Exploring the Link between Information Quality and Systematic Risk: Corporate Insider Trading as an Illustrative Case

Robert Faff, David Hillier, and Suleiman Mohamed*

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*The Authors are from Monash University, University of Strathclyde, and Institute of Finance Management, respectively. Address for correspondence: David Hillier, Department of Accounting and Finance, University of Strathclyde, Glasgow, UK, G4 0LN., e-mail: d.j.hillier@strath.ac.uk. All errors are our own.

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Abstract

We extend Kim and Verrechia's (1991, 1997) model to show that the rationale underlying their work can be applied not only to total risk but also to systematic risk. To illustrate this enhanced model, we examine the impact of information quality on systematic risk of equities on the LSE. Specifically, our empirical tests center on corporate insider trading and the empirical results indicate that systematic risk significantly increases subsequent to this event. Consistent with the insights provided by our model, the change in systematic risk is increasing in the ratio of event-related to pre-event information quality. Our results are consistent with similar research by Easley, Hvidkjaer and O'Hara (2002) and have implications for all empirical work attempting to model security returns around firm and macroeconomic announcements.

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1 Introduction

The hypothesis that relative information quality around price sensitive announcements can lead to a change in the return dynamics of asset pricing has been examined in several papers. Much of this work has been based on the models of Pfleiderer (1984), Grundy and McNichols (1989), Holthausen and Verrecchia (1990) and Kim and Verrecchia (1991, 1997), Easley, Kiefer and O'Hara (1996, 1997), Easley, Kiefer, O'Hara and Paperman (1996), Easley, O'Hara and Paperman (1998), Veronesi (2000) and Easley, Hvidkjaer and O'Hara (2002). They predict that the dynamics underlying asset returns, trading volume and return volatility will change during periods of differential information quality. Unfortunately, consistent empirical verification of these predictions has remained elusive.

Of most relevance to the current study are those papers that focus on volatility.[1] In general, high levels of observed volatility are experienced during announcement periods compared to other times.[2] Consistent with Kim and Verrecchia (1991, 1997), it has been shown that there is also an inverse relationship between the level of predisclosed information and the stock price reaction to an event.[3]

[1] With respect to trading volume, Bamber (1987), Atiase and Bamber (1994) and Gillette, Stevens, Watts, and Williams (1999) have reported a positive relationship between volume and information quality (as proxied by absolute price changes) whereas Ziebart (1990) and Bamber, Barron, and Stober (1997) and Barron and Karpoff (1997) have reported a negative or zero relationship between volume and announcement information precision.

[2] For example, Beaver (1968), May (1971), Hagerman (1973), Morse (1981), McNichols and Manegold (1983), and Patell and Wolfson (1981, 1984) for the US and Brookfield and Morris (1992) and Pope and Inyangete (1992) for the UK.

[3] See for example, Grant (1980), Morse (1981), Atiase (1985, 1987), Bamber (1987) and Potter (1992).

The volatility of stock returns is an appropriate measure of risk for portfolios. However, for individual securities other measures such as systematic risk or beta become more important. Changes in a firm's systematic risk can be attributed to changes in earnings (Ball and Kothari (1991)), changes in the degree of operating and financial leverage (Lev (1974), and Mandelker and Rhee (1984)), and other factors such as pre-announcement levels of market risk (Blume (1971, 1975)). In addition, if a market is informationally efficient, the observed systematic risk of a security would also be expected to change if an announcement pertained to any of these aforementioned factors.

In contrast to studies of volatility and information quality, there has been no analytical or empirical work regarding the association between systematic risk and the quality (precision) of information. How the quality of pre- and post-announcement period information impacts upon systematic risk is an interesting issue. Traditional finance theory argues that changes in information levels themselves should not affect the beta of a company. However, we show that if Kim and Verrecchia's (1991, 1997) predictions regarding information quality and volatility are valid, one should also expect to see a corresponding impact of relative information quality on the levels of systematic risk.

In this paper, we extend the model of Kim and Verrechia (1997) to examine the effect of information quality on a firm's systematic risk and test the resulting hypotheses derived from our extension. Our model predicts an analytical relation between the systematic risk of asset returns and the unobservable theoretical precision (quality) of a public announcement. After developing an analytical relation between beta and the quality of news disclosed, we use proxies for information quality to empirically examine the link between systematic risk, the amount of pre-announcement information, and the quality of news released to the market.

We exemplify the application of this model by examining corporate insider trading. By their very nature, corporate insider trades are unanticipated events. Previous research has shown that on average, insider trades are associated with substantial changes in share valuation.[4] Recent work has also shown that when corporate insiders trade, not only do they time when their trade takes place but also that there is a significant associated volume reaction to their trade (Hillier and Yadav (2002)). John and Mishra (1990) and John and Lang (1991) show that insider trades signal private information to the market especially when investor expectations are inconsistent with managers' own valuation of their firms. It would be expected then that information quality would be poor prior to insider trade events and much improved subsequently.

Our results strongly support the hypothesis that systematic risk increases around price sensitive announcements. This increase is directly related to the relative information quality in the market around an event. Subsequent to insider trades, systematic risk increases by approximately 13% with buy trades causing a growth of nearly 22% in beta compared to 6% for sale trades. This result is consistent with empirical research into the area, which reports substantially higher abnormal returns for insider buys than for sales. Smaller firms with insider buying activity experience the greatest shift in systematic risk with an increase of approximately 30%, a movement large in comparison to FT-100 companies who experience systematic risk growth of

[4]See for example, Baesel and Stein (1979), Seyhun (1986), Lin and Howe (1990), Meulbroek (1992) and Petit and Venkatesh (1995).

13%. Using a direct measure of information quality around announcements, namely, relative signed trading volume, we show that insider trades that significantly increase information quality are associated with systematic risk growth of approximately 35%.

Finally, we investigate whether the high abnormal returns associated with corporate insider activity are also (at least) partly explained by the increases in risk at that time. Based on our analysis, it appears that changes in systematic risk are not the main reason for the return patterns around their occurrence. Although the magnitude of abnormal returns is lower once systematic risk changes are controlled, they are still statistically significant.

The paper is organized as follows. In section two, our extension to Kim and Verrechia's (1991) model is presented. Section three describes the data used along with some salient institutional characteristics, while section four contains our main empirical results. Finally, section five concludes the paper.

2 The Model

In this section we seek to obtain an analytical expression for the relation between shifts in systematic risk around public announcements, the quality of an announcement and the quality of pre-announcement information present in the market. Our model builds on the rational expectations model developed by Kim and Verrecchia (1991).

Kim and Verrechia (1991) showed that the price change of assets in an economy in the period of a value-affecting announcement is related to the relative quality of information released by that announcement, the precision of pre-announcement information in the market and the expected change in value of the asset as a result of the event.

$$P_2 - P_1 = \frac{n}{K_2}(y_2 - P_1) \tag{1}$$

where P_1 and P_2 are equilibrium prices in periods 1 and 2 respectively; y_2 is the observed value of the asset in period 2 and is defined as $y_2 = \mu + \eta_2$, where η_2 is normally distributed with mean zero and precision n, and μ is the true value of the asset; n is the precision of new information contained in an announcement and K_2 is the average total precision of all information in period 2 (including the announcement). K_2 is defined as $K_2 = (h + m + n + s + r^2 s^2 t)$ where h is the precision of period 1 investor beliefs about μ; m is the precision of y_2; s is the average precision of private information regarding the firm's value; r is the average risk tolerance of investors in the market and t is the average precision of liquidity demand.

To obtain a functional relationship between the systematic risk of a security, the precision of an announcement, and the quality of the pre-announcement information, we define the average quality of pre-announcement information, $\theta = (h + m + s + r^2 s^2 t)$, so that $K_2 = (\theta + n)$. Substituting $(\theta + n)$ for K_2 in [1] and rearranging, gives:

$$P_2 - P_1 = \frac{n}{\theta}(y_2 - P_2) \tag{2}$$

To obtain the announcement period return, [2] is divided by P_1 to give:

$$R_{ja} = \frac{P_2 - P_1}{P_1} = \frac{n}{\theta}\left(\frac{\mu - P_2}{P_1} + \frac{\eta_2}{P_1}\right) \tag{3}$$

Defining the expected liquidating return to be $R_{jL} = (\mu - P_2)/P_1$, equation [3] can be expressed as:

$$R_{ja} = \frac{P_2 - P_1}{P_1} = \frac{n}{\theta}(R_{jL} + \frac{\eta_2}{P_1}) \tag{4}$$

Under the assumption that the single index market model is a valid representation of the return generation process of security j:

$$R_{ja} = \alpha_{ja} + \beta_{ja} R_{ma} + \xi_{ja} \tag{5}$$

where α_{ja}, R_{ma}, and ξ_{ja} denote the announcement period values for the market model alpha, market return, and the residual returns for security j respectively, the systematic risk of a security in the vicinity of an announcement can now be expressed in terms of information quality.

$$\beta_{ja} = \frac{\left(\frac{n}{\theta}\left[R'_{jL} + \frac{\eta_2}{P_1}\right] - [\alpha_{ja} + \xi_{ja}]\right)}{R_{ma}} \tag{6}$$

Although equation [6] provides an insight into the determinants of a firm's systematic risk in terms of information quality, it is perhaps of more interest to examine the change in systematic risk around an event with respect to information precision. Standardising K_2 to be equal to 1 allows [6] to be expressed in terms of n where θ = *1-n*. Taking the first derivative of [6] with respect to n and θ demonstrates the effect of pre-announcement and announcement period information quality on the systematic risk of firms.

$$\frac{\partial \beta_{ja}}{\partial n} = \frac{R_{ja}}{n R_{ma}} \tag{7}$$

$$\frac{\partial \beta_{ja}}{\partial \theta} = -\frac{R_{ja}}{n\theta R_{ma}} \tag{8}$$

Ceteris Paribus, the relationships in [7] and [8] predict that the systematic risk of a security at the time of a public announcement will almost always be increasing in the precision of the announcement, n, and inversely related to the quality of pre-announcement private and public information, θ.

An interesting testable implication of equation [6] is that securities with relatively less quality of pre-announcement information will experience larger shifts in systematic risk around public news releases compared with other securities that have higher quality pre-announcement information. To the extent that the level of pre-announcement information for firms is increasing in firm size, equation [6] predicts that the public announcements of small firms should be accompanied by a relatively strong price reaction not only as a result of new information but also through a shift in systematic risk.

3 Data

Our sample of corporate insider trading data is drawn from the Directorwatch database, an information service that provides data on all trades by UK company directors. The data consists of the name of the firm, the date of the trade, whether it was a buy or sell, the name of the director, the number of shares traded, the transaction price and the post-transaction holding of the director in the firm.

Our sample of insider trades spans the time period 1 August 1994 to 31 May 1996. In the UK, any director of an exchange-listed firm is required to notify their company within five days of trading in the company's securities.

The company in turn, must notify the London Stock Exchange within one day of notification of trading by the director. Thus there is a potential lag in the announcement of the insider trade by up to six days. Our data source allows us to bypass this problem by using the date of the transaction instead of the announcement date.

The range of corporate insiders that are required to report their dealings in a firm is considerably narrower in the UK than in the US and other countries. US studies of insider trading have defined insiders to be any corporate employee (in addition to investors that hold greater than 10% of all outstanding shares).[5] However, because of reporting restrictions UK insider trading studies [Pope, Morris and Peel (1990); Gregory, Matatko, Tonks and Purkis (1994); Hillier and Marshall (2002a)] have defined an insider to consist only of directors in a company.[6]

As a result, the number of insider transactions in studies using data from the United Kingdom is considerably smaller than in comparable US studies. However, Seyhun (1986) has analysed the performance of US insider trades by class of insider, and found that directors' trades appeared to contain the most information relevant for share revaluation. Consequently, we believe that our sample of trades can be used to make comparisons with other insider trading studies.

The daily log returns data on the FT All Share Index of the London stock exchange are used as the proxy for the market returns series and were

[5] See for example, Finnerty (1976); Keown and Pinkerton (1981); Rozeff and Zaman (1988); Seyhun (1988a,b); Loderer and Sheehan (1989); Lin and Howe (1990); Lee, Mikkelson and Partch (1992).

[6] Eckbo and Smith (1998) have studied the performance of insider trades in the Norwegian stock exchange. Their definition of insider is similar to US studies.

collected from Datastream. All data relating to the firm specific information proxies used in this study are collected from Datastream.

In our tests of information quality before and after firm-specific events, we utilize a signed volume measure. To construct this measure, we generate aggregate daily signed volume data for all stocks traded on the London Stock Exchange from transactions and quotes data provided by the exchange.[7]

Each transaction record includes the name of the traded stock, the transaction price, the date and time of the trade, the number of shares traded and the dealing capacity of the buyer and seller (i.e. whether they acted as an agent representing an order from the public or as a principal in the transaction).[8]

Following Hansch, Naik and Viswanathan (1998), we do not report results based on the use of the pound sterling value of trading volume but instead use standardised measures. The broad differences in volume across securities trading on the London Stock Exchange will bias any cross-sectional aggregation of results towards larger, more liquid securities. The process of standardising the time series of signed volume controls for these differences and allows for the aggregation and comparison of signed volume across stocks.

Each security's pound sterling signed trading volume is standardised as follows: LetQ_t^j denote the net aggregate level of trading volume in stock j at time t. For every stock we consider all public trades in which any dealer executes as a principal in the trade. We also defineq_t^j to be positive (negative)

[7]Other studies that have used this data are Reiss and Werner (1993), Board and Sutcliffe (1995), Tonks and Snell (1995), Lai (1996), Gemmill (1996), Reiss and Werner (1996), Hansch, Naik and Viswanathan (1999) and Naik and Yadav (2003a, 2003b).

[8]This is an explicit identifier unlike the inferred identifier developed by Lee and Ready (1991) and used by many studies.

when a public trader sells (buys) q shares of stock j to (from) any dealer at time t. Thus for any day t, $Q_t^j = \sum q_s^j$.

To generate a daily signed trading volume series, we take the aggregate signed trading volume at the end of each day and combine them into a time series. For each signed trading volume series, the mean signed volume and standard deviation over the whole period are calculated and used to create a standardised daily signed volume measure: $V_t^j = \left(Q_t^j - \bar{Q}^j\right)/\sigma^j$. In this way, we create a standardised trading volume series that has an expected zero mean and unit standard deviation. For notational convenience we hereafter refer to standardised daily signed trading volume as 'signed volume'.

4 Tests and Results

We adopt a multi-stage event study methodology to test the hypothesis that systematic risk changes around firm-specific events. In the first stage, using data from 1 January 1986, a daily GARCH(1,1) return volatility series is estimated for each company and the market index. A Dimson-adjusted GARCH(1,1) beta series is then constructed as follows:[9]

$$\beta_{it}^{GARCH} = \frac{\sigma_{it}\rho_i}{\sigma_{mt}} + \frac{\sigma_{it}\rho_i}{\sigma_{mt-1}} \tag{9}$$

[9] The rationale behind the Dimson-adjusted GARCH(1,1) beta follows in the same vein as earlier work on non-synchronous trading and its effect on the measurement of systematic risk [see Scholes and Williams (1977), Dimson (1979), Fowler and Rorke (1983), Cohen et al. (1983a, 1983b)]. As a result of inefficiencies in the intertemporal dissemination of new information, illiquid securities would have observed betas smaller in magnitude than more liquid securities. Since our sample spans the full range of equities listed on the London Stock Exchange, non-synchronous trading effects are likely to be evident and an adjustment to beta is necessary.

where σ_{it} is the GARCH(1,1) standard deviation of company i at time t and σ_{mt} is the GARCH(1,1) standard deviation of the market index at time t. The correlation,ρ_i, between the two return series is assumed constant throughout the sample period.

Once the GARCH(1,1) beta series is constructed, a relative beta metric is generated and is defined as the ratio of the mean daily Dimson beta in the period t+11 to t+20 days over the mean daily Dimson beta in the period t-20 to t-11 days.

$$\beta_i^{REL} = \frac{\sum_{t=+11}^{+20} \beta_{it}^{GARCH}}{\sum_{t=-20}^{-11} \beta_{it}^{GARCH}} \tag{10}$$

Our first test centers on systematic risk changes around corporate insider buy and sell transactions. The buying and selling activities of corporate insiders elicit different reactions in the market. Insider buy trades are strongly associated with new information, with strong price increases reported for several months on average after a transaction date. Insider sales on the other hand do not cause similar price decreases in affected stocks, with only muted price changes subsequent to a trade.[10] Recognizing that buy transactions provide stronger information signals to the market, it would be expected that if our model is valid, systematic risk would increase by a greater amount for buy trades than sell trades.

The results in Table 1 confirm our model's main proposition. Systematic risk increases by over 21% in the days subsequent to an insider buy

[10]See Finnerty (1976); Keown and Pinkerton (1981); Rozeff and Zaman (1988); Seyhun (1988a,b); Loderer and Sheehan (1989); Lin and Howe (1990); Lee, Mikkelson and Partch (1992) for the US and Hillier and Marshall (2002a) for the UK.

transaction and by approximately 5% after insider sales. For buy trades, the increase is particularly striking and a comparison of risk increases across buy and sell transactions leads to a rejection of the hypothesis that the means of both samples are equal (t=11.50).

It is possible that systematic risk would change because of a perceived shift in the risk of the operations of the insider's firm. However, this is unlikely given that very little information is ever released to the market concerning the reason for an insider's transaction. John and Mishra (1990) and John and Lang (1991) show that corporate insider trading may be used by managers to signal information to the market, especially if the consensus valuation of a company's stock is erroneous or imprecise. The pattern of abnormal returns around insider trading as recorded by Seyhun (1988a, b), Lin and Howe (1990) and others is also very similar to that of a contrarian strategy. Insiders buy after poor performance and sell after good performance. The fact that the market reacts to the insider trade without full cognizance of the reasons behind the transaction could translate into an observed increase in systematic risk in the period immediately after the trade. This argument, which provides the basic intuition behind our model, is subjected to further tests below.

To provide more insight into the beta movements around insider buy trades we examine the changes in systematic risk for companies grouped by the market value classifications. A firm's market value is a very strong indicator of the level of investor and analyst interest in the fortunes of a stock. Large companies are closely followed by a vast number of analysts compared to much smaller firms whose shares are traded very infrequently in the financial markets. Banz (1981) documented that small firms experienced not only higher returns than large firms but also had higher systematic risk. The higher systematic risk of small companies is likely due to a combination of uncertain future expectations, low economies of scale, undiversified operations and low information quality of the companies' ongoing operations.

An analysis of systematic risk changes around corporate insider trading events, conditioned on firm market value, provides a valuable insight into the effect of information quality on systematic risk. By treating the market value of a firm's equity as a proxy for information quality, the analysis of information differentials, corporate insider trading and systematic risk becomes directly measurable. Since the quality of information for small firms is likely to be poor in general, a corporate insider trading event will provide greater information relative to pre-event levels compared to larger firms, where information quality is on average high.

We separate all firms into four groupings as at the first day of trading each year based on their market value of equity. The four market value classifications, FT-100, FT-250, small companies greater than £30 million and small companies smaller than £30 million, act as an information quality proxy. Because of informational inefficiencies in the market for smaller stocks it is expected that relative systematic risk around corporate insider trading will be higher for smaller companies.

An examination of Table 2, Panel A shows the relationship between market value and systematic risk changes for our sample of corporate insider trades. For large FT-100 firms, systematic risk increases on average by thirteen percent compared to an increase of approximately seventeen percent for

FT-Midcap companies. Although the changes in systematic risk are economically significant, smaller firms experience much stronger shifts in systematic risk with the two small company groupings having an average increase of approximately 30% in beta around insider buying activity. As such, it is clear that the change in relative systematic risk around insider trading events is monotonically and negatively related to firm size.

Although each size grouping records a significant increase in beta around insider trades, it is of interest to see whether smaller firms experience a much larger change in relative beta. From Table 2, Panel B, which is a matrix of t-statistics from equality of means tests between the size groupings, it can be seen that there is a significant difference between the 'smallest' and (a) FT-100 and (b) FT-Midcap firms. Likewise there is a significant difference between the 'small' firm group and (a) FT-100 and (b) FT-Midcap firms. These findings reinforce evidence in favour of our model.

Our previous tests have addressed the issue of information quality differentials in an indirect way through the utilization of broad categorical proxy groupings for the unobserved information quality variable. Market value of equity is by its very nature a noisy measure of information quality. A dynamic measure that quantifies information quality around insider trades would more effectively detect information differentials across events than a simple market value grouping.

One measure of information quality, relative signed volume, directly quantifies information precision in markets over time. Market expectations before and after information events can be classified into two main groupings. When expectations are in agreement with event information, information efficiency predicts that market prices already incorporate this information and as a result, reaction to the announcement will be muted. On the other hand, when prior consensus expectations are in error or noisy, an information shock will occur upon release of news and the market will adjust its holdings accordingly. To capture this notion of differential expectations and market reaction to new information, we utilize the relative signed volume measure (total signed volume from event date, t, to day t+5 divided by total signed volume between day t-20 to t-1 day before insider trades) around events to assess the impact of information quality on systematic risk.

So as to maximize the power of our tests, we subdivide each expectations classification. Specifically, we group all insider trading events into four separate classifications:

1. Low pre-announcement information quality - relative signed volume large and positive.

2. Low pre-announcement information quality – relative signed volume large and negative.

3. High pre-announcement information quality – relative signed volume small and positive.

4. High pre-announcement information quality – relative signed volume small and negative.

This classification system captures all levels of information quality in markets around events.

In using this measure with insider trading, we need to acknowledge the issue of endogeneity - insiders can choose their optimal time to trade. Insider buying activity is strongly associated with positive abnormal returns, an indication of valuable and private information being released to markets. Information quality differentials before and after corporate insider trading is likely, therefore, to be very high leading to powerful tests of our model's central proposition.

In Table 3, all corporate insider trades are classified according to the relative strength of pre-event information. An examination of trades during periods of low information quality shows that systematic risk increases by, on average, greater than thirty percent, with large signed volume changes with the same sign before and after the trade leading to an average increase in beta of just over forty-six percent. Insider buying activity in periods of high quality information also leads to significant increases in systematic risk with an average increase of approximately eight percent.

In our final piece of analysis, we test to see whether the anomaly associated with corporate insider trading (abnormal performance of insider buying) is at least partly explained by the changes in systematic risk around these events. Given the very large observed changes in systematic risk resulting from an insider trade, it is possible that the very large abnormal returns following the trade are illusory and in fact a result of the shift in beta. This is especially so for insider buying activity where positive abnormal returns are recorded. If insider buying causes systematic risk to shift upwards, event study methodologies that do not incorporate this change would underestimate the expected returns (assuming a positive market risk premium) earned by the insider trade company. Although actual returns in the post-event period may not be larger than normal, because their expectation is biased downward it would appear that the company experiences positive abnormal performance.

We use the Dimson-adjusted GARCH(1,1) to calculate the abnormal return around the insider trade. The market model alpha is calculated in the usual fashion from a 120-day estimation period spanning days t-140 to t-21 days before the insider transaction. Gregory, Matatko, Tonks and Purkis (1994) report that most of the performance attributed to insider trading is actually caused by small firms, with virtually no abnormal performance in large firms. This finding is consistent with our information quality hypothesis and consequently we examine the performance of corporate insider trades over the four market value categories defined earlier.

From Table 4 it can be seen that for each of the market value groupings, measured abnormal performance is reduced when dynamic systematic risk changes are allowed in the event period. Although the drop in performance is consistent across all firm sizes, it is small with only an average drop of about 0.4% over a twenty-day period following the insider trade. It is clear from the results in Table 4 that information quality differentials are not the cause of the recorded insider trading performance in equities.

Moreover, for our sample period, insider buying performance is positive and significant for the largest companies as well as smaller firms. It thus appears that insider trading abnormal performance is robust to allowing for the change in systematic risk predicted by our model.

5 Conclusions

This article characterizes systematic risk changes before and after information events. We illustrate the empirical application of our model using corporate insider trading events in the UK stock market. We also test whether these shifts contribute to the observed market anomaly of corporate insider trading. There are several new findings.

Consistent with our model's central proposition, systematic risk changes in proportion to the relative level of pre- and post-announcement information quality. Small firms experience larger changes in systematic risk subsequent to information events due to the information inefficiencies in the market for these stocks.

When information quality prior to an event is particularly low, systematic risk grows substantially for a period afterwards. In addition, after controlling for information quality effects in systematic risk, although the recorded performance of corporate insider trading is less, abnormal returns are still strongly evident. A natural path for future research is to study the components of information quality in the context of Kim and Verrechia (1991) and how they impact on systematic risk changes around events.

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Tables

Table 1 – Relative GARCH(1,1) Betas Around Corporate Insider Trading Classified by Transaction Type

This table summarizes the relative betas around Corporate Insider Trades. A relative beta is measured for each trade in the sample and is constructed as follows: For the market return and for every company in the sample, a daily GARCH(1,1) volatility series is estimated. The daily Dimson-adjusted GARCH(1,1) beta is defined as:

$$\beta_{it}^{GARCH} = \frac{\sigma_{it}\rho_i}{\sigma_{mt}} + \frac{\sigma_{it}\rho_i}{\sigma_{mt-1}}$$

The relative beta is defined as the ratio of the mean daily Dimson beta in the period t+11:t+20 over the mean daily Dimson beta in the period t-20:t-11. Sample insider trade period is 1/8/1994 to 31/7/1996 although Dimson beta series is calculated from 1/1/1986. Market return is return on the FT All-Share index. All return data are collected from Datastream. ** Denotes Significance at 5% level.

	Full Sample	Buy Trades	Sell Trades
No. Trades	5,730	2,957	2,773
Mean Relative Beta	1.136	1.219	1.048
T-test ($H_0 : \mu = 1$)	18.16**	17.98**	5.90**
T-test ($H_0 : \mu_{Buy} = \mu_{Sell}$)			11.50**
Standard Deviation	0.567	0.661	0.429
Skewness	4.215	4.382	2.197
Kurtosis	43.346	41.227	13.824
Minimum	0.153	0.168	0.153
Maximum	9.263	9.263	8.677
Jarque-Bera Probability	0.000	0.000	0.000

Table 2 - Relative GARCH(1,1) Betas Around Corporate Insider Buy Trades Classified by Market Value

This table summarizes the relative betas around corporate insider buy trades categorized by equity market capitalisation. A relative beta is measured for each corporate insider trade in the sample and is constructed as follows: For the market return and for every company in the sample, a daily GARCH(1,1) volatility series is estimated. The daily Dimson-adjusted GARCH(1,1) beta is defined as:

$$\beta_{it}^{GARCH} = \frac{\sigma_{it}\rho_i}{\sigma_{mt}} + \frac{\sigma_{it}\rho_i}{\sigma_{mt-1}}$$

The relative beta is defined as the ratio of the mean daily Dimson beta in the period t+11:t+20 over the mean daily Dimson beta in the period t-20:t-11. Sample insider trade period is 1/8/1994 to 31/7/1996 although Dimson beta series is calculated from 1/1/1986. Market return is return on the FT All-Share index. All return data are collected from Datastream. ** Denotes Significance at 5% level.

Panel A: Summary Statistics

	FT-100 Firms	FT-Midcap Firms	Small Firms >£30million	Smallest Firms < £30million
No. Trades	546	1,137	176	1,090
Mean Relative Beta	1.134	1.169	1.273	1.301
T-test ($H_0 : \mu = 1$)	8.055**	9.683**	6.251**	12.079**
Standard Deviation	0.389	0.587	0.579	0.822
Skewness	1.989	3.759	1.141	4.400
Kurtosis	8.504	30.303	4.327	36.818
Minimum	0.345	0.259	0.169	0.244
Maximum	3.369	8.344	3.400	9.264
Jarque-Bera Probability	0.000	0.000	0.000	0.000

Panel B: Matrix of T-test statistics ($H_0 : \mu_i = \mu_j$)

	FT-100 Firms	FT-Midcap Firms	Small Firms >£30million	Smallest Firms < £30million
FT-100 Firms	-	1.245	3.610**	4.489**
FT-Midcap Firms		-	2.193**	4.374**
Small Firms >£30million			-	0.432
Smallest Firms < £30million				-

Table 3 - Relative GARCH(1,1) Betas Around Corporate Insider Trading Classified by Signed Trading Volume

This table summarizes the relative betas around corporate insider trades. A relative beta is measured for each trade in the sample and is constructed as follows: For the market return and for every company in the sample, a daily GARCH(1,1) volatility series is estimated. The daily Dimson-adjusted GARCH(1,1) beta is defined as:

$$\beta_{it}^{GARCH} = \frac{\sigma_{it}\rho_i}{\sigma_{mt}} + \frac{\sigma_{it}\rho_i}{\sigma_{mt-1}}$$

The relative beta is defined as the ratio of the mean daily Dimson beta in the period t+11:t+20 over the mean daily Dimson beta in the period t-20:t-11. Sample insider trade period is 1/8/1994 to 31/7/1996 and Dimson beta series is calculated from 1/1/1986. Market return is return on the FT All-Share index. All return data are collected from Datastream. Daily signed volume is constructed from the aggregate signed Pound Sterling public transactions throughout the trading day. ** Denotes Significance at 5% level.

	Low Pre-Event Information Quality		High Pre-Event Information Quality	
$\frac{Volume_{t:t+5}}{Volume_{t-20:t-1}}$	Large, Positive	Large, Negative	Low, Positive	Low, Negative
No. Trades	271	271	271	272
Mean Relative Beta	1.464	1.295	1.14	1.066
T-test ($H_0 : \mu = 1$)	7.05**	9.30**	4.59**	2.61**
Standard Deviation	1.083	0.523	0.511	0.416
Skewness	3.715	1.394	2.957	2.453
Kurtosis	22.256	4.991	18.097	12.677
Minimum	0.441	0.376	0.302	0.429
Maximum	8.344	2.975	4.623	3.477
Jarque-Bera Probability	0.000	0.000	0.000	0.000

Table 4 – Performance of Corporate Insider Trades

This table summarizes the cumulative abnormal returns subsequent to corporate insider trades. Three abnormal return measures are calculated from 1. a normal market model, 2. A market model with post earnings beta multiplied by relative beta multiplier and 3. stationary market model beta substituted by GARCH(1,1) beta time series. The relative beta multiplier is measured for each corporate insider trade in the sample and is constructed as follows: For the market return and for every company in the sample, a daily GARCH(1,1) volatility series is estimated. The daily Dimson-adjusted GARCH(1,1) beta is defined as:

$$\beta_{it}^{GARCH} = \frac{\sigma_{it}\rho_i}{\sigma_{mt}} + \frac{\sigma_{it}\rho_i}{\sigma_{mt-1}}$$

The relative beta is defined as the ratio of the mean daily Dimson beta in the period t+11:t+20 over the mean daily Dimson beta in the period t-20:t-11. Sample insider trade period is 1/8/1994 to 31/7/1996 and Dimson beta series is calculated from 1/1/1986. Market return is return on the FT All-Share index. All return data are collected from Datastream. Estimation period market model parameters are constructed from t-240:t-21 company and market returns. ** Denotes Significance at 5% level; * Denotes Significance at 10% level.

	Market Model Beta	Relative Beta	GARCH(1,1) Beta
FT-100 Companies:			
Buy: CAR 0 to 20 Days	0.081%** (3.32)	0.076%** (3.17)	0.042%* (1.82)
FT-Midcap Companies:			
Buy: CAR 0 to 20 Days	0.285%** (15.28)	0.283%** (15.42)	0.242%** (13.08)
Small Firms > £30million:			
Buy: CAR 0 to 20 Days	0.308%** (5.75)	0.309%** (5.86)	0.251%** (4.95)
Small Firms < £30million:			
Buy: CAR 0 to 20 Days	0.609%** (20.18)	0.598%** (19.89)	0.555%** (18.68)