.805)	0.002 (0.374)	0.004 (0.568)	0.011 (1.037)	-0.005 (-1.606)	-0.0001 (-0.034)	-0.001 (-0.089)	0.008 (0.708)	-0.012 [b] (-2.115)	-0.005 (-0.611)	0.023 (2.236)	0.018 (1.234)
S_1	-0.003 (-0.052)	0.073 (0.719)	0.065 (0.449)	0.083 (0.333)	0.012 (0.216)	0.075 (0.808)	0.069 (0.509)	0.075 (0.319)	0.077 (0.710)	0.083 (0.558)	0.040 (0.156)	0.026 (0.066)
S_2	-0.031 (-1.867)	0.006 (0.225)	0.025 (0.587)	0.012 (0.216)	-0.022 (-1.333)	0.012 (0.455)	0.028 (0.649)	0.010 (0.165)	0.0183 (0.563)	0.055 (1.034)	-0.036 (-0.834)	-0.054 (-0.790)
S_3	-0.019 [b] (-2.017)	-0.069 [a] (-3.597)	-0.093 [a] (-3.409)	-0.118 [a] (-3.426)	-0.006 (-0.522)	-0.061 [a] (-3.012)	-0.082 [a] (-2.838)	-0.112 [a] (-3.091)	-0.048 [b] (-2.453)	-0.076 [b] (-2.463)	-0.109 [a] (-2.632)	-0.129 [b] (-2.404)
S_4	-0.009) [c] (-1.725)	-0.041 [a] (-4.379)	-0.065 [a] (-4.297)	-0.087 [a] (-4.781)	-0.008 (-1.30)	-0.044 [a] (-4.373)	-0.066 [a] (-4.033)	-0.087 [a] (-4.572)	-0.048 [a] (-3.866)	-0.088 [a] (-4.372)	-0.030 [b] (-2.271)	-0.021 (-1.028)
S_{ALL}	-0.014 [a] (-3.683)	-0.025 [a] (-3.952)	-0.031 [a] (-3.194)	-0.0468 [a] (-3.740)	-0.013 [a] (-3.126)	-0.023 [a] (-3.420)	-0.031 [a] (-3.110)	-0.047 [a] (-3.643)	-0.020 [a] (-2.602)	-0.027 [b] (-2.330)	-0.037 [a] (-3.068)	-0.038 [b] (-2.174)
M_t	0.001 (1.356)	-0.001 (-0.773)	-0.001 (-0.897)	-0.002 (-0.779)	0.001 (1.389)	-0.001 (-0.978)	-0.003 (-1.405)	-0.003 (-1.405)	0.002 (1.513)	-0.0004 (-0.341)	-0.004 [c] (-1.845)	-0.003 (-0.824)
PR_t	0.042 [c] (1.944)	0.101 [a] (2.751)	0.244 [a] (4.597)	0.323 [a] (4.775)	0.034 (1.485)	0.098 [a] (2.658)	0.248 [a] (3.975)	0.302 [a] (4.209)	0.076 (1.622)	0.203 [a] (2.974)	0.153 [a] (2.779)	0.336 [a] (4.156)
VE_t	1.5e-008 [b] (2.148)	2.0e-008 [b] (1.816)	3.4e-008 [b] (2.423)	1.8e-008 (0.825)	1.3e-008 [b] (1.720)	1.9e-008 (1.576)	3.8e-008 [b] (2.438)	1.0e-008 (0.490)	4e-008 [a] (3.103)	5.6e-008 [b] (2.371)	8e-010 (0.051)	1.8e-008 (0.084)
Z_t	5.6e-007 [b] (2.009)	7.9e-007 [b] (2.475)	1.2e-006 [b] (2.511)	2.2e-006 [a] (3.781)	1.2e-006 [b] (1.865)	1.4e-006 [b] (2.302)	3.0e-006 [a] (3.476)	4.8e-006 [a] (5.476)	7e-007 (1.628)	1.5e-006b (2.222)	1e-006 [c] (1.901)	1.1e-006 (1.593)
σ	0.081	0.137	0.207	0.271	0.087	0.140	0.213	0.277	0.133	0.207	0.142	0.206
R^2	0.011	0.018	0.023	0.024	0.013	0.019	0.029	0.030	0.018	0.024	0.043	0.032
Obs.	2879	2879	2879	2879	2879	2879	2879	2879	1915	1915	964	964

In our specification, the constant term captures the effects of H_{ALL} when all of the stock acquired at exercise is held. The variable S_{ALL} captures exercises that are all (100%) sold; S_1 captures 0 < sell ≤ 0.25 proportion; S_2 covers 0.25< sell ≤ 0.5; S_3 captures 0.50 < sell ≤ 0.75; S_4 when 0.75 < sell < 1. M_t is moneyness defined as the ratio of the stock price to the exercise price at the time of exercise. PR_t is the stock's abnormal return measured over the 30 days up to the exercise. VE_t is the value of the exercise (number of shares times the exercise price) and Z_t denotes the firm size measured by the market capitalisation of the firm at the time of exercise. Reported results are obtained by the OLS estimator. Figures within parentheses are heteroscedasticity consistent t-ratios. Superscripts a, b and c respectively denote significance at 1%, 5% and 10% or better.

Table 8: Multivariate Analysis of Future Return Volatility and Option Exercise

Explanatory Variables	Vol+50			Vol+100			Vol+200		
Constant	0.004[a] (14.872)	0.005[a] (4.223)	0.005[a] (3.360)	0.004[a] (18.773)	0.005[a] (4.889)	0.005[a] (3.848)	0.005[a] (21.408)	0.006[a] (5.699)	0.005[a] (4.523)
S_1	-0.002 (-0.504)	-0.002 (-0.535)	-0.002 (-0.348)	0.003 (0.820)	0.003 (0.757)	0.004 (0.957)	0.012[b] (2.021)	0.012[b] (2.117)	0.013[b] (2.266)
S_2	0.001 (0.841)	0.0004 (0.312)	0.0003 (0.243)	0.002 (1.475)	0.001 (0.826)	0.0009 (0.759)	0.003[b] (2.275)	0.002[c] (1.695)	0.002 (1.623)
S_3	0.002 (1.343)	0.002 (1.323)	0.002 (1.438)	0.0005 (0.581)	0.0005 (0.563)	0.0006 (0.717)	0.001 (1.353)	0.001 (1.370)	0.001 (1.545)
S_4	-0.0004 (-0.791)	-0.0002 (-0.471)	-0.0001 (-0.261)	-0.0006 (-1.430)	-0.0005 (-1.025)	-0.0003 (-0.787)	-0.0006 (-1.383)	-0.0004 (-0.961)	-0.0003 (-0.698)
S_{ALL}	-3.9e-005 (-0.121)	7.1e-005 (0.217)	0.0002 (0.528)	-0.0001 (-0.468)	-2.4e-005 (-0.081)	7.5e-005 (0.262)	6.7e-005 (0.246)	0.0002 (0.655)	0.0003 (1.075)
Vol-50	0.457[a] (16.232)	-	-	0.458[a] (16.850)	-	-	0.450[a] (16.521)	-	-
Vol-100	-	0.299[c] (1.859)	-	-	0.295[c] (1.880)	-	-	0.330[b] (2.327)	-
Vol-200	-		0.320[c] (1.694)	-	-	0.320c (1.716)	-	-	0.353[b] (2.097)
σ	0.007	0.008	0.008	0.006	0.007	0.007	0.006	0.007	0.006
R^2	0.171	0.102	0.105	0.213	0.129	0.158	0.217	0.163	0.165
Obs.	2879	2879	2879	2879	2879	2879	2879	2879	2879

The constant term captures the effects of H_{ALL} when all of the stock acquired at exercise is held.
The variable S_{ALL} captures exercises that are all (100%) sold; S_1 captures $0 < \text{sell} \leq 0.25$ proportion; S_2 covers $0.25 < \text{sell} \leq 0.5$; S_3 captures $0.50 < \text{sell} \leq 0.75$; and S_4 when $0.75 < \text{sell} < 1$. Vol-50, Vol-100 and Vol-200 are the stock return volatilities estimated over 50, 100 and 200 days before exercise. Vol+50, Vol+100 and Vol+200 are the corresponding estimates after exercise. Volatility is the daily standard deviation of raw returns minus the daily standard deviation of market returns. Reported results are obtained by the OLS estimator. Figures within parentheses are heteroscedasticity consistent t-ratios. Superscripts a, b and c respectively denote significance at 1%, 5% and 10% or better.

[1] There is recent evidence that some US executives are able to hedge a proportion of their options through the use of zero-cost collars and equity swaps (see Bettis et al. (2001)).

[2] Early exercise is subject to the completion of a vesting period, during which executive stock options cannot be exercised.

[3] See Lambert et al. (1991), Hall and Murphy (2000, 2002), Meulbroek (2001), Ingersoll (2002) and Tian (2004).

[4] See the London Stock Exchange's 'Model Code'.

[5] A further possible reason for the greater use of options by US firms is that the gain realised by the executive at exercise is tax deductible by the firm, assuming they are nonqualified options.

[6] The average time to vest is 23.6 months in the US (Kole (1997)), whereas UK guidelines have consistently stressed a minimum vesting period of three years.

[7] The Association of British Insurers (ABI) is one of two main associations representing institutional shareholders in the UK. The other is the National Association of Pension Funds (NAPF).

[8] The change was introduced as a result of the Greenbury Report, published on 17 July 1995.

[9] Directus Ltd is a UK corporate directors' trading information service. It was purchased by Primark from BARRA (UK) Ltd in 2000, before being acquired by Thomson Financial in 2001.

[10] The lack of data on grant dates means that we cannot distinguish between pre- and post-July 1995 grants, and therefore we are unable to include option exercises after July 1998.

[11] The book-to-market ratio has important explanatory power for the cross-section of UK stock returns (Strong and Xu (1997)), whilst Fama and French (1998) document a value premium for UK stocks between 1975 and 1995 of 2.65%. Dimson and Marsh (1999) also confirm the presence of a size effect in the UK stock market. Overall, Fama and French (2006) conclude that 'size and book-to-market or risks related to them are important in expected returns.'

[12] See panel B of table 7.

[13] Our results below are robust to the exclusion of outlier returns.

[14] This includes exercises where there is no associated sale. The average proportion sold where executives sell at exercise is 83%. Where executives do sell, it is

possible they make subsequent sales of stock. We do not include sales that occur some time after an exercise, although the data show that subsequent sales within a month of exercise are rare.

[15] The drawback is that the computed returns do not correspond to returns that would be experienced by investors. It is straightforward to calculate event-time abnormal returns (which measure precisely the investors' abnormal return), but the problem of misspecified test statistics remains, and cannot be eliminated by the use of, for example, a bootstrapped skewness-adjusted t-statistic.

[16] We note, however, that there are likely to be a number of other reasons motivating executives' trading decisions, including the need to diversify, dividend capture and information about post-exercise stock return volatility.

[17] Data on executives' shareholdings and outside wealth, if it had been available, would have allowed us to exclude trades that are likely to be motivated by diversification rather than information.

[18] The existing evidence confirms trade informativeness is negatively related to firm size (see, for example, Seyhun (1986), Lakonishok and Lee (2001) and Carpenter and Remmers (2001)).

[19] The reported t-ratios are derived using the heteroscedasticity consistent standard error due to White (1980). Inferences remain unchanged if heteroscedasticity consistent standard errors (HACSEs) due to Andrews (1991) are used.

[20] The significance of the proportion sold at exercise is also evaluated by an alternate specification: $AR_{it} = \phi_1 + \phi_2 S_t + \phi_3 M_t + \phi_4 PR_t + \phi_4 VE_t + \phi_5 Z_t + e_t$. In this specification, the various proportions sold are lumped together (there is no segregation of different proportions sold) and entered as a single regressor (S_t). In this specification, the proportion sold (S_t) appears consistently negative and significant across all windows. Under this specification, it is straightforward to test if 100% hold (H_{ALL}) or different proportions sold (S_1, S_2, S_3, S_4 and S_{All}) exhibit different effects on abnormal returns by entering them as additional regressors, preferably one at a time. On the differential effects, H_{ALL}, S_1 and S_2 appear insignificant; S_3 and S_4 appear negative and significant whilst S_{ALL} appears positive and significant. These signs are consistent vis-à-vis the results reported in Table 7 panel A. This approach is not fundamentally different from specification (5), and confirms that UK executives' trading decisions are motivated by their private negative information. However, this approach lumps all the proportions sold together, thereby masking the insignificance of proportions sold which are less than 50%. In view of the heterogeneous effects of different proportions sold on subsequent abnormal returns, we prefer specification (5).

[21] Brooks et al. (2006) provide evidence that the informativeness of insider trading varies between sectors. Whilst the heterogeneity of executives' informativeness across sectors is an interesting issue, we cannot pursue this here because of a lack of data.