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Identification of stock market manipulation: a case study

Abstract

This paper is based on an actual expert witness report undertaken by university business academics for a corporate regulatory authority in a developed country. The paper describes the methodology used to identify cases of stock market manipulation by insiders of a no liability mining company. An actual data set has been analyzed but the company and the country remain anonymous. It should be added that the real parties originally under suspicion were in fact charged with stock market manipulation based on the actual expert witness report outlined in this paper.

Keywords: stock markets, market manipulation, informational efficiency, transactions, expert witness, regressions, and descriptive statistics.
JEL Classification: G14.

Introduction

Fama (1970) formulated the Efficient Market Hypothesis (EMH) and posited that the informational efficiency of capital markets can be tested at three levels. Weak form efficiency where daily share prices have an equal probability of rising falling or staying the same because news affecting share prices arrives in a random fashion. At the semi strong level the share prices should instantaneously reflect all publicly available information and at the strong form level share prices should similarly reflect all public and private information if markets are efficient. In these instances investors cannot achieve positive abnormal returns. For example, the strong form EMH implies that no group of investors has access to private information that will allow them to consistently experience above average profits. It could be said that most tests show that markets are at best semi strong form efficient, which implies that there exists, even in developed markets, problems relating to insider trading and insider market manipulation (Reilly & Brown, 2003). In this paper it is deemed important to summarize the legal and institutional environment surrounding the issues of insider trading and stock market manipulation. These issues and the resolution of these issues will ultimately determine whether or not a particular country's stock market has the potential to achieve a utopian outcome or in other words strong-form informational efficiency.

1. Legal and institutional environment

In developed countries such as the United States, United Kingdom, Canada, New Zealand and Australia there exists a plethora of statutory provisions which relate both directly and indirectly to insider trading and stock market manipulation. For example, in Australia, Part 7.10 Corporations Law – Market Misconduct and Other Prohibited Conduct Relating to Financial Products and Financial Services (ss.104A – 1045A) – civil and criminal liability provisions; Continuous Disclosure Provisions – Chapter 6CA Corporations Act and ASX Listing Rule 3.1; Section 205G Corporations Act (this requires disclosure by directors of a listed company to disclose to Australian Stock Exchange, a director's relevant interest in securities of a company or related body corporate or contracts in relation thereto); substantial shareholding provisions in Chapter 6C Corporations Act; prohibition against self-acquisition in Chapter 2J.2 Corporations Act; s.183(1), which provides that a secretary, director or other officer/employee of a corporation must not improperly use their position to gain an advantage for themselves or someone else or to cause detriment to the corporation.

The key provisions of most developed country related legislation appear to be as follows: a person (the insider) possesses inside information; the information is not generally available; the insider knows or ought reasonably to know that the information is not generally available; a reasonable person would expect the information to be material (that is, that it would have a material effect on the price or value of certain securities); whilst in possession of the information, the insider trades in those securities or procures another person to trade in those securities. The definition of "insider" is usually very broad and generally covers a person not conventionally regarded as corporate "insiders" as well as information which does not originate and emanate from the company at all.

A key case which set the current institutional environment in Australia in relation to insider trading and stock market manipulation involved a defendant R. Rivkin in 2004, and the main points that emerged from that case were as follows: There was no requirement that the "insider" used the

relevant information, only that he possessed information when he traded in the relevant securities; information does not have to be 'specific'; information includes the source and state of affairs communicated and there is no need for knowledge or belief in the truth of the information he possesses; the source of information is relevant as this indicates a higher level of reliability which impacts upon materiality as defined by the Corporations Law (that is, it influences trading decisions); information includes matters of supposition and can include rumors. For example, *something may be about to happen*, which a person neither believes nor disbelieves; there is no requirement that 'information' was received under an obligation of confidence; generally available information means, 'readily observable material' (that is, facts directly observable in the public arena).

In addition the question as to who must observe and where they must be to observe is still contentious; proposals have been put forward by advisory committees that information is only generally available if: (a) it is *accessible* to persons who commonly invest in securities of a kind whose price might be affected by the information; or (b) it consists of deductions, conclusions or inferences made or drawn from information referred to in (a); knowledge elements are most difficult to prove as they are subjective to a particular defendant having regard to all the relevant circumstances, including state of trader's mind; the size of the profit made is not a relevant factor in determining whether the offence committed determines the seriousness of the offence.

In developed legal systems insider trading and stock market manipulation remain a complex area of law and even though the legislative provisions are extensive the area needs further judicial interpretation and reconsideration if traders are to be certain as to the circumstances under which they may be liable to civil and criminal prosecution. For example, the general position is that the law leaves the meaning and scope of the terms "readily observable" and "generally available" unresolved and, the subjective test of what an alleged insider trader "ought to have known" is convoluted and clumsy and needs to be clarified.

2. Background

The following expert witness report considered the relevant period of trading for a liability oil exploration company (hereinafter referred to as the Company). The report was requested by the Stock Exchange Regulatory Authority (SERA) who was investigating an alleged case of market manipulation by three individuals linked to the Company. The three individuals and their individual trades and the volumes of those individual trades are denoted by the letters A, B and C. Collectively the trades and volumes of trades are denoted by A+B+C. The relevant trading period was from 1/11/XXX1 to 30/4/XXX2. The report was compiled after analysis of the data and information contained in information provided by SERA. The types of trades (designated as stated above by "A", "B", and "C" individually and "A+B+C" collectively) in the shares of the Company were examined in the period up to the date of share consolidation and in the period after the share consolidation (with adjustments of prices, parcels traded and volumes for the share consolidation). The share consolidation (a four for one share price and thus a one for four volume consolidation) took place on 14/12/XXX1.

A SERUM is a hypothetical regulatory authority for a developed stock market system and it has a monitoring role to strive to maintain market efficiency in the share market and will prosecute parties found guilty of insider trading and market manipulation. The authority therefore, is acting under the assumption that markets are at best semi-strong form efficient. After examination of stock exchange trading information they initially identify possible instances of market manipulation and then seek out independent expert witnesses to provide evidence in order to verify or reject their suspicions.

Concerns were that three parties (later discussed as types of transactions) identified as "A", "B" and "C" had engaged in trading that affected the prices of a no liability oil exploration company in our hypothetical stock market. The parties were shareholder/directors of the company. The parties held call options and it would certainly be in their own interests if spot share prices moved well above the exercise prices of those options so that the options could be exercised and substantial positive abnormal returns achieved. Their position also would be improved after a share consolidation associated with a takeover of involving another no liability oil exploration company.

3. Investigation method and models applied

In many similar forms of empirical analysis of stock market data, stock market prices are converted to returns and the logarithms of these returns are taken to avoid different measures of upward versus downward movements. In addition multiple discriminant analysis is often utilized to demonstrate the significance of various factors that influence those returns if it is deemed appropriate to analysis single period models of unlagged data. In this study, for the purposes of providing an expert witness

report to a regulatory authority it was deemed appropriate, based on inspection of the raw data specifying individual and collective trades by parties A, B and C, that straightforward intraday price and volume data be examined. However, mere data inspection is not sufficient when reporting to a regulatory authority, so the writers went further and comprehensively analyzed the data using a combination of:

1. Descriptive statistics (predominantly the Arithmetic Means of price changes, parcel changes, and volumes traded for "A+B+C" type and "Other" trades).
2. Ordinary Least Squares (OLS) analysis of single period unlagged data was used to examine the prices change in the subject company compared to volume traded data.
3. OLS Regressions were used to compare the price changes in the subject company shares to the returns in the relevant hypothetical stock market indices namely All Equities Share Price Index and the Oil Exploration and the other Energy Exploration and Development Share Price Index.

More analysis could have been undertaken, e.g. OLS of risk-adjusted returns in an event study taking into account the share consolidation or causality studies as suggested by Heimstra and Jones (1994). However the above methodology was deemed sufficient in this case and proved adequate in light of the real life charges laid as previously mentioned in footnotes.

a. Descriptive statistics in arithmetic means using intra-day data

The Arithmetic Mean is a commonly used key measure of central tendency. The sample Arithmetic Mean (Mean) of raw data used in this analysis is given by the following:

The Arithmetic Mean is a commonly used key measure of central tendency. The sample Arithmetic Mean (Mean) of raw data used in this analysis is given by the following:

$$\overline{X} = \frac{\sum X}{n}, \qquad (1)$$

where $\overline{X}$ is the Arithmetic Mean; $\sum X$ is the sum of all values of X; n is the number of values in the sample.

When descriptive statistics in Means were taken into the analysis the following points were noted:

1. Higher intra-day price changes (greater upward price movements) indicate that shares trade at higher prices from one trade to the next. This may imply irrational behavior where higher intra-day price changes may indicate that buyers sell lower and buy higher.
2. Lower intra-day parcel changes indicate that the sizes of the parcels of shares traded tend toward size similarity. Higher intra-day changes may indicate that the sizes of parcels traded reflect heterogeneity in the market (that is, trading was not dominated by certain types of transactions).
3. Higher means of parcels traded indicate that individual parcels traded intra-day were larger.

b. An OLS analysis of price and trading volume relationships

To examine the possible direct effects that trading volume may have on the price of the Company shares, we have employed an OLS regression model which examines the explanatory power that trading volume within the day may have on the rate of return on the share[1]. Levels of statistical significance were at 5%. The model is defined as follows:

$$\widetilde{R}_{it} = a_0 + a_1 Vol_t + \varepsilon_t, \qquad (2)$$

where $\widetilde{R}_{it}$ is the return of the Company stock in period t; a_o is the intercept for the regression. The average return on the Company when the market return is zero; a_1 is the regression coefficient; Vol_t is the trading volume on day t; ε_t is the residual term.

c. An OLS analysis of price determination for Market Comparison

While the above model can reveal the trading volume effects on share prices, the model itself does not represent the manner in which the share price of the Company was determined (the results for this analysis are shown in Appendix 2, Table 6a and 6b). Levels of statistical significance were at 5%. For our analysis we have employed a fundamental Return-Generating Model known as the Market Model. The Market Model is well recognized and widely used in the finance industry for many purposes such as modelling of stock returns and the estimation of betas.

The Market Model for the Company can be estimated using OLS regressions. To estimate the Market Model for the Company's stock (denoted as *i*), the required model inputs were the time series of rates of returns of the stock over the relevant period, and the time series of returns of the stock market

[1] These types of studies have been undertaken in the past by researchers such as, Karpoff (1987), Epps (1975), Ariff and Lee (1993) and Stephan and Whaley (1990).

index calculated over the same period (the results of this analysis are shown in Appendix 3, Table 7). The market model is given as follows.

$$\widetilde{R}_{it} = a_i + \beta_i \widetilde{R}_{mt} + e_{it}, \quad (3)$$

where $\widetilde{R}_{it}$ is the return of the Company stock *i* in period *t*; $\widetilde{R}_{mt}$ is the returns of the market index in period *t*; a_i is the intercept. The average return on the Company when the market return is zero; β_i is the slope of the regression line, representing the beta; e_{it} is the residual term, representing firm specific factors affecting the return.

The data contained information on intra-day trades, prices and parcels traded in the shares in the Company. For analysis the data were separated into three periods or sections and then each of the "A", "B" and "C" type highlighted transactions was analyzed as well as the "A+B+C" trades and "Other" transactions. Section 1 was the entire period of the study from November 1st, 2001 to April 30th, 2002. The data were adjusted over this period up to the date of consolidation to reflect the one for four share-consolidations (that is, the price data were multiplied by four and the volume data were divided by four up to the date of consolidation). Section 2 covered the period up to the date of consolidation, and Section 3 covered the period after the date of consolidation. Within each section there were three sub-sections. Sub-Section a) was where all trades ("A+B+C" as well as "Other" trades) were considered. Only the individual "A", "B" and "C" types were considered in Sub-Section b) and in Sub-Section c) "Other" trades only were considered. These results are tabulated in Appendix 1.

4. Report questions and findings

The SERA asked the following questions of the expert witnesses and the answers were provided as follows:

"A" type transactions

a. What proportion of the total volume of trading in the Company shares did "A" type transactions comprise?

The Mean of parcels traded in "A" type trades up to the date of consolidation was higher than that for "Other" trades. For the full period the Mean parcels traded in "A" type trades was higher than for "Other" trades (See Appendix 1, Table 3). That is, larger parcels of shares were associated with "A" type trades. Examinations of daily volumes trade in "A" type trades reveal that over the whole period the percentage of "Total" trades was unadjusted 18.28%, adjusted 27.54%. Within pre-consolidation period the adjusted and unadjusted proportions were 6.78%. In the post-consolidation period this percentage grew to 35.17% of "Total" trades (See Appendix 1, Table 5). It is also noted from Table 5 (Appendix 1) that "A" type trades as proportions of "A+B+C" trades (unadjusted pre-consolidation) were 49.88%, and 43.77% in post-consolidation period.

b. What effect if any did these trades have on the price of the shares in the Company?

When OLS (Equation 2 application) analysis was applied using daily data volumes traded in "A" transactions were statistically significant determinants of prices changes but overall the model possessed weak explanatory power (See Appendix 2, Table 6a). Similarly, when intra-day data were analyzed using Equation 2 "A" type trades were statistically significant determinants of the share price changes of the Company but the model lacks strong explanatory power (See Appendix 2, Table 6b). However, when Means were considered, up to the date of consolidation the prices associated with "A" type transactions were higher. After the consolidation the associated prices were lower. Over the entire period the prices associated with "A" type transactions were higher (See Appendix 1, Table 3).

c. What effect if any did the factors identified above have on the market for the Company shares?

When Means were considered, up to consolidation the intra-day price changes were higher and the intra-day parcel changes were lower. After consolidation the intra-day price changes were lower as were the intra-day parcel changes. Over the full period the intra-day parcel changes were lower. The Mean of parcels trade in "A" type trades was higher than that for "Other" trades (See Appendix 1, Table 3).

d. Did those transactions create an appearance of active trading in the Company shares and if so why and to what extent?

When Means were considered, an appearance of active trading seemed to have been created. Intra-day parcel changes associated with "A" type trades were lower over the full period indicating that parcels traded in "A" transactions tended towards size similarity. Intra-day price changes were higher in the period leading up to consolidation and were thus traded at higher prices in that period (See Appendix 1, Table 3).

e. How would the market in the Company shares have appeared as to both volume and price had those transactions not appeared?

When Means were considered, "A" type transactions had not appeared (and assuming no

change to market conditions and no other transactions occurring over the period), the share price and the intra-day price changes would have been lower, and the intra-day parcel changes would have been higher, particularly in the period leading up to consolidation. The individual parcels traded would not have tended towards size similarity (See Appendix 1, Table 3). Volumes traded would explain when OLS analysis was considered even less of the price movements in the Company.

"B" type transactions

a. What proportion of the total volume of trading in the Company did those transactions comprise?

In the post-consolidation period the Mean of "B" parcels traded was higher than "Other" trades and this also applies over the full period (See Appendix 1, Table 2). That is, larger parcels of shares traded were associated with "B" type transactions. Examination of daily volumes reveals that "B" trades (unadjusted numbers) for the entire period represented 10.68% of the "Total" trades. Adjusted numbers show that "B" trades accounted for 19.20% of "Total" trades. In the period up to consolidation unadjusted and adjusted trades were at 0.11%. In the period after consolidation the "B" trades were 26.21% of "Total" trades (See Appendix 1, Table 5). It was also noted from Table 5 (Appendix 1) that the proportion of "B" trades to "A+B+C" trades on an unadjusted basis was 1.54% in the pre-consolidation and 32.62% in the post-consolidation periods.

b. What effect if any did those transactions have on the price of the Company shares?

When OLS analysis of daily data (Equation 2) was applied, the volume traded in "B" type transactions was not a statistically significant determinant of price changes and overall the model possessed very weak explanatory power (See Appendix 2, Table 6a). When OLS analysis of intra-day data was applied using Equation 2, it was found that "B" type transactions were not a statistically significant determinant of price changes in the Company and that the models had negligible explanatory power (See Appendix 2, Table 6b). However, when Means were considered, over the period up to consolidation, the share price associated with "B" type transactions was higher than that associated with "Other" transactions, but this was not the case in post-consolidation period. The share prices associated with "B" type transactions over the full period were higher than that associated with "Other" transactions (See Appendix 1, Table 2).

c. What effect if any did the above factors have on the market for shares in the Company?

When Means were considered, the intra-day price change over all periods was higher for "B" trades and the intra-day parcel changes were lower. The Mean of parcels traded in "B" trades was higher than that for "Other" trades (See Appendix 1, Table 2). That is, larger parcels of similar sized "B" trades were transacted at higher prices.

d. Did those transactions create an appearance of active trading in shares in the Company and if so why and to what extent?

When Means were considered, "B" trades seemed to create the appearance of active trading with associated lower intra-day parcel changes and higher intra-day price changes indicating that "B" traded at higher prices in the course of daily trading for larger share parcels that tended towards size similarity (See Appendix 1, Table 2).

e. How would the market in the shares of the Company have appeared as to both volume and price had those transactions not appeared?

When Means were considered, with the absence of "B" trades, the share prices (assuming no change to market conditions and no other transactions occurring over the period), and the intra-day price changes would have been lower and the intra-day parcel changes would have been higher in both pre- and post-consolidation periods. The individual parcels traded would not have tended towards size similarity (See Appendix 1, Table 2). The volumes traded would explain when OLS analysis was considered even less of the price movements in the Company.

"C" type transactions

a. What proportion of the total volume of trading in the Company did those transactions comprise?

In the period up to the share consolidation "C" type transactions were non-existent but appeared with strength in the period after consolidation, and thus over the entire period the Mean of the "C" parcels traded was higher than the Mean of "Other" parcels traded (See Appendix 1, Table 1). That is, larger individual parcels of shares were associated with "C" trades. Examination of daily volumes indicates that over the full period the proportion of the volume of "C" trades over "Total" trades was 7.69% (unadjusted for the consolidation) and 13.88% (with all numbers adjusted for consolidation). In the post-consolidation period (there were no "C" trades prior to consolidation) the percentage of "C" trades to "Total" trades was 18.97% (see Appendix 1, Table 5). It was also noted (Appendix 1, Table 5) that "C" trades as a proportion of "A+B+C" trades on an unadjusted basis were 0.00% up to consolidation and 23.61% after consolidation.

b. What effect if any did those transactions have on the price of the Company shares?

When OLS was conducted (Equation 2 was applied to the daily data), the volumes traded in "C" type transactions were not a statistically significant determinant of price changes in the Company and overall this model possessed substantially weak explanatory power (See Appendix 2, Table 6a). When OLS analysis (Equation 2) was applied to the intra-day data "C" trades were not significant and the models possess negligible explanatory power (See Appendix 2, Table 6b). When Means were considered, the share prices associated with "C" type transactions over the full period were lower than those associated with "Other" trades, bearing in mind that there were no "C" trades up to the share consolidation date (See Appendix 1, Table 1).

c. What effect if any did the factors identified above have on the market for the Company shares?

When Means were considered, the intra-day price changes were higher and intra-day parcel changes associated with "C" trades, were lower than "Other" trades in the period after share consolidation and thus, over the full period. The Mean of parcels traded for "C" type transactions was higher than that for "Other" transactions. That is, individual parcels of "C" trades were larger than those for "Other" trades and "C" trades tended towards size similarity (See Appendix 1, Table 1).

d. Did those transactions create an appearance of active trading in the Company shares and if so why and to what extent?

When Means were considered, "C" transactions seemed to create the appearance of active trading. Despite the fact that "C" trades were associated with lower intra-day share prices over the full period, larger intra-day parcels traded with higher intra-day price changes and lower intra-day parcel changes. This indicates that there was a higher positive price movement from one trade to the next with "C" trades. Lower intra-day parcel changes mean that "C" parcel trades tended towards size similarity (See Appendix 1, Table 1).

e. How would the market in the Company shares, as to both volume and price have appeared had those transactions not occurred?

When Means were considered, and in the absence of "C" trades over the period up to consolidation with stronger "C" trades after consolidation (assuming no changes to market conditions and no other transactions occurring over the period), it follows that there would have been lower prices, lower intra-day price changes and higher intra-day parcel changes. The individual parcels traded would not have tended towards size similarity (See Appendix 1, Table 1). When OLS analysis was considered, even less of the price movements in the Company, would be explained by the volumes traded.

"A+B+C" type transactions

a. What proportion of the total volume of trading in the shares of the Company did those transactions comprise?

In the period up to consolidation, after consolidation and over the full period the Mean of "A+B+C" trades were higher than that for "Other" trades (See Appendix 1, Table 4). Examination of the proportions of volumes traded in the full period revealed that "A+B+C" trades comprised 36.64% (unadjusted) and 60.62% (adjusted). Over the period up to consolidation these proportions were 6.88% (adjusted and unadjusted) and after the consolidation the proportion was 80.35% (See Appendix 1, Table 5).

b. What effect if any did these transactions have on the price of the Company shares?

When OLS analysis of daily data was considered (Equation 2 application), volumes traded in "A+B+C" were a statistically significant determinant of price changes but overall the model possessed weak explanatory power (See Appendix 2, Table 6a). This was also the case when the analysis was extended to intra-day data except that the explanatory power of the models was negligible (See Appendix 2, Table 6b). However, when Means were considered, higher prices were associated with "A+B+C" trades in each period before and after consolidation and thus in the overall period (See Appendix 1, Table 4).

c. What effect if any did the factors identified above have on the market for the shares in the Company?

When Means were considered, "A+B+C" trades were associated with higher prices and higher intra-day price changes and lower intra-day parcel changes. The Mean of parcels traded for "A+B+C" trades was higher than that for "Other" trades (See Appendix 1, Table 4).

d. Did those transactions create an appearance of active trading in the shares of the Company and if so why and to what extent?

When Means were considered, "A+B+C" trading seemed to create an appearance of active trading in the Company shares. Lower intra-day parcel changes associated with those trades indicated that whilst larger parcels were traded the individual trades tended towards size similarity. At the same

time, the associated higher intra-day price changes indicated that these parcels traded at higher prices (See Appendix 1, Table 4).

e. How would the market in the Company shares have appeared as to volume and price had those transactions not appeared?

When Means were considered, without the appearance of the "A+B+C" trades (and assuming no changes to market conditions and no other transactions occurring over the full period), prices would have been lower, intra-day price changes would have been lower, and intra-day parcel changes would have been higher. The individual parcels traded would have not tended to size similarity (See Appendix 1, Table 4). Volumes traded would explain even less of the price changes in the Company when OLS analysis was considered.

NOTE: An OLS analysis of daily data (Equation 3 application) shows that, whilst the unlagged growth in the All Equities, Oil Exploration and Other Energy Exploration and Development Prices may be statistically significant explanatory variables of price growth in the Company, the explanatory power of these models was not great (less than 10% in each case). This indicates that the price behavior of the Company was different to or not strongly related to the price behavior in the market over the period under study (See Appendix 3, Table 7).

4. General comment on results

When trading of shares associated with the selected types of transactions was examined and compared to "Other" transactions over the full period of the study, the following evidence was apparent:

1. The intra-day price of shares associated with the "A+B+C" transaction types was higher, except in the case of "C" trades (these trades did not occur in the period up to the share consolidation).
2. The intra-day size of parcels associated with the "A+B+C" transaction types was greater.
3. The intra-day price changes associated with "A+B+C" transaction types, were higher. This indicates that parcels in the "A+B+C" transaction types traded at higher prices.
4. The intra-day parcel changes associated with the "A+B+C" types were lower. This means that parcels traded through the "A+B+C" trade types tended towards size similarity to a greater extent than those associated with "Other" trades.
5. Volumes traded overall in the "A+B+C" transaction types were 36.64% (unadjusted for the consolidation) and 60.62% (adjusted for consolidation) of total volumes traded. Post-consolidation "A+B+C" trades were 80.35% of "Total" trades. "A" type trades as a proportion of "Total" trades over the full period were the highest of the "A+B+C" type transactions at 18.28% (unadjusted) and 27.54% (adjusted). Post-consolidation "A" type trades were 35.17% of "Total" trades. The "A" type trades were also the greatest proportion of "A+B+C" trades (Appendix 1, Table 5).
6. "A" and "A+B+C" trading volumes on a daily basis were statistically significant determinants of price changes in the Company but the explanatory power of the models was low at less than 11% in each case. This was also the case when intra-day data were considered except that explanatory power of the models was negligible in each case. Daily and intra-day volumes were not statistically significant determinants of prices movements in the Company in the cases of "C" and "B" type transactions.
7. The daily price behavior in the Company shares was not strongly explained by or strongly related to the overall price behavior in the market.
8. If the "A+B+C" type transactions had not occurred the effect on the market may be postulated. However in that case certain assumptions need to be made. If market conditions remained the same and if no other traders in the Company shares entered the market over the period under study, it would follow that share prices would have been lower, parcel sizes (individual transactions) would have been smaller, price changes from trade to trade would have been lower and parcels traded would not have tended towards size similarity. In addition even less of the variation in prices in the Company would be explained by trading volumes.
9. Thus, prices, price changes, parcels, parcel changes and volumes would have differed, the "A+B+C" type transactions had not appeared. In addition "A" and "A+B+C" trading volumes were statistically significant determinants of price changes in the Company (despite the low explanatory power of those models).
10. Evidence supports the contention that the "A+B+C" type transactions have created the appearance of active trading and the evidence is presented and detailed in the appendices.

Conclusion

This case study was based on actual data and emphasizes the need for regulation, good governance and transparency of any stock markets,

not only those in developed economies if international investment funds are to flow. It is deemed by the writers that it is a noble aim to strive for strong-form efficiency in stock markets and that any problems, anomalies and ambiguities in the interpretation of legislation relating to insider trading and market manipulation are removed sooner rather than later.

In the case in question, the evidence overall supports the notion that "A", "B" and "C" type transactions, both individually and collectively, have created the appearance of active trading thus influencing the share price of the subject company. This would not be the example of an informationally efficient market or a level playing field as people with inside information appear to have been able to manipulate the market for their own purposes. An example of how the insider parties may have benefited from the positive abnormal returns thus created would be if they were in possession of low exercise price call options and if these parties exercised those options at a time when the market price had been influenced to be well above the exercise price.

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12. SERA Annexure 5: Values of All Oil Exploration, All Equities, Other Energy Exploration and Development, S & P/Small Ords and S & P/XSX Small Resources Price Growth Indices.
13. SERA Annexure 6: Compaq Laptop Computer loaded with XSX EATScan for the Company.

Appendix A. Summary of results: descriptive statistics in arithmetic means for trading in company (intra-day data)

Table 1. Summary of results for "C" type transactions

Section	Price mean	Parcel mean	Price changes mean	Parcel changes mean
1a	131.5153	12843.8608	0.0004	123.7831
1b	124.1545 [1]	51458.7480[4]	0.0018[7]	8.7826 [10]
1c	131.7794	11458.3208	0.0003	127.9094
2a	29.9980	29442.3576	0.0009	245.7920
2b	No trades [2]	No trades [5]	No trades [8]	No trades [11]
2c	29.9980	29442.3576	0.0009	245.7920
3a	141.6770	17679.1357	0.0015	16.1912
3b	124.1545 [3]	51458.7480 [6]	0.0018 [9]	8.78726 [12]
3c	142.8988	15323.7545	0.0015	16.7078

Comment: 1. Prices associated with "C" trades were lower in all periods. See (1), (2) and (3). Note zero trades of "C" type in the period up to consolidation. 2. Parcels traded associated with "C" trades were higher in the full period and in the period after consolidation. See (4), (5) and (6). 3. Higher intra-day price changes were associated with "C" in the full period and in the period after consolidation. See (7), (8) and (9). 4. Lower intra-day parcel changes were associated with "C" in the full period and in the period after consolidation.

Table 2. Summary of results for "B" type transactions

Section	Price mean	Parcel mean	Price changes mean	Parcel changes mean
1a	131.5153	12843.8608	0.0004	123.7831
1b	134.5648 (1)	45369.4922 [4]	0.0016 [7]	14.7262 [10]
1c	131.3401	10974.4603	0.0003	130.0511
2a	29.9980	29442.3576	0.0009	245.7920
2b	31.5000 [2]	17300.0000 [5]	0.0054 [8]	-0.3932 [11]
2c	29.9952	29464.2884	0.0009	246.2367
3a	141.6770	17679.1357	0.0015	16.1912
3b	134.7000 [3]	46017.5632 [6]	0.0016 [9]	14.9649 [12]
3c	142.4582	14506.3005	0.0015	16.3285

Comment: 1. Higher share prices were associated with "B" over the full period. 2. Higher share prices were associated with "B" over the period up to consolidation. 3. Lower share prices were associated with "B" after the consolidation. 4. Higher parcels traded were associated with "B" over the full period. 5. Lower parcels traded were associated with "B" up to consolidation. 6. Higher parcels traded were associated with "B" after consolidation. 7. Higher intra-day price changes were associated with "B" over the full period. 8. Higher intra-day price changes were associated with "B" for the period up to consolidation. 9. Higher intra-day price changes were associated with "B" after the consolidation. 10. Lower intra-day parcel traded changes were associated with "B" in each of the periods. See (10), (11) and (12).

Table 3. Summary of results in means for "A" type transactions

Section	Price mean	Parcel mean	Price changes mean	Parcel changes mean
1a	131.5153	12843.8608	0.0004	123.7831
1b	132.1884 [1]	15566.2351 [3]	0.0002 [5]	55.5064 [8]
1c	131.3174	12043.2208	0.0005	144.9689
2a	29.9980	29442.3576	0.0009	245.7920
2b	31.7076 [2]	36080.8587 [4]	0.0038 [6]	397.5912 [9]
2c	29.8979	29053.8448	0.0009	236.8526
3a	141.6770	17679.1357	1.70754E-05	16.1912
3b	132.8778 [11]	16408.5203 [12]	-0.0003 [7]	11.4717 [10]
3c	147.0451	18454.2978	4.12028E-05	21.7230

Comment: 1. Higher share prices were associated with "A" type trades in the overall period. 2. Higher share prices were associated with "A" in the period up to consolidation. In the period after consolidation lower prices and parcels traded were associated with A. See (11) and (12). 3. Higher parcels traded of shares traded were associated with "A" over the full period. 4. Higher parcels traded of shares traded were associated with "A" in the period up to consolidation. 5. Lower intra-day share price changes were associated with "A" over the full period. 6. Higher intra-day share price changes were associated with "A" up to consolidation. 7. Lower intra-day share price changes were associated with "A" after consolidation. 8. Lower intra-day traded parcel changes were associated with "A" over the full period. 9. Higher intra-day traded parcel changes were associated with "A" up to consolidation. 10. Lower intra-day traded parcel changes were associated with "A" in the period after consolidation.

Table 4. Summary of results in means for "A+B+C" type transactions

Section	Price mean	Parcel mean	Price changes mean	Parcel changes mean
1a	119.9918	7630.5894	-0.0001	115.7402
1b	126.8042 [1]	8871.9447 [4]	0.0019 [7]	33.6645 [10]
1c	131.4221	7397.3888	-0.0010	153.7175
2a	29.9980	29442.3576	0.0008	245.7916
2b	31.7011 [2]	35487.7789 [5]	0.0016 [8]	387.1448 [11]
2c	29.8948	29076.3187	0.0008	237.2329
3a	89.3442	23191.3861	0.0004	115.2105
3b	123.6716 [3]	26871.0543 [6]	0.0021 [9]	32.7524 [12]
3c	73.4670	21489.4638	-0.0004	153.3648

Comment: 1. Except for the overall period higher share prices were associated with "A+B+C" in the period up to and the period after consolidation. See (2) and (3) compared to (1). 2. Higher parcels traded were associated with "A+B+C" over the three periods considered. See (4), (5) and (6). 3. Higher intra-day price changes were associated with "A+B+C" over the three periods. See (7), (8)

and (9). 4. Except in the period up to consolidation lower intra-day parcel changes were associated with "A+B+C". See (10) and (12) compared to (11).

Table 5. Summary of volumes of daily trades

Type of trade	Entire period		Pre-consolidation		Post-consolidation
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted
A	15,051,531.00	12,561,951.75	3,319,439.00	829,859.75	11,732,092.00
C	6,329,426.00	6,329,426.00	0.00	0.00	6,329,426.00
B	8,795,237.00	8,756,312.00	51,900.00	12,975.00	8,743,337.00
A+B+C	30,176,194.00	27,647,689.75	3,371,339.00	842,834.75	26,804,855.00
Other	52,176,418.00	17,960,860.00	45,620,744.00	11,405,186.00	6,555,674.00
Total (both "a+b+c" and other)	82,352,612.00	45,608,549.75	48,992,083.00	12,248,020.75	33,360,529.00
Percentages					
A / All trades	18.28%	27.54%	6.78%	6.78%	35.17%
C / All trades	7.69%	13.88%	0.00%	0.00%	18.97%
B / All trades	10.68%	19.20%	0.11%	0.11%	26.21%
A+b+c / All trades	36.64%	60.62%	6.88%	6.88%	80.35%
Other / All trades	63.36%	39.38%	93.12%	93.12%	19.65%
Total	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*
Types / A+B+C					
A	49.88%	45.44%	98.46%	98.46%	43.77%
C	20.97%	22.89%	0.00%	0.00%	23.61%
B	29.15%	31.67%	1.54%	1.54%	32.62%
Total	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*

Appendix B. Summary of results of OLS relationship between price differences and volumes traded (daily and intra-day data)

Equation 2 in the methodology section was applied to the data and the results of this analysis for each of "A", "B" and "C" and then "A+B+C" type transactions are shown below.

Table 6a. OLS results for price growth in company against volumes traded in types of transactions using daily data

Type of trades	Adjusted R square value	F statistic (probability or significance level)	t statistic (probability or significance level)
C	0.0003	0.0031 (0.9555)	0.0559 (0.9556)
B	0.0005	0.0503 (0.8230)	0.0559 (0.9556)
A	0.1021 **	11.3710 (0.0011) *	3.3721 (0.0011)*
A+B+C	0.0751 **	21.5116 (1.08586E-10)*	6.4941 (2.00863E-08)*

Note: * These values are significant at the 1% level. The explanatory power of these models was less than 11% in each case for "A" and "A+B+C" trades (See **).

Table 6b. OLS results for price growth in the company against volumes traded in types of transactions intra-day

Type of trades	Adjusted R square value	F statistic (probability or significance level)	t statistic (probability or significance level)
C	5.39712E-05	1.0958 (0.3344)	0.5247 (0.5998)
B	3.90286E-05	1.0693 (0.3434)	0.5730 (0.5667)
A	0.0020 **	4.4855 (0.0113) *	2.6654 (0.0077) *
A+B+C	0.0024 **	5.2009 (0.0056) *	2.9213 (0.0035) *

Note: * The type of trade was statistically significant at the 1% level as a determinant of the price changes in the Company but the models have very small explanatory power (See **).

Comments: The only statistically significant determinants of share price changes over the full period of the study were demonstrated with volumes in "A" type trades and with volumes in "A+B+C" trades. However, even in these instances there was a low explanatory power of the OLS regression. The conclusion was reached that volumes traded were only partial drivers of price changes.

Appendix C. Relationship between growth in company share price and growth in the All Equities, All Equities Accumulation, Oil Exploration and Other Energy Exploration and Development Price Indices (Daily Data)

The share price growth in the Company was compared to the growth in the All Equities, the All Equities Accumulation, the Oil Exploration and the Other Energy Exploration and Development Price Growth indices. Part of the share price growth in the Company was explained by unlagged (level data), first and second differences in the level series of the indices.

Table 7. OLS regressions of price growth of subject entity shares against all equities, all equities accumulation, oil exploration, and other energy exploration and development price growth indices

Independent variable	Adjusted R square value	F statistic (significance level)	t statistic (significance level)	Durbin-Watson statistic
All Equities Price Growth Index	0.0547	8.8606 (0.0000)*	4.7264 (0.0000)*	2.1322
All Equities Accumulation Growth Index	0.0105	0.9417 (0.4210)	1.3758 (0.1700)	2.2225
Oil Exploration Price Growth Index	0.0721	7.1700 (0.0001)*	4.6154 (0.0000)*	2.1494
Other Energy Exploration and Development Price Growth Index	0.0606	5.9551 (0.0006)*	4.0864 (0.0000)*	2.1522

Comments on results: 1. The R Square values in each case show the low explanatory power of each model. In other words the level series, first and second changes of the All Equities, All Equities Accumulation, the Oil Exploration and the Other Energy Exploration and Development price growth indices fail to explain a substantial percentage of the Company price growth (see R Square values at around 5%, 1%, 7% and 6% respectively). * Significant at the 1% level. 2. However, in each case the level series of independent price and accumulation growth index variables were statistically significant factors in that part of the model that was explained, except for the All Equities Accumulation price growth index. In this latter case the level series was not a statistically significant determinant of the price growth of the Company (See t statistics and associated levels of statistical significance for each index). The first and second differences in all data for all indices were not statistically significant determinants of the prices growth of the Company. 3. Durbin-Watson statistics were statistically significant at values greater than zero and also greater than two and demonstrate that the OLS regressions were not spurious or unreliable apart from their low explanatory power. This statistic also indicates that the level series data were stationary and that there was no problem with serial correlation or time dependency in the level series data. 4. There was, thus, evidence to suggest that the share price growth in the Company was positively related to the price growth in the above indices. However, there was low explanatory power in these models. Therefore one can conclude that there was not a strong relationship between the price growth of the Company, and the price growth in the All Equities, Accumulated All Equities, the Oil Exploration or the Other Energy Exploration and Development indices. That is, price behavior in the Company was different to that in the market or in other words was not strongly explained by price behavior in the market.