# THE INFORMATION CONTAINED IN THE EXERCISE OF EXECUTIVE STOCK OPTIONS

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**Abstract**

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## Abstract

This paper investigates whether insiders use private information in their decision to exercise executive stock options. Consistent with existing research, exercises overall do not yield subsequent abnormal returns. Categorising exercises by the proportion of stock sold at exercise yields a marked and significant difference in subsequent performance between those accompanied by a 'high' and 'low' sale proportion respectively. Further, near-the-money exercises produce negative abnormal returns, consistent with such exercises being expensive. The disparity in US and UK executives' exercise behaviour may be related to the extent to which executive remuneration is linked to shareholder wealth, highlighting the difficulties associated with designing effective remuneration packages for executives.

## 1. Introduction

Economists have frequently investigated the impact of insiders' trades in their own stock. Superficially, this research identifies the predictive ability of insiders' trades and therefore the benefit to outside investors of conditioning their own trades on those of the insiders. More importantly, the principal motivation is to establish if insiders exploit their informational advantage. The predominant focus of existing research has been to examine the information contained in the purchase and sale of stock in their own firms by executives. This research shows 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. More recent research investigates the information content of executive stock option exercises.

Executives are increasingly being remunerated by means of performance based remuneration packages that incorporate executive stock options. Hall and Murphy (2002), however, show that the value executives place on their stock options may be considerably lower than the cost to the firm of granting them. The divergence between value and cost is important, not only because it reduces the incentive effect of the options, but also because it will increase as the proportion of remuneration in the form of options increases. The extent of this divergence may be mitigated by executives' ability to use their private information when exercising.

Stock option exercises were initially thought to have little predictive ability given the restrictions executives faced in exercising. Any discretion they may have would imply an exercise and sell prior to poor stock price performance. Exercise requires the payment of the exercise price, and therefore an executive should not exercise unless he intends to sell immediately. If the price of the underlying stock is

expected to rise, it is cheaper to continue to hold the option. It is therefore generally accepted that if executives use their private information, an exercise should be viewed by investors as a sell signal, provided the executive is free to sell the shares purchased.[1] Consistent with this, Ofek and Yermack (2000) find that 'for [US] executives who exercise stock options, we find near-total selling of the shares acquired'. Carpenter and Remmers (2001) examine the information content of US executive stock option exercises, and find that in the current regulatory regime where executives can sell immediately, only for a small subset of exercises (by top managers in small firms) does exercise precede significant negative abnormal returns. Therefore, the overwhelming majority of US executives do not use their information advantage with respect to option exercises.

The assumption that executives sell all the stock they acquire through exercise is not the case in the UK. We find that executives sell on average approximately 45% of the shares purchased at exercise. (Table 1 presents additional summary statistics). In section 2 we discuss the reasons why the decisions taken by UK executives may differ from those taken by US executives. Among these reasons are important differences in the remuneration and taxation of executives in the United States and the United Kingdom. These differences may be a key factor in determining the distinct contrast in exercise behaviour, and in turn allow private information to play a role in motivating UK executives' exercise decisions.

The focus of our research is to extract the information contained in executive stock option exercises in the UK. Because executives sell on average a proportion of the stock acquired at exercise, we distinguish between exercises on the basis of this

[1] This scenario may be confused by option expiry or forfeiture, both of which force the executive to exercise irrespective of his expectations regarding future performance.

proportion. If executives use their private information, then we would expect negative post-exercise performance after an exercise accompanied by a proportionately large sale of stock. An exercise and low sale proportion is analogous to a stock purchase, and might therefore be followed by positive post-exercise performance. Table 2 shows that this is indeed the case.

The remainder of the paper investigates further the factors that may impact on the nature of these post-exercise returns. Existing research identifies both private information and issues relating to the nontradabilty of executive stock options as being possible theoretical motivations for exercise. Controlling for option moneyness is important as this has implications for the costs associated with exercising the option. A priori, a near-the-money option exercise should be a 'better' signal of poor future performance than a deep in-the-money exercise. Whilst our results are consistent with this intuition, the importance of the proportion sold persists after controlling for option moneyeness. Finally, we examine the relevance of both firm size and executive age. Firm size may be important if information asymmetries are more meaningful in smaller firms. Furthermore, controlling for age allows us to examine the importance of diversification and risk aversion as non-information motives for exercising and selling.

The empirical findings of the existing research in relation to the information content of executive stock option exercises are limited. This paper, however, provides evidence that executives in the UK do incorporate private information in their exercise decisions. This private information is reflected both in the timing of their option exercises and in the related decision of how much of the stock purchased should be sold. Perhaps more importantly, our research has implications for the most appropriate and cost-effective way of remunerating executives.

Executives' exercise decisions are indicative of the trade-off that exists between, on the one hand, the attempt to align executives' remuneration (and therefore incentives) with that of shareholders, and on the other hand, the ensuing reduction in executives' personal portfolio diversification that this creates. Incentive alignment is most effective where executives' shareholdings represent a sufficiently large proportion of their remuneration. However, this is likely to give them an undiversified portfolio. The greater the proportion of remuneration linked to shareholder wealth, the more likely exercise and associated sell decisions are motivated by the need to diversify. Since a higher proportion of US executives' remuneration is linked to shareholder wealth, their need to diversify is such that they exercise and sell irrespective of their private information. In the UK, decisions to exercise and sell are in general strong indicators of negative future stock returns because executives are more diversified, and sales bring forward a tax liability associated with option gains. The distinction between diversifying and informed trades highlights the impact of insufficient personal portfolio diversification, and demonstrates the difficulties associated with the design of effective remuneration packages for executives.

## 2. Executive Remuneration and the Regulatory Regime in the UK

Table 1 below shows that exercise behaviour in the UK contrasts strongly with that in the US. Specifically, executives in the UK sell on average approximately 45% of the stock acquired at exercise, whereas Ofek and Yermack (2000) find that US executives sell most of the stock purchased. This section examines the remuneration of UK executives to determine if there are any aspects of this that might allow UK executives' private information to play a more significant role in their exercise

decisions. In examining this issue, we implicitly address the question - why might US and UK executives behave differently when making their respective exercise decisions? Although the decision to exercise and the decision to hold or sell the stock acquired are related decisions, we begin by examining the exercise decision itself. We show that executives in the US have an incentive to exercise in order to diversify their personal portfolios, whilst executives in the UK have an incentive to exercise in order to facilitate the grant of additional options.

The remuneration of UK executives differs significantly from that of US executives. Executive remuneration is lower in the UK than in the US, a large proportion of the difference due to the aggressive linking of remuneration to stock market performance in the US. Specifically, UK CEOs receive less remuneration than US CEOs, as well as a smaller proportion of their total remuneration from stock options.[2] Conyon and Murphy (2000) compare CEO pay in the US and the UK, finding that in 1997 median base salary was £317,000 and £240,000 respectively. Furthermore, where options are granted, the median option grant for US CEOs is worth approximately 16 times as much as that for UK CEOs. As a result, the option grant comprised 42% of total remuneration among US CEOs, and just 10% of total remuneration among UK CEOs. Perhaps more important than differences in remuneration at just one point in time is the impact these differences have over time. Conyon and Murphy find that the effective value of CEOs' shareholdings in their respective companies is approximately ten times as large in the US. Thus a median

[2] Whilst there are a number of reasons for this, there appears to be a greater sensitivity in the UK to the public's perception of the level of executive remuneration in general, and option related gains in particular. A further possible reason for the greater use of ESOs by US firms is that the gain realised by the executive at exercise is tax deductible by the firm.

base salary that is only approximately one third larger in the US means there is a marked contrast in the proportion of executives' wealth linked to the value of their firms. On the one hand, executive remuneration (and therefore wealth) is much more closely aligned with that of shareholders in the US. On the other hand, US CEOs are likely to be substantially less diversified than UK CEOs.

It follows that the need to diversify will be much stronger among US executives. According to Meulbroek (2001), executives holding undiversified portfolios place less value on their stock and stock options than diversified investors, and will therefore reduce their shareholding irrespective of their private information. That private information is ignored in US executives' desire to diversify is consistent with the lack of information in insider sales (see, for example, Jeng, Metrick and Zeckhauser (2000)). It is also consistent with Carpenter and Remmers (2001), who show that option exercise in the US is generally uninformative where the executive is free to sell the acquired shares.

Whilst executives in the UK have less need to diversify, they may also have a strong incentive to exercise, albeit for a very different reason – the four times emoluments rule.[3] This rule specifies 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 limit the tax advantages associated with approved option schemes. At the time, the executive was taxed at the capital gains tax rate (30%) on sale of the shares, rather than at the income tax rate (60%) on exercise. This rule was incorporated into the guidelines

[3] For a discussion of this and other aspects relating to executive stock options in the UK, see Main (1999).

developed by the Association of British Insurers (ABI)[4], and persisted even after the two tax rates were equalised in 1988.[5] 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.'

The four times emoluments rule gives executives a strong incentive to exercise since exercising provides space for the granting of additional options.[6] If options are regarded as an important method of aligning incentives, then pressure to regrant will be strong. Therefore, whilst executives in the US and the UK may have different reasons for exercising, both will exercise early.[7] Given that US executives exercise to diversify, they will sell the acquired stock. We now discuss the reasons why executives in the UK may hold their acquired stock.

The decision to exercise and hold or sell will be complicated by the rules regarding the exercise of options and the way the gains are taxed.[8] In the US, gains at exercise are taxed as income, whether or not the executive sells the acquired shares. In the UK, gains are taxed as capital gains when the shares are sold. Given

[4] 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).

[5] The recently revised ABI guidelines (ABI (2002)) favour an annual grant of up to one times salary conditional on the 'achievement of demanding and stretching financial performance.'

[6] Exercising to receive additional options is not necessarily limited to the UK. Hall and Murphy (2002) note that 'to the extent that exercised options are replaced with new grants, early exercise provisions may increase the total number of options granted in the long run.'

[7] This consistent with Huddart and Lang (1996) and Main (1999).

[8] An example of the former is demonstrated by the impact of the rule change in the US in 1991 documented by Carpenter and Remmers (2001).

that the capital gains tax rate is the same as the upper level income tax rate, this simply enables UK executives to postpone their tax liability by holding the acquired shares.[9] For executive stock options granted after July 1995, the tax position in the UK is the same as in the US.[10] 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. Exercises immediately prior to July 1995 may have been motivated by an attempt to avoid the expected change in the tax regime. Given the difference in tax treatments, an exercise and hold is a more viable decision in the UK than in the US. Alternatively, although the cost of exercising and selling is effectively the same for US and UK executives, exercising and selling is relatively more expensive than exercising and holding in the UK because it brings forward the tax liability.

A second important distinction between the US and the UK is the shorter vesting period in the US. Kole (1997) measures vesting periods applied to executive stock options in the US, and finds that the average time to vest is 23.6 months. Hall and Murphy (2002) concur that vesting schedules in the US are relatively short – 'the most common schedules vest options 33% annually over 3 years, 25% annually over 4 years or 20% annually over 5 years.' In the UK, the ABI guidelines have

[9] The tax treatment referred to applies to options classified as nonqualified in the US and approved in the UK. Most options in the US are nonqualified since qualified options are more restrictive and do not allow the firm to treat the gain at exercise as a tax deductible expense. Similarly, most options in the UK are approved since they are discretionary and have the associated tax advantages.

[10] The change was introduced as a result of the Greenbury Report, published on 17 July 1995. The Greenbury Committee recommended that executive stock options should in future incur income tax at exercise rather than capital gains tax when the acquired stock is sold.

consistently stated that there should be a minimum vesting period of three years. Longer vesting periods reduce the value of the options when granted (see Meulbroek (2001) and Hall and Murphy (2002)). As a result, for a given option position (that includes unvested options), UK executives will have less effective wealth in that position, further mitigating their need to diversify.

Finally, the increasing use of company imposed blackout periods in the US gives executives in the UK a greater opportunity to exploit their private information. Bettis, Coles and Lemmon (2000) find that by 1996, 78% of the firms in their sample place restrictions on when insiders can trade. The most common restriction allows insiders to trade during a two week period after an earnings announcement. UK executives are prohibited from trading during the two months prior to the announcement of year-end or half-year results, and may therefore have greater opportunities to profit from an information advantage. In addition, stock options in the UK are not granted to non-executive directors, thereby restricting them to the better-informed insiders.

These differences in remuneration practice between the US and the UK go some way to explaining the differences in exercise behaviour illustrated by Table 1. Irrespective of their private information, executives in the US are likely to exercise and sell to diversify their personal portfolios. If so, then the informativeness of their exercise decisions will be limited. Whilst executives in the UK are also motivated to exercise early, they are more likely to hold the acquired shares because this defers a tax liability and their need to diversify is much less strong. As a result, their private information is more likely to be conveyed in the proportion of acquired stock they sell.

## 3. Literature

Ever since Fama (1970) stimulated the debate on market efficiency, researchers have sought to determine the information content of insider trades.[11] The general consensus of the resulting research is that insider trades are informative. In particular, insider purchases, which require an investment and are unlikely to be liquidity driven, are more informative than sales. The most recent research in the US by Jeng, Metrick and Zeckhauser (2000) and Lakonishok and Lee (2001) concludes that insider purchases have predictive ability over holding periods of up to a year, but that insider sales have little information regarding future stock returns. Furthermore, the information content of purchases is limited to the smaller firms. Research in the UK by Friederich, Gregory, Matatko and Tonks (2002) confirms that purchases are more informative than sales.

Whereas the focus of the above literature has been on standard equity transactions, the aim here is to examine the information contained in the exercise of executive stock options. The key factors motivating exercise behaviour relate to the nontradability of executive stock options and the ability of executives to use their private information. Nontradability and private information are the two features of executive stock options that distinguish them from ordinary traded options, and explain why the associated exercise behaviour may be different from that predicted by option theory.

[11] US studies include those by Jaffe (1974), Finnerty (1976), Givoly and Palman (1985), Seyhun (1986, 1988), Rozeff and Zaman (1988), Pettit and Venkaatesh (1995) and Eckbo and Smith (1998). Similar studies have been conducted in the UK by King and Roell (1988), Pope, Morris and Peel (1990), Gregory, Matatko, Tonks and Purkis (1994), Gregory, Matatko and Tonks (1997).

## 3.1. THE EXERCISE DECISION

The assumption that the holder of an option can be viewed as a risk-neutral investor underpins option pricing theory. Holders of executive stock options cannot, however, be regarded as risk-neutral investors. Firstly, an executive stock option is nontradable. Secondly, the executive is unable to hedge an option position by short-selling the underlying stock.[12] Thirdly, the holder of an executive stock option is unlikely to hold a well-diversified portfolio. In addition to these three factors, executive stock options are subject to minimum vesting periods, during which they cannot be exercised. The breakdown of risk-neutrality, the imposition of a vesting period and the possibility that executives have access to inside information, drive a wedge between the value executives place on executive stock options and the value of equivalent traded options. See, for example, Huddart (1999), Meulbroek (2001) and Hall and Murphy (2002). Moreover, these factors will impact on the optimal exercise policy for executive stock options.

That the exercise decision will be influenced by the characteristics of an executive stock option has been recognised in the literature. Huddart (1994) examines the effects of nontradability and risk aversion, and identifies a trade-off between early payment of the exercise price and the resulting ability of the executive to diversify risk. Risk-averse individuals may exercise early in order to switch into a less risky asset. Similarly, Huddart (1999) notes that the inability to hedge allows

[12] There is some recent evidence, however, that a very small number of executives in the US are able to hedge a proportion of their stock options through the use of zero-cost collars and equity swaps. See Bettis, Bizjak and Lemmon (2001).

factors such as risk preferences and wealth to influence the timing of the exercise decision. Early exercise occurs because no market exists where these instruments can be traded. Meulbroek (2001) argues that the need to diversify will be such that not only will executives exercise early, they will ignore their private information. Hall and Murphy (2002) also show that the more risk-averse and less-diversified an executive is, the earlier they will exercise.

## 3.2. EMPIRICAL STUDIES

The associated empirical research confirms these predictions relating to the exercise of stock options. Huddart and Lang (1996) find that a high proportion of stock options held by employees are exercised as soon as they vest, sacrificing a large portion of the option's value. Moreover, exercise is positively related to stock returns over the previous three months and the risk of the firm. Heath, Huddart and Lang (1999) find that employee stock option exercise is positively related to both the fraction recently vested and previous short-term returns. Over 90% of transactions are accompanied by a sale of all the stock acquired through exercise. There is also evidence that early exercise is triggered by the stock price exceeding its high for the year.[13]

The importance of diversification as a motive for early exercise is stressed by Hemmer, Matsunaga and Shelvin (1996). From a small sample of option exercises by top executive officers in 1990, they find a positive relation between option exercise and the investment risk inherent in holding an option position, as proxied by

[13] See Heath, Huddart and Lang (1999), Core and Guay (2001) and Huddart and Lang (2003). Poteshman and Serbin (2003) find similar evidence relating to traded options.

the variability of returns. Similarly, Meulbroek (2001) identifies the importance of insufficient personal portfolio diversification, since the risk associated with holding such a portfolio is not compensated for by increased expected return. She calculates that an investor holding a one-stock portfolio would require a return premium of 9% over the stock's equilibrium return. Even an investor with just 25% of their wealth invested in one firm requires an additional premium of 3%. This means that the 'efficiency' of either stock or option-based compensation will fall as managers become less diversified – i.e. the difference between the value that managers place on their stock options (or restricted stock) and their cost to the firm will increase. Furthermore, this effect will be aggravated by the imposition of a vesting period. As a result, managers in the average NYSE firm with all their wealth invested in their firm will value their stock options at just 70% of their value to an outside investor. This rises to 88% for managers with 75% of their wealth in a diversified portfolio. Meulbroek concludes that executives will have a strong incentive to diversify even if they believe the stock to be undervalued.

Whilst Meulbroek (2001) provides a rationale for the lack of informativeness in executives' exercise and associated sell decisions, theory suggests that executives have access to information that should enable them to make informed exercise decisions. Carpenter and Remmers (2001), using data for all US corporate insider option exercises during 1984-1995, examine stock price performance following insider option exercise. Prior to 1991, when insiders were required to hold the acquired shares for six months, exercises are followed by positive abnormal returns, suggesting executives do use their private information to time their exercise decisions. In the current regime (post-May 1991), in which insiders can sell at exercise, the use of private information should manifest itself in post-exercise

negative abnormal returns. Here post-exercise returns are marginally positive, but insignificant. Conditioning on both firm size and the rank of the insider, they find that a very small subsample composed of top managers in the smaller firms do appear to use their information advantage when exercising. This subsample yields six-month post-exercise abnormal returns of –5.22% (t-statistic of –2.45).

In addition to the use of private information in determining the timing of an exercise decision, executives may also be able to use their information in influencing the exercise price of their options. Yermack (1997) suggests that CEOs manipulate the timing of the option grant, ensuring that it precedes the announcement of positive information. Consistent with this, he finds positive abnormal returns up to ten weeks after an option grant. Chauvin and Shenoy (2001) extend this analysis, hypothesising that CEOs manipulate the flow of information to depress stock prices prior to the option grant. They find small but significant negative abnormal returns during the two weeks prior to the grant date.

Whilst the above literature (based on the analysis of executive stock options in the US), suggests that executives may use their private information to influence the exercise price of the grant, their private information does not impact significantly on the exercise decision, except where the executive is a top manager in a small firm. We suggest that the general uninformativeness of their exercise decisions is driven primarily by the need for US executives to diversify their personal portfolios.

## 4. Data and Methodology

We analyse the period from 17 July 1995 to 3 July 1998. The data include all executive transactions taking place in the UK during this period and is provided by

Directus Ltd. Table 1 has summary statistics relating to the exercises during this period. Of the 3392 executive stock option exercises, 148 are removed due to missing returns data. The remaining 3244 exercises comprise our sample. The number of event days denotes the number of days on which at least one exercise takes place. For each exercise, we determine the proportion of stock sold by the executive at the time of the exercise. Perhaps the most striking finding is that this proportion averages approximately 45%.[14]

Table 1

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. This dependence on previous stock returns (which we detail below, and which has also been documented by Heath, Huddart and Lang (1999)) means the use of a market model will bias downwards the estimated abnormal returns. We avoid this problem by comparing post-exercise returns with the returns to a benchmark portfolio, composed according to size and momentum. The formation of size and momentum portfolios is a similar approach to that of Carpenter and Remmers (2001). Adjusting for size is important given the evidence that size can explain some of the cross-section of average stock returns (see Fama and French (1992)). As a result, measuring abnormal returns through the use of

[14] It is possible executives make subsequent sales of stock. However, sales that occur some time after an exercise cannot have an impact on the information content of the exercise, and are therefore ignored. Further, the data shows that subsequent sales within a month of exercise are rare.

matching portfolio deciles sorted by size is common in the literature (see, for example, Loughran and Ritter (1995) and Esplenaub, Gregory and Tonks (2000)).[15]

The likelihood that the exercise decision follows a period of superior return performance suggests a further sort by momentum. Jegadeesh and Titman (1993) and Jegadeesh and Titman (2001) provide consistent evidence that stocks in the US exhibit momentum, or medium term return persistence. Rouwenhorst (1998) obtains similar results in the UK for the period 1980 to 1995, and shows that this return persistence is independent of firm size. Lyon, Barber and Tsai (1999) argue that ignoring pre-event return performance induces a positive (negative) bias in test statistics of abnormal return performance where firms had high (low) pre-event returns. They suggest that matching firms to benchmark portfolios on the basis of pre-event return performance can control for this potential bias.

Each day, all firms are allocated to one of forty portfolios on the basis of size and previous return (or momentum). On the basis of a ranking by size, we allocate firms to one of ten size-based portfolios. Each portfolio is then subdivided in four based on a ranking of 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 that firm's return and the equally weighted return to its matching size/momentum portfolio.

[15] An alternative approach is to distinguish between value and growth stocks, since value stocks may earn higher returns than growth stocks (Fama and French (1998)). For UK stocks between 1975 and 1995, portfolios formed on the basis of high and low earnings to price ratios produce annual return differences of 2.65%. In results that we do not report, we find no differences in post-exercise returns when exercises are categorised by the firm's earnings to price ratio.

The second methodological issue arises from the event clustering and overlapping returns apparent in the data. Overall, 3244 option exercises relating to 765 firms take place on just 707 days within the sample period. 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 option exercises are independent, and therefore we cannot aggregate the abnormal returns in event time. We overcome these problems by using a calendar-time approach (see, for example, its application in Brav and Gompers (1997)). Lyon, Barber and Tsai (1999) show this approach is particularly suited to a study in which cross-sectional dependence is induced by return calculations that are overlapping. Under these circumstances, a traditional event study framework would yield misspecified test statistics.[16]

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

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

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 size/momentum 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

[16] 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. Whilst we do not report event-time abnormal returns, they are very similar to the calendar-time abnormal returns presented below.

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 return performance), and post-event windows up to nine months after exercise. London Stock Exchange rules do not permit executive transactions during the two months prior to the year-end or half-year earnings announcements. Thus event windows of several months or longer might best capture the ability of executives to trade on the basis of information relating to forthcoming earnings announcements.

## 5. Results

We hypothesise that the proportion of an exercise that is sold reflects the information contained in executive stock option exercises. We examine this by distinguishing between exercises where more than 50% is sold, and those where 50% or less is sold. At exercise, the proportion sold will be influenced by a number of factors, one of which is the executive's expectation about the future performance of the stock. Given that exercise requires payment of the exercise price, it is normally assumed that exercise will take place only if the executive expects the stock to underperform, and should be accompanied by a sale of all the stock purchased. Whilst the resulting information content will be reduced by the need to diversify, section 2 demonstrates that the need to diversify is considerably weaker in the UK than in the US. In addition, selling the stock acquired at exercise is costly in the UK because it brings forward a tax liability on the option gains. As a result, we regard the sale of a large proportion of stock as a signal akin to a stock sale, with corresponding implications for post-exercise abnormal returns.

The decision to exercise and hold is, in theory, difficult to justify because of the costs associated with exercising. Section 2 identifies the four times emoluments rule as giving executives an incentive to exercise early. In addition, option expiration may also force executives to exercise. Having exercised, the ability to defer a tax liability provides a strong motive for executives to hold the acquired stock. Hence the executive's decision will be determined by the need to balance the exercise and tax costs with his expectation about the future performance of the stock. As a result, we regard the decision to hold or to sell a small proportion of the stock acquired as weakly equivalent to a stock purchase.

A subdivision of exercises by proportion sold should yield information signals consistent with either a purchase or a sale if executives use their private information in motivating their exercise and related sale decisions. The alternate factors behind this decision will blur the quality of the proportion sold as an information signal. We hypothesise that post-event abnormal returns will be negative following the sale of a large proportion of the stock acquired. The information signal where the proportion of stock sold is small will be weaker because of the conflicting motives for such a strategy. Overall, we anticipate positive abnormal returns consistent with those observed for stock purchases.

Table 2

The complete sample of exercises in Table 2 shows that exercises succeed significantly positive abnormal returns of 2.26% (t-statistic of 8.79). Post-exercise, abnormal returns are negative, but insignificant. For example, the mean abnormal return over the six-month period after exercise is –0.31% (t-statistic of –0.60). This is not out of line with Carpenter and Remmers (2001), who find that when an executive can sell exercised stock immediately, post-exercise abnormal returns are marginally positive but not significant. (They obtain a mean abnormal return over the corresponding period of 0.18%). That the decision to exercise capitalises on previous superior stock price performance is consistent with Heath, Huddart and Lang (1999). Whilst exercises appear to contain little information about a firm's future performance, it could be argued that they are informative to the extent that they mark the end of a period of positive abnormal returns.

Rows 2 and 3 in Table 2 give corresponding results for exercises categorised as low and high proportion respectively. Both Low and High exercises succeed significantly positive abnormal returns over the preceding 30 days of 1.01% and

4.02% respectively. The difference is significant, indicating executives sell more stock after larger recent abnormal returns. Thus not only do executives appear to time their exercises, but the choice of how much stock to sell is influenced by the strength of the recent stock performance and reflects a desire to capture short-term gains, in line with Hall and Murphy (2002). The post-event abnormal returns confirm the importance of the proportion sold. Low exercises yield consistently positive abnormal returns, whilst High exercises precede negative abnormal returns. For example, the six-month post-exercise abnormal return is 1.32% (t-statistic of 2.13) and –2.19% (t-statistic of –2.95) after Low and High exercises respectively. The difference is 3.52% (t-statistic of 3.63). These results are consistent with exercises being approximately equivalent to stock sales or purchases depending on the proportion of the exercise sold. Executives not only time their exercises to take advantage of short-term price appreciation, but their sale decisions are well informed. In contrast to previous research, executives in the UK do use their information advantage when exercising their executive stock options.

This analysis assumes post-exercise returns are independent of pre-exercise returns. If executives' sale decisions are simply conditioned on pre-exercise performance, we could not conclude that they use their information advantage. Table 2 suggests a relation between pre- and post-exercise returns. Specifically, there is evidence of a reversal of pre-exercise returns. Table 3 examines this by sorting the exercises according to their pre-exercise abnormal returns, and denoting them as 'Good' and 'Poor' respectively. Exercises in the former category exhibit generally positive post-exercise abnormal returns, whilst the reverse is the case for exercises with lower pre-exercise returns. The Poor sample significantly underperforms the Good sample over the subsequent six and nine-month windows. It is therefore

unlikely that a relation between pre- and post-exercise abnormal returns can explain the results in Table 2.

Table 3 also subdivides the two samples by the proportion of stock sold. Both the Good (Low – High) and Poor (Low – High) are positive and significant for windows of three months or more post-exercise, i.e. irrespective of pre-exercise returns, the low sale proportion outperform the high sale proportion. Post-exercise abnormal returns cannot be explained by the immediate pre-exercise returns. Conditioning on the proportion of stock sold therefore yields significant information over and above that contained in previous stock returns.

Table 3

## 5.1. OPTION MONEYNESS

This section categorises exercises by the moneyness of the option at the time of exercise. The moneyness of the option is the ratio of the stock price to the exercise price, and will be an important consideration for executives when exercising since it impacts on the cost of 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 the exercise of near-the-money options expensive. Since deep in-the-money options have little time value, the loss associated with exercising is lower. Furthermore, the option's delta approaches one as moneyness increases, so holding the option becomes approximately equivalent to holding the stock. Consequently, near-the-money exercises are likely to be

information driven, whilst deep in-the-money exercises are likely to be motivated by the need to diversify.

The exercise data is incomplete, with approximately ten percent of exercises missing an exercise price. The remaining 2914 exercises, ranked by moneyness, are split into two and categorised as near-the-money and deep in-the-money. The mean moneyness of the two samples is 1.61 and 4.71. Table 4 presents the results. Deep in-the-money exercises follow large positive abnormal returns that are significantly greater than those prior to near-the-money exercises. This is not surprising since pre-exercise run-up is likely to influence the moneyness at exercise. More interestingly, we find significant post-exercise negative abnormal returns at all horizons for the near-the-money exercises, whilst corresponding returns for the deep in-the-money exercises are small and insignificant. For example, over a six-month window, abnormal returns are –1.57% (t-statistic of –2.16) and –0.03% (t-statistic of –0.04) respectively.

Table 4

These results suggest that the near-the-money exercises are associated with poor subsequent stock price performance, in line with them being expensive due to the loss of time value. A near-the-money exercise should therefore be viewed as a negative signal, consistent with our hypothesis that they are likely to be induced by negative private information. Conversely, deep in-the-money exercises are uninformative. As moneyness increases, so the option position approximates to a position in the underlying stock, and diversification rather than information becomes the dominant motive for exercising.

Whilst intuitively appealing, this analysis implicitly assumes that the sale proportion and moneyness are independent. It would, however, be realistic to expect

executives to sell a higher proportion of a near-the-money exercise given that a near-the-money exercise requires proportionately more stock to be sold to fund the exercise. Moreover, the profit generated, together with the resulting tax liability, will be correspondingly lower. Disentangling these factors is crucial in determining whether post-exercise negative abnormal returns are related to a high sell proportion or the moneyness of the option at exercise. We examine this by measuring the post-exercise performance of exercises categorised by both moneyness and proportion sold.

Table 5

The near and deep in-the-money samples from Table 4 are subdivided by the proportion of stock sold. The four samples, a Low and High sale proportion for both near and deep in-the-money exercises, are presented in Table 5. The proportion sold remains an important indicator of post-exercise returns, irrespective of option moneyness. Overall, however, there is evidence that near-the-money exercises are more informative than deep in-the-money exercises (consistent with the latter being motivated by diversification). If the postponement of a tax liability is an important consideration for executives, this will be apparent in the deep in-the-money exercises, where the incentive to hold and delay paying tax will be strongest. Despite this, there is no evidence that a low proportion sale is less informative for these exercises than for near-the-money exercises.

## 5.2. FIRM SIZE

This section examines whether the results are driven by a small firm effect. Exercise decisions by executives in small firms may be relatively more informed if

investors are at a greater informational disadvantage in these firms (see, for example, Lakonishok and Lee (2001)). Although Carpenter and Remmers (2001) do not find significant differences between large and small firm post-exercise abnormal returns, exercises by top managers in smaller firms precede significantly negative abnormal returns. Ranking exercises by firm size, we partition the sample in two and then subdivide each by the proportion sold. The results are presented in Table 6.

Table 6

There is no difference between the small and large firm abnormal returns. Low and high proportion sales continue to produce signals in line with those found above, both for small and large firms. The difference in six-month post-exercise abnormal returns between low and high sale proportion exercises is 3.5% (t-statistic of 2.64) for the smaller firms, and 3.22% (t-statistic of 2.34) for the larger firms. Thus there is no evidence consistent with executives' informational advantage being related to firm size. Furthermore, these results reaffirm the importance of the proportion sold.

## 5.3. AGE OF EXECUTIVE

Finally, we examine the importance of executive rank in determining post-exercise abnormal returns. Executive rank is generally considered an important determinant of the information content of an insider's transaction. The higher the rank of the executive, the better informed they should be about the firm's prospects. Carpenter and Remmers (2001) find some evidence to support this when they combine executive rank with firm size. They obtain six-month post-exercise abnormal returns of –5.22% for exercises by high ranked insiders in smaller firms.

We are unable to determine executive rank, but we do have some information on the age of the executive at exercise. This may be an important information signal, since there is likely to be a correlation between age and position within the firm, implying that older executives are better informed. In addition, age may have some bearing on both diversification and risk aversion. Hall and Murphy (2002) show that the desire to exercise and sell will be strongest amongst undiversified and risk averse executives, both inclined to vary with age. If executives' total wealth increases with age, then the proportion of their wealth represented by their option position will decline with age, making them relatively more diversified. Conversely, risk aversion is likely to increase with age. Overall, whether option exercises by older executives are more informative depends on the importance of risk aversion.

Table 7

The data on age is not comprehensive, being available only for a subset of exercises. However, we continue with a restricted sample because the analysis of age is unique to both executive stock options and executive trades in general. Excluding exercises without data on the executive's age reduces the sample by approximately 30% to 2302 exercises. The first row of Table 7 gives the results for this reduced sample, and shows that returns are in line with those for the complete sample. There is therefore no evidence that this restricted sample is biased.

We rank exercises by the age of the executive, and divide the sample equally in two – young and old. This is a somewhat arbitrary division, with old being categorised as those aged over 52. We then subdivide by the proportion sold. The smaller sample sizes means that significance levels are generally lower than those reported above. Whilst there is little evidence of a significant difference between old and young post-exercise returns, the results suggest that the signals generated from

exercises by younger executives are consistently more informative than those generated from the corresponding exercises by older executives. Given the assumption that older executives are better informed and more diversified, this implies that risk aversion may play an important part in determining executives' exercise decisions. Whilst we are unable to draw firm conclusions from this, a more detailed examination on a larger sample would be of interest. In particular, it would increase our understanding of the extent to which executives are prepared to ignore their private information.

## 6. Conclusion

Executives derive increasing proportions of their remuneration from stock based incentive schemes such as executive stock options. The ability to use private information in their exercise decisions impacts directly upon their value and the remuneration they receive. This study identifies that there is information content in executive stock option exercises, contrary to the overall conclusions of previous research. Not only do executives time their exercises to capture gains, but the proportion of stock sold at exercise is an important determinant of the direction of post-exercise abnormal returns. The sale of a low proportion of the stock acquired is consistent with subsequently superior stock return performance, whilst the reverse is observed following the sale of a high proportion of stock. These findings indicate insiders do make use of their private information when deciding when to exercise their stock options, and how much of the stock acquired they should sell. In contrast to previous research on insider transactions, the sale of a high proportion of stock (analogous to a sale) is consistently more informative than the sale of a low

proportion of stock (categorised as a purchase). The importance of the proportion of stock sold at exercise is robust to both option moneyness and firm size. The moneyness results are consistent with the exercise of a near-the-money option indicating negative private information because exercising such an option is expensive.

Our finding that the sale of a high proportion of stock is more informative than the sale of a low proportion of stock is consistent with the possibility that postponing a tax liability provides a motive for executives to hold the stock acquired at exercise. It is also consistent with the expectation (as expressed in the Greenbury Report) that executives should be encouraged to hold the stock they acquire. Whilst we do not dispute that a tax consideration may play a role in motivating executives' sell decisions, it is incapable of explaining why executives exercise rather than continue to hold the option. A more likely explanation is the attempt to make room for the grant of additional options. In addition, the specific results we present in relation to option moneyness are inconsistent with decisions being motivated by the attempt to delay a tax liability. We conclude that our analysis provides support for private information as being an important factor motivating executives' exercise and sell decisions.

Future research needs to consider the implications of the trade-off between incentive alignment and insufficient portfolio diversification. The contrast between our results and those for the US shows that this trade-off is very real. Executives in the UK make use of their private information when exercising their stock options because they are more diversified than their US counterparts. If executives ignore their private information, then the value they place on their options is significantly less than their cost to shareholders. Not only does this make such remuneration

relatively expensive for shareholders, it means that the alignment of incentives is weaker than shareholders might expect. A better understanding of the implications of this trade-off is needed in order to determine the appropriate proportion of executive remuneration that is linked to shareholder wealth.

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Table 1 UK Executive Stock Option Exercises - Summary Statistics

| | No. of Exercises | No. of Firms | No. of Event Days | Mkt. Cap. £m | Moneyness |
|---|---|---|---|---|---|
| All | 3244 | 765 | 707 | 2909 | 3.16 |
| Low | 1727 | 583 | 600 | 2687 | 3.35 |
| High | 1517 | 484 | 566 | 3162 | 2.93 |

All represents all exercises occurring between July 1995 and July 1998 for which we have corresponding returns data. Low represents those exercises that are accompanied by a sale of 50% or less of the stock purchased through the exercise. High represents exercises accompanied by a sale of more than 50% of the stock purchased. 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. Mkt. Cap. is the mean market capitalisation of the firm at the time of exercise. Moneyness is the mean of the ratio of the stock price to the exercise price at the time of exercise.

Table 2 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 |
| All | 2.26<br>[8.79] | -0.10<br>[-0.51] | -0.45<br>[-1.30] | -0.31<br>[-0.60] | -0.75<br>[-1.06] |
| Low | 1.01<br>[3.02] | 0.23<br>[0.90] | 0.73<br>[1.80] | 1.32<br>[2.13] | 1.77<br>[2.08] |
| High | 4.02<br>[11.73] | -0.42<br>[-1.34] | -1.72<br>[-3.36] | -2.19<br>[-2.95] | -3.46<br>[-3.47] |
| Low - High | -3.00<br>[-6.27] | 0.65<br>[1.61] | 2.45<br>[3.75] | 3.52<br>[3.63] | 5.23<br>[3.99] |

All denotes the mean percentage abnormal return for the complete sample of exercises, while Low High represent the corresponding abnormal returns for exercises accompanied by a sale of 50% or less more than 50% of the stock purchased at exercise. Low - High is the difference between the Low and High 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 firms abnormal return each day is that firms return minus the firms respective size/momentum portfolio return. The corresponding t-statistics, measuring significance from zero, are in brackets.

Table 3 Abnormal Returns around Option Exercises Categorised by Previous Stock Performance and Proportion Sold

| Stock Option Exercises July 1995 – July 1998 | | | | | |
|---|---|---|---|---|---|
| | -30 to 0 | +30 days | +3 months | +6 months | +9 months |
| Good | 8.87<br>[22.28] | -0.05<br>[-0.17] | -0.22<br>[-0.44] | 0.99<br>[1.33] | 1.14<br>[1.14] |
| Poor | -4.74<br>[-15.97] | -0.36<br>[-1.30] | -0.88<br>[-1.95] | -1.72<br>[-2.56] | -2.67<br>[-2.97] |
| Good - Poor | 13.61<br>[27.41] | 0.31<br>[0.77] | 0.66<br>[0.98] | 2.72<br>[2.70] | 3.81<br>[2.84] |
| Good Low-High | 0.29<br>[0.39] | 1.06<br>[1.91] | 1.87<br>[2.10] | 2.61<br>[1.94] | 5.38<br>[2.94] |
| Poor Low-High | -2.86<br>[-4.82] | 0.94<br>[1.08] | 3.51<br>[3.95] | 5.06<br>[3.90] | 6.35<br>[3.76] |

Good and Poor represent the mean percentage abnormal returns for exercises that follow relatively superior and inferior previous returns respectively. The previous returns are the abnormal returns measured over the 30 days prior to the option exercise. Good – Poor is the difference between the Good and Poor abnormal returns. Low High represent exercises accompanied by a sale of 50% or less more than 50% of the stock purchased at exercise. Good Low - High is the difference between the Low and High abnormal returns for exercises following superior previous returns. Poor Low - High is the difference between the Low and High abnormal returns for exercises following inferior previous 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 firms abnormal return each day is that firms return minus the firms respective size/momentum portfolio return. The corresponding t-statistics, measuring significance from zero, are in brackets.

Table 4 Abnormal Returns around Option Exercises Categorised by Moneyness

| Stock Option Exercises July 1995 – July 1998 | | | | | |
|---|---|---|---|---|---|
| | -30 to 0 | +30 days | +3 months | +6 months | +9 months |
| All | 2.22<br>[8.21] | -0.25<br>[-1.16] | -0.79<br>[-2.18] | -0.76<br>[-1.39] | -1.14<br>[-1.52] |
| NTM | 1.48<br>[4.56] | -0.64<br>[-2.33] | -1.33<br>[-2.78] | -1.57<br>[-2.16] | -2.02<br>[-2.03] |
| ITM | 3.00<br>[7.72] | 0.12<br>[0.37] | -0.22<br>[-0.41] | -0.03<br>[-0.04] | -0.38<br>[-0.36] |
| NTM - ITM | -1.52<br>[-3.00] | -0.76<br>[-1.86] | -1.11<br>[-1.54] | -1.54<br>[-1.46] | -1.64<br>[-1.13] |

All denotes the mean percentage abnormal return for the complete sample of exercises, while NTM and ITM represent the corresponding abnormal returns for exercises that are near-the-money and deep in-the-money respectively. NTM - ITM is the difference between the near-the-money and the deep in-the-money 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 firms abnormal return each day is that firms return minus the firms respective size/momentum portfolio return. The corresponding t-statistics, measuring significance from zero, are in brackets.

Table 5 Abnormal Returns around Option Exercises Categorised by Moneyness and Proportion Sold

| Stock Option Exercises July 1995 – July 1998 | | | | | |
|---|---|---|---|---|---|
| | -30 to 0 | +30 days | +3 months | +6 months | +9 months |
| NTM Low | 0.30 [0.71] | -0.26 [-0.70] | 0.25 [0.42] | 0.56 [0.60] | 0.78 [0.61] |
| NTM High | 2.98 [7.46] | -1.16 [-2.97] | -2.99 [-4.60] | -3.81 [-3.87] | -4.84 [-3.71] |
| NTM Low – High | -2.68 [-4.58] | 0.90 [1.67] | 3.24 [3.68] | 4.36 [3.23] | 5.61 [3.09] |
| ITM Low | 1.56 [2.99] | 0.43 [1.19] | 0.58 [1.00] | 0.87 [1.02] | 1.56 [1.34] |
| ITM High | 5.63 [9.41] | -0.22 [-0.43] | -1.38 [-1.41] | -1.18 [-0.93] | -3.19 [-1.89] |
| ITM Low – High | -4.07 [-5.14] | 0.65 [1.04] | 1.96 [1.72] | 2.05 [1.34] | 4.75 [2.32] |

NTM and ITM represent the mean percentage abnormal returns for exercises that are near-the-money and deep in-the-money respectively. Low High represent exercises accompanied by a sale of 50% or less more than 50% of the stock purchased at exercise. Thus NTM Low represents the abnormal return for near-the-money exercises that have a corresponding low sale proportion, while NTM High represents the abnormal return for near-the-money exercises that have a corresponding high sale proportion. NTM Low - High is the difference between the Low and High abnormal returns for the near-the-money exercises. ITM Low - High is the difference between the Low and High abnormal returns for the deep in-the-money exercises. 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 firms abnormal return each day is that firms return minus the firms respective size/momentum portfolio return. The corresponding t-statistics, measuring significance from zero, are in brackets.

Table 6 Abnormal Returns around Option Exercises Categorised by Size of Firm and Proportion Sold

| Stock Option Exercises July 1995 – July 1998 | | | | | |
|---|---|---|---|---|---|
| | -30 to 0 | +30 days | +3 months | +6 months | +9 months |
| Small Low | 1.40 [2.88] | 0.32 [0.96] | 1.06 [1.84] | 1.37 [1.60] | 1.57 [1.37] |
| Small High | 3.85 [7.76] | -0.27 [-0.60] | -1.32 [-1.76] | -2.14 [-2.11] | -3.42 [-2.64] |
| Small Low – High | -2.45 [-3.52] | 0.59 [1.04] | 2.37 [2.52] | 3.50 [2.64] | 4.98 [2.88] |
| Large Low | 0.48 [1.19] | 0.03 [0.09] | 0.18 [0.29] | 1.13 [1.22] | 2.05 [1.62] |
| Large High | 4.08 [9.63] | -0.52 [-1.39] | -2.13 [-3.30] | -2.09 [-2.07] | -3.40 [-2.51] |
| Large Low – High | -3.61 [-6.17] | 0.56 [1.04] | 2.31 [2.61] | 3.22 [2.34] | 5.45 [2.94] |

Small and Large represent the mean percentage abnormal returns for exercises in firms categorised as small and large market capitalisation respectively. Low High represent exercises accompanied by a sale of 50% or less more than 50% of the stock purchased at exercise. Thus Small Low represents the abnormal return for exercises of firms with a small market capitalisation that have a corresponding low sale proportion, while Small High represents the abnormal return for exercises of firms with a small market capitalisation that have a corresponding high sale proportion. Small Low - High is the difference between the Low and High abnormal returns for the small firms. Large Low - High is the difference between the Low and High abnormal returns for the large firms. 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 firms abnormal return each day is that firms return minus the firms respective size/momentum portfolio return. The corresponding t-statistics, measuring significance from zero, are in brackets.

Table 7 Abnormal Returns around Option Exercises Categorised by Age of Executive and Proportion Sold

| Stock Option Exercises July 1995 – July 1998 | | | | | |
|---|---|---|---|---|---|
| | -30 to 0 | +30 days | +3 months | +6 months | +9 months |
| All | 2.62<br>[8.88] | -0.15<br>[-0.62] | -0.61<br>[-1.55] | -0.48<br>[-0.81] | -0.77<br>[-0.93] |
| Old Low | 0.53<br>[1.17] | 0.20<br>[0.56] | 0.65<br>[1.17] | 1.09<br>[1.28] | 2.23<br>[1.83] |
| Young Low | 2.45<br>[4.20] | 0.35<br>[0.81] | 0.87<br>[1.28] | 2.22<br>[2.12] | 3.52<br>[2.55] |
| Old – Young Low | -1.93<br>[-2.61] | -0.15<br>[-0.27] | -0.21<br>[-0.24] | -1.11<br>[-0.84] | -1.28<br>[-0.70] |
| Old High | 3.96<br>[8.43] | -0.33<br>[-0.84] | -1.26<br>[-2.03] | -1.50<br>[-1.57] | -2.93<br>[-2.24] |
| Young High | 3.83<br>[8.69] | -0.46<br>[-1.17] | -1.84<br>[-2.80] | -2.30<br>[-2.40] | -3.76<br>[-2.94] |
| Old – Young High | 0.13<br>[0.20] | 0.13<br>[0.23] | 0.58<br>[0.64] | 0.80<br>[0.60] | 0.83<br>[0.45] |

All denotes the mean percentage abnormal return for the complete sample of exercises that have associated data on the age of the executive at the time of exercise. Old and Young represent the abnormal returns for exercises categorised as being by the older and younger executives respectively. Low High represent exercises accompanied by a sale of 50% or less more than 50% of the stock purchased at exercise. Thus Old Low represents the abnormal return for exercises by the older executives that have a corresponding low sale proportion, while Old High represents the abnormal return for exercises by the older executives that have a corresponding high sale proportion. Old - Young Low is the difference in abnormal return between the Old and Young exercises that have a corresponding low sale proportion. Old - Young High is the difference in abnormal return between the Old and Young exercises that have a corresponding high sale proportion. 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 firms abnormal return each day is that firms return minus the firms respective size/momentum portfolio return. The corresponding t-statistics, measuring significance from zero, are in brackets.