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A test of the effects of changing information asymmetry in a capital market.

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A Test of the Effects of Changing Information Asymmetry in a Capital Market

ABSTRACT

Predictions by Lev (1988) about the observable effects of information asymmetry in capital markets are tested in the New Zealand sharemarket of late 1987 and early 1988. It is argued that the crash caused information asymmetries in that the extent of losses suffered by many companies were not public information. The crash should therefore have increased spreads, reduced volumes, and led to fewer quotes being available, while a subsequent special disclosure of the extent of losses should have had opposite effects. Both the median and the 5%-trimmed mean of spreads (adjusted for price changes) were found to increase at the time of the crash, and exhibited a short-lived decrease at the time of the announcement. In contrast, volumes rose for a few days after the crash, but then fell below pre-crash levels, and did not appear to change at the announcement date. The proportion of days on which both buy and sell quotes were available fell on both occasions. This evidence does not appear to support the idea that information asymmetry was important in this situation. It is noted that dealership models of a capital market may not give a good description of a market which lacks a dealership system. The autocorrelations suggest that spreads are generated by a nonstationary process.

KEYWORDS: accounting; crash; market structure; New Zealand.

I. Introduction

According to Lev (1988), the mandatory disclosure of accounting information in Western economies may be intended to improve the efficiency of capital markets by reducing the information asymmetries among participants in those markets. Lev argues that markets with substantial information asymmetries will feature wide bid-ask spreads, low trading volumes, a reduced number of traders, and lower liquidity of securities generally. In the extreme, the capital market may shut down (Glosten and Milgrom, 1985). Lev proposes that mandatory disclosure, by reducing the information asymmetries, improves the functioning of the capital markets, to the benefit of all participants and of society as a whole. He further suggests a number of ways of testing his arguments.

There are other views of the reasons for mandating accounting disclosure (e.g. Watts and Zimmerman [1979], Gaa [1988]), and Lev's view presupposes certain facts about the operation of capital markets. If information asymmetry is not in fact a practical problem, then Lev's explanation for mandating disclosure, and his prescription for how that should be done, would both collapse.

To provide a strong test of Lev's arguments, one needs a capital market with trading intermediated by specialists and with generally poor standards of disclosure in which an identifiable event creates a substantial information asymmetry (or corrects a previously existing situation of asymmetry). The New Zealand sharemarket of late 1987 and early 1988 provides the information conditions required, although not the system of specialists. The structure and practices of the market were conducive to the development and persistence of large information asymmetries. These

asymmetries were presumably exacerbated by the October 1987 crash, because many companies suffered substantial losses but the extent of these losses was not public information. In response, the NZ Stock Exchange imposed a special requirement, described more specifically below, for disclosure of any losses which companies suffered as a result of the crash.

This article reports evidence concerning the effects of a postulated increase in information asymmetry in the NZ sharemarket at the time of the crash and a decrease at the time of the later disclosures. Following Lev (1988), it is expected that spreads should have widened at the time of the crash and narrowed at the time of the later disclosures; that volumes should have decreased and then increased; and that suitable proxies for liquidity should have shown a decrease and then an increase in liquidity.

The absence of a system of specialist dealers poses a theoretical problem for tests of Lev's ideas, in that the models refer to the dealer's holding costs and the adverse selection problem from trading with informed individuals. However, if being a dealer is expected to be profitable, some brokers and other institutions should voluntarily assume that role by quoting prices for both sides of a transaction (although keeping the freedom to withdraw if conditions become difficult). Such dealers will be subject to the same economic pressures as specialists and should respond in the same way. Further, ultimate investors face some of the same pressures as a specialist: fo example, if they believe that insiders are trading in the market, potential sellers will raise and potential buyers will lower the prices at which they are willing to trade[1] in order to reduce their adverse selection losses. Such actions will affect market conditions in just the way predicted by theories of specialist behaviour, although the actions of non-specialist investors cannot be fully modelled because their utility functions are not specifiable.

Consequently, the absence of a specialist system should not preclude using the New Zealand market as a test for Lev's ideas, although the institutional environment is somewhat different from that which Lev envisaged.

The remaining sections of this article describe the relevant features of the NZ sharemarket, formulate hypotheses to be tested, describe the data and test methods used, and report and discuss the results.

II. The New Zealand Market in 1987-88

A. Nature of the Market

The New Zealand sharemarket is a small one by world standards. In March 1988, typical daily trading volumes ranged from about $10 million to about $30 million. Only about 300 companies were listed, and the total market value of equities was about $20 billion[2]. The small size of the sharemarket implies that the demand for financial analysts' services was small, and only the largest firms were studied by analysts.

The market was dominated by a very few firms. The largest seven firms represented more than 50% of the total capitalisation of the market. This reinforced the analysts' tendency to focus attention on a small number of companies.

The market was an auction market. There were no specialists or dealers required to make a market in listed shares. Thus, the quoted buy and sell figures represented orders from investors or from floor traders who chose to act as dealers for the time being; in the absence of orders, there were no corresponding quotes. A specialist who is obliged to make a market in a company's shares has an obvious incentive to seek out the best available information

about that company. Without specialists, there is one less channel through which information can be reflected in prices and transmitted to investors.

Most trading activity centred on the small number of large companies. In a typical day, about half the listed shares would not trade; in a typical week, about a third would not trade. For the smaller firms, even buy and sell quotes[3] may not be available: on a typical day, some 40% of the listed firms would not have one or both quotes available on the Auckland exchange, the largest trading floor of the New Zealand Stock Exchange.

The large companies included investment companies, financial institutions, and others with large investments in listed companies. Some of these firms were badly affected by the crash: Brierley Investments lost 60% of its value between September 1987 and March 1988. The years leading up to the crash had been a period of constant change in shareholdings, and the last annual report of many companies was of little value in assessing their current risk exposure. Some financial institutions had lent substantial sums secured by shares of listed firms which were themselves highly levered, and suffered large losses when the value of the security collapsed.

Individual investors have a significant role in share ownership in NZ. In a country with about 1 million households, Brierley Investments Limited had 159,245 shareholders in September 1987. Individual shareholders are not usually important in setting the market price for heavily traded shares, since institutional traders will dominate the market. However, in rarely-traded shares, quotes from individuals may remain for days as the only available price information.

Table 1 shows the information just discussed for the ten largest listed companies. Market information is as at 1

March 1988; information about shareholdings is obtained from the annual report before or after that date. The Stock Exchange required that annual reports list the holdings of directors and large shareholders, and from this an estimate of inside shareholdings and large institutional holdings can be compiled. This has been done in Table 1.

B. Barriers to Information Dissemination

New Zealand disclosure requirements were very limited by North American standards, and such requirements as existed were virtually unenforceable.[4] Creative accounting by improper classification or presentation in the financial statements drew public comment from the Society of Accountants, but no official action. During 1987, moreover, a number of instances came to light of material non-disclosure by major companies in connection with their share investments. In certain cases, an option or conditional sale of a major investment had been announced to the Stock Exchange as being a simple sale; in other cases, an announced outright sale was subject to an undisclosed put option which allowed the purchaser to force the vendor to repurchase the sold shares at a fixed price. The true nature of these "sales" only became public knowledge following the crash, when the previously announced sales fell through or were reversed, causing substantial losses to the "vendors".

Well-informed traders were certainly present in the market. Insider trading was not illegal and was essentially unregulated throughout the relevant period,[5] despite earlier scandals involving the sale of shares in failing companies by directors. Sharebrokers could freely trade on their own account, using any private information as to the identity of other traders. There are no statistics on the extent of insider trading, but it was commonly believed to be widespread.

Another barrier to the dissemination of information was provided by the fact that the New Zealand Stock Exchange consisted of four regional trading floors, without real-time sharing of information between them. One effect could be clearly seen in the present study: of 20,029 values of the spread between the highest national buy quote and the lowest sell quote, 2,375 were negative. Thus, shares could have been bought on one floor and simultaneously sold on another at a higher price[6]. In contrast, for 19,621 observations of the spread on the Auckland and Wellington floors, none was negative and only two were zero. The negative national spreads thus suggest that communication between regional floors was less effective than communication between traders on a single floor.

C. The February 1988 Disclosure Requirement

The NZ sharemarket environment of 1987-88 was clearly one in which significant information asymmetries (both actual and perceived) could be expected to exist. The characteristics described above imply a market in which, except for the small number of closely followed firms, there are few channels for dissemination of information and such channels as exist do not operate reliably, while there are no obstacles to the activities of traders with superior information. Perceived information asymmetry is significant, because in Lev's (1988) argument, the adverse effects of information asymmetry are caused by the uninformed traders' attempts to protect themselves, and these attempts will obviously be made if the uninformed believe themselves to be at an informational disadvantage, whether they in fact are or not.

It is postulated that the crash and the revelations about the extent of undisclosed deals increased information asymmetry. Most directly, many firms suffered large losses in the crash because of their shareholdings in other

companies and/or loans secured by shares, but the extent of these losses could not be accurately gauged by outsiders. The revelations of previously undisclosed deals added to general uncertainty about what other information companies might be concealing.[7]

The timing of company profit announcements was not helpful for relieving this uncertainty. New Zealand companies publish six-monthly rather than quarterly reports, and most financial years end on March 31 or June 30. Thus, almost no companies were expected to make profit announcements for the periods ending October 31 or November 30; the earliest announcements which would include the effects of the crash were for the periods ending 31 December. But profit announcements are rarely released within two months after the end of a period, and the typical delay is three to four months. In the normal course of events, reports of losses from the crash could not be expected until, at the earliest, March-April 1988.

In response, on 11 February 1988, the NZ Stock Exchange imposed a particular disclosure requirement on listed companies. All firms were required to report, by 29 February 1988, the extent of any losses suffered as a result of the crash and to provide a balance sheet as at 31 December 1987.[8] Income statements and notes were not required. The disclosures were not required to be audited, and in practice some leeway was allowed in compliance. Some firms produced balance sheets as at 31 January 1988; some merely reported that they had had no significant sharemarket investments, without presenting balance sheets; and extensions of the reporting deadline were allowed for a few companies for various reasons. In Lev's terms, this mandated disclosure should have had the effect of reducing information asymmetry and thus reduced its observable consequences.

III. Hypotheses

The preceding discussion suggests the following hypotheses (expressed in each case as the alternative, against a null of no difference)

H_{1A} The spreads tended to be greater after the crash than before.

H_{1B} The spreads tended to be less after the date on which each firm reported its losses and balance sheet to the Exchange (the "announcement date" for each firm) than before.

H_{2A} The volume of trading tended to be less after the crash than before.

H_{2B} The volume of trading tended to be greater after the announcement date than before.

H_{3A} The liquidity of trading tended to be less after the crash than before.

H_{3B} The liquidity of trading tended to be greater after the announcement date than before.

To permit operational tests of these hypotheses, it is necessary to consider how long a period should be used for the before-and-after comparisons and how spreads, volumes, and liquidity should be measured. These matters will now be considered in turn.

As previously mentioned, the changes are expected to persist because the information asymmetry will tend to persist until either the information is disseminated (possibly through the effects of trading by insiders) or it is superseded by new information. This allows one to distinguish the effects of information asymmetry from the previously reported effects on spread and volume of new

public information (Beaver, 1968; Morse, 1981; Morse and Ushman, 1983; Bamber, 1986; Karpoff, 1986; Anthony, 1987) and large price changes (Morse and Ushman, 1983; Anthony, 1987), since the latter effects are localized around the event.[9]

Two factors limit the length of the before-and-after periods which can be compared. First, there are mechanisms by which private information eventually becomes public, including trading by informed traders (Copeland and Galai, 1983; Glosten and Milgrom, 1985), so that the information asymmetry will not persist forever. Second, other factors affecting the spread also change over time, and so any difference between "before" and "after" subperiods caused by information asymmetry will be obscured, for long subperiods, by the noise from changes in these other factors. These include other information events, both information releases and new private information, changes in the number of shareholders (Demsetz, 1968; Benston and Hagerman, 1974; Hamilton, 1978; Karpoff, 1986), changes in the price level of the stock (Demsetz, 1968; Benston and Hagerman, 1974; Hamilton, 1978), changes in the price variance and/or in systematic or unsystematic risk (Benston and Hagerman, 1974; Hamilton, 1978), and changes in the structure of transaction costs (Karpoff, 1986).[10]

Thus in testing for before-and-after differences, the periods used must be long enough to eliminate localised effects but short enough that other changes are not obscuring the persistent effects of information asymmetry. The periods used in this study were the four weeks before and four weeks after the crash, and the months of February and March 1988 (which implies test periods of differing lengths for different firms).

The effect of changes in the price level of the stock cannot be eliminated by choosing test periods of suitable length, because the crash date itself is by definition a

date on which substantial price declines occurred. Thus the values of spread must be explicitly adjusted for changes in the stock price. Some authors have used the proportional spread (spread divided by the price) (Stoll, 1978; Morse and Ushman 1983; Anthony, 1987), but Benston and Hagerman (1974) showed that spreads in a sample of 314 over-the-counter US stocks increased less than proportionally with price. Thus, using proportional spreads does not control properly for price.[11]

Benston and Hagerman performed two different multiple regressions in which the logarithm of the spread was regressed on the logarithm of the price (and other variables). The relevant coefficients were 0.471 (standard deviation 0.018) in one regression and 0.594 (0.023) in the other. This implies a power-law relationship in which spread is proportional to price raised to the power 0.471 or 0.594. If the power is taken as 0.5, and assuming that their results transfer to the NZ market, this implies that spread should increase as about the square root of the price.

Therefore, the spread was divided by the square root of the price (the average of the buy and sell quotes), in order to eliminate any confounding effects from changes in price.

Volume may be measured in terms either of the number or the dollar value of shares traded. Conceptually, investors trade claims by value, and market value is the relevant variable for such matters as determining the composition of a portfolio. For this reason, volume was measured in dollars for this study (although similar results were obtained when volume was measured as the number of shares traded).

Liquidity, which Lev (1988) stated should also be affected by information asymmetry, does not correspond to a

specific body of theory and the appropriate proxy is not clear. However, in a market in which buy and sell quotes are not always available, the presence of such quotes means that an investor can immediately buy or sell at least some of the stock, because there is a willing seller or buyer waiting at a stated price. Without any such quotes, the investor may have to wait an unknown time before a desired trade can be consummated at an unknown price. Thus, in this study, the proportion of trading days on which both buy and sell quotes were available for a stock was taken as a measure of the liquidity of that stock during a test period.

IV. Data Used

The NZ Stock Exchange provided data on daily closing buy and sell quotes and trading volumes for all listed companies for four weeks before and after the crash, and for the months of February and March 1988. The Stock Exchange also provided the announcement dates for each firm. The trading data contained information for 520 securities, many of which were not ordinary shares and some of which were duplicates where a company had changed its name during the period and appeared under both old and new names. Restricting the sample to ordinary shares and eliminating duplicates left 328 firms, of which 272 had known announcement dates in February and March 1988.[12] All of these were used in the analysis.

Although the trading data were taken on disk directly from the Stock Exchange's computer files, they contained various errors. Negative spreads have been referred to as evidence of impaired information sharing between the regional exchanges. However, the largest negative spreads appeared to be spurious, the result of data errors. (The largest was a negative spread of $10.50, but there were 17 cases of negative spreads exceeding $1.00.) Looking at the

pattern of buy and sell quotes around the date of each large negative spread suggested that the large negative spreads were all data errors such as transposing two digits. Accordingly, all negative spreads above 5 cents were taken to be data errors, and the day's entire record for that firm was then deleted just as if the firm had not been listed on that date.[13] An examination of the largest positive spreads found only one clear data error, with other figures being clearly correct or at least plausible, even though they ranged up to $6.00. The particular error was corrected, but other large positive spreads were accepted as being correct[14].

V. Testing the Hypotheses

a. Hypotheses Concerning the Spread

As refined in section III, the hypotheses concerning the spread can be stated as:

H_{1A}' The normalised spreads tended to be greater in the four weeks after the crash than in the four weeks before.

H_{1B}' The normalised spreads during February and March 1988 tended to be less after the announcement date for each firm than before.

For testing these hypotheses, one might consider a t-test (or nonparametric equivalent). Unfortunately, the spread on any date is correlated with the spread on other dates. Indeed, an examination of the autocorrelations, shown in Table 2, suggests that the normalised spread for a single firm is generated by a nonstationary process, since the autocorrelations do not die out quickly (Judge et al.,

1985, p. 240). The serial correlation between consecutive spreads means that the assumption of mutual independence which underlies the t-test is invalid.

Instead of a formal test of these hypotheses, Figure 1 presents plots of the median and the 5%-trimmed mean[15] of the normalised spreads for the period around the crash, for the months of February and March 1988, and for 15 trading days before and after the announcement dates. The announcements were mostly clustered in the last two weeks of February, but they spanned a period of about a month. Plotting the spreads by calendar date allows one to look for any economy-wide events which might have caused a change in spreads, and plotting the spreads relative to the announcement dates tends to average out the effects of any such events. The spread is that between the highest buy quote and the lowest sell quote available anywhere in New Zealand at the close of trading on the day.[16] Error bars on selected data points indicate the standard error of the cross-sectional daily estimates (which is not of course related to the magnitude of any time-series disturbance).

Clearly the normalised spread was much larger on the crash date than before or afterwards, and was larger after the crash than before. There was no sudden jump in the normalised spread during February and March, although there appears to be a downwards drift. There was a short-lived decline in the normalised spread after the announcement date; however, the spread returns within two or three days to its previous level.

There is a further, more pronounced fall about ten trading days (two weeks) after the announcement date. It seems hard to connect this to the announcement, given the lag time. In a market which is semi-strong efficient, one would expect that all variables which are determined by the actions of competing individuals would adjust rapidly to any shock, and this is what was reported by Morse and Ushman

(1983). However, the fall in the spread is much sharper relative to the announcement date than it is in calendar time, so it does not seem to be caused by any economy-wide event. It may be purely a demonstration of the non-stationary time-series nature of the spreads.

An alternative methodology is to examine the day-to-day changes in the normalised spread. Table 3 reports, for the same dates as were used in Figure 1, the number of companies for which a one-day change in normalised spread could be computed, and the number of those which were increases and decreases. Overall, 46.6% of the changes were increases, and so on a typical day one would expect 46.6% of the changes to be increases. A binomial test (Conover, 1980, p. 96) allows one to determine whether the actual proportion of increases on any day was significantly greater or less than expected. Table 3 thus shows the significance level of this test. Values of the significance close to zero indicate significantly more decreases than expected (these have been flagged with a - if the significance is below .01); values close to one indicate significantly more increases than expected (flagged with a + if the significance is above .99). These significance levels are free of any ambiguity arising from autocorrelation.

However, information events and large price changes should produce an increase followed by a decrease in spreads, and a number of such patterns can be discerned (most obviously at the time of the crash, but also during October 8-13, October 27-28, November 4-6, and February 29-March 4). It is hard to separate permanent increases in spread from increases which are immediately reversed. This methodology is therefore not very helpful for determining whether a permanent change in the spreads occurred at the time of the crash; but clearly there was no significant number of decreases in spread at the announcement date or in the immediately succeeding days.

b. Hypotheses Concerning the Volume

As refined in section III, the hypotheses concerning volume are

H_{2A}' The daily number of shares traded for each firm tended to be less in the four weeks after the crash than in the four weeks before.

H_{2B}' The daily number of shares traded for each firm during February and March 1988 tended to be greater after the announcement date than before.

Figure 2 shows total daily trading volumes (in dollars) on a logarithmic scale; the values shown are the median and the 5%-trimmed mean, and error bars are again added. (Because of the logarithmic scale, the error bars appear asymmetric in the diagram.) The volume increases for a few days after the crash, but then falls to considerably lower levels than before the crash. There is no consistent change in volume after the announcement date: the median appears unchanged and the trimmed mean is fluctuating. There does appear to be an increase in mean volume at the beginning of March, but this seems to be linked to calendar time (and hence an unrelated economic event) rather than to event time.

c. Hypotheses Concerning Liquidity of the Market

The refined hypotheses concerning liquidity are

H_{3A}' The proportion of days on which both buy and sell quotes were available tended to be greater in the four weeks after the crash than in the four weeks before.

H_{3B}' The proportion of days during February and March 1988 on which both buy and sell quotes were available

tended to be less after the announcement date for each firm than before.

Table 4 shows a pair of 2x4 contingency tables, where the rows represent before or after the crash date (announcement date) and the columns represent which closing quotes were available in New Zealand (not necessarily on the same regional exchange) for a company on a trading day (i.e. no quotes, buy quote only, sell quote only, both quotes). From such a table, the chi-square test (Conover, 1980, p. 154) can be applied to determine whether the probability that a company will fall into one of these categories on a certain day is the same before and after the crash (announcement date). The values and significance of the chi-square test are given in Table 4.

Discussion

The changes in spreads are consistent with the predictions of hypotheses H_{1A} and perhaps with H_{1B}, although the evidence in the latter case is extremely ambiguous.

The volume reaction is much less consistent with expectations. The median volume decreases about 4-8 days after the crash, which is about the same time lag as was reported by Morse and Ushman (1983). The trimmed mean shows a brief but sharp increase immediately after the crash date; this may reflect portfolio rebalancing and margin calls in response to the sudden price changes, with an underlying information asymmetry effect becoming visible after these transient effects clear away. There is no particular change in volume about the announcement date, contrary to hypothesis H_{2B}.

The liquidity reaction is consistent with the prediction of hypothesis H_{3A}, but contrary to H_{3B}. Statistically significant differences in the distribution of quotes occurred around both the crash and the announcement

date, and the differences are obviously due to a substantial decrease in the proportion of firms having both quotes available.

The results at the crash date are consistent with the behaviour predicted for a market in which information asymmetry abruptly increases, with temporary masking by portfolio effects. It seems that the results around the announcement date, however, give little support to Lev's (1988) view that reducing information asymmetry by forcing disclosure of price-sensitive information improves the liquidity of capital markets.

There seem to be four possible explanations for these results:

(i) The results observed at the crash date are not caused by an increase in information asymmetry but by some other phenomenon. Therefore, evidence of reduction in information asymmetry at the announcement date is not to be expected.

In Glosten and Milgrom's (1985) model, the spread increases if the elasticity of supply and demand by uninformed traders increases. After the crash, some holders of shares would have been forced to liquidate their positions, thus reducing the elasticity of supply. On the other hand, elasticity of demand may have increased if investors became more cautious after the preceding "go-go" period. The direction of any net effect on the spread is hard to predict; but the figures in Table 4 show that the probability of finding a sell quote for a share remained almost unchanged at 89% before and after the crash, while the probability of finding a buy quote fell from 91% to 85%. These probabilities are only indirectly related to elasticities of supply and demand, but they suggest that the elasticity of demand may have

increased after the crash while the elasticity of supply was not much changed. This would be consistent with an increase in the spreads, according to Glosten and Milgrom's model.

(ii) The information about losses had already been disseminated to the market in some other way before the announcement date, and the adjustment had already occurred. This is certainly possible, even though the Stock Exchange had clearly felt that insufficient information had been disseminated in the three and a half months from the crash until 11 February 1988. This explanation requires one to accept that this information was then disseminated over the next two weeks but before the firms announced the extent of their losses. Further, if the spread increased in October because of the new information asymmetry which was then corrected before February, one would expect the spreads to have returned to their pre-crash levels. In fact, they were still at their post-crash levels, and remained there throughout February and March.

(iii) The theoretical models which predict the effects of information asymmetry are wrong, or at least are not applicable to the New Zealand sharemarket.

(iv) There are flaws in the empirical work. One obvious query would be whether the sample size is large enough to detect small changes which may have occurred at the announcement date. This objection can be turned around: the study sets upper bound, which can be inferred from Figures 1 and 2, on the changes in normalised spreads and volume which occurred at the announcement date. The sample is so close to a census of listed NZ companies that sample selection bias does not appear likely to be a problem either.

On balance, two explanations seem most likely: either information asymmetry is just not important, even in such an extreme situation as this one, or the theoretical models are not fully applicable to the New Zealand sharemarket. Theoretical work on the effects of information asymmetry on spreads, trading volume, and liquidity in markets without specialists would be valuable in helping to interpret the results. Within the limitations of present theoretical understanding, it seems that the actions of the NZ Stock Exchange in requiring the special disclosure had very little effect on the functioning of the market.

TABLE 1.

Information about the ten largest (as of 1 March 1988) NZ listed firms.

Firm	Industry	Market Value ($ millions)	Number of Shareholders	Largest Holding	Directors' Holdings[a]	Institutional Holdings[b]
Fletcher Challenge	Forestry	3,783	68,020	23%	4%	>49%
Goodman Fielder Wattie	Food	2,072	48,717	10%	0.2%	>55%
Brierley Investments	Investment	1,783	159,245	5%	5%	>23%
NZ Forest Products	Forestry	1,318	55,059	20%	0.1%	>60%
NZI Corporation	Insurance	1,070	42,590	30%	0.2%	<63%
Petroleum Corp of NZ	Fuel & Energy	1,066	n.a.	70%	n.a.	n.a.
Bank of New Zealand	Finance & Banking	866	n.a.	87%	0.0%	n.a.
Lion Corporation	Liquor & Tobacco	677	11,594	11%	12%	>36%
L D Nathan & Company	Retail	598	14,353	10%	1%	<73%
Magnum Corporation	Liquor & Tobacco	584	13,593	67%	0.2%	n.a.

[a] Excluding shares held by pension plans for which directors are trustees.

[b] If shown as >49%, the information was compiled by identifying investment institutions in the list of the largest shareholders; thus institutions whose holdings are too small to appear on the list are excluded. If shown as <63%, the figure given is the proportion of shares which the firm reported as being owned by companies; thus the proportion includes small temporary holdings by firms which are not in the business of investment, small share clubs, etc.

n.a. Figure not available.

The data on shareholdings are compiled from information in the 1987 or 1988 annual reports of the firms. The market values are at 1 March 1988.

TABLE 2.

Autocorrelations and partial autocorrelations of the normalised spreads, and of the first differences.

	Normalised Spreads		First Differences	
Lag	Autocorr	Partials	Autocorr	Partials
1	0.892	0.892	-.240	-.240
2	0.825	0.143	-.079	-.145
3	0.769	0.052	-.034	-.098
4	0.721	0.033	.053	.007
5	0.690	0.084	.010	.015
6	0.658	0.021	-.041	-.031
7	0.638	0.067		
8	0.615	0.014		
9	0.595	0.025		
10	0.581	0.043		

TABLE 3.

Frequencies of increases and decreases in normalised spreads.

The binomial test for each date tests the hypothesis that 46.6% of the spread changes are increases.

Date	Number of firms	Number of increases	Number of decreases	Significance of binomial test
870922	229	80	82	.782
870923	234	88	78	.957
870924	233	71	82	.509
870925	230	62	96	.037
870928	228	93	77	.985
870929	237	67	88	.220
870930	224	70	81	.505
871001	226	76	78	.775
871002	228	70	74	.712
871005	230	74	84	.552
871006	232	86	83	.881
871007	233	66	96	.076
871008	225	84	64	.995 +
871009	222	90	66	.998 +
871012	222	68	90	.204
871013	223	58	96	.015
871014	228	77	78	.799
871015	229	75	78	.749
871016	225	80	75	.907
871019	214	92	63	.999 +
871020	158	133	18	.9999 +
871021	167	37	11	.0001 -
871022	176	44	88	.001 -
871023	190	66	88	.195
871027	183	96	54	.9999 +
871028	186	47	89	.003 -
871029	191	73	73	.815
871030	194	63	74	.473
871102	194	65	74	.546
871103	199	58	83	.110
871104	195	89	56	.9999 +
871105	188	78	64	.980
871106	195	47	90	.002 -
871109	191	55	74	.205
871110	192	75	70	.905
871111	202	73	64	.950
871112	201	72	75	.742
871113	197	45	74	.032
871116	193	62	67	.660
871117	198	46	80	.014
871118	206	63	68	.663
871119	220	59	83	.128
871120	219	57	73	.291
871123	217	65	76	.483
871124	219	68	84	.349
871125	215	62	70	.565
871126	216	60	75	.336
871127	213	56	67	.438

TABLE 3 (continued)

Date	Number of firms	Number of increases	Number of decreases	Significance of binomial test
880202	221	66	49	.992 +
880203	227	56	64	.539
880204	231	63	52	.967
880205	230	35	82	.0002 -
880208	224	61	68	.593
880209	222	63	56	.929
880210	220	49	54	.614
880211	223	53	54	.757
880212	218	45	62	.197
880215	209	51	60	.480
880216	213	47	65	.185
880217	225	54	62	.530
880218	227	56	73	.259
880219	219	51	64	.345
880222	219	55	66	.433
880223	222	53	64	.422
880224	174	44	40	.878
880225	153	28	46	.080
880226	147	25	43	.065
880229	141	49	31	.997 +
880301	136	25	47	.027
880302	137	27	45	.075
880303	140	28	52	.023
880304	138	24	47	.019
880307	122	29	41	.226
880308	125	23	44	.028
880309	129	28	40	.217
880310	132	34	33	.787
880311	134	30	37	.428
880314	130	32	52	.071
880315	139	32	37	.531
880316	141	36	42	.512
880317	126	28	33	.506
880318	116	33	29	.878
880321	119	24	45	.031
880322	120	31	37	.480
880323	134	29	48	.071
880324	140	32	39	.443
880325	143	29	46	.102
880328	124	45	26	.998 +
880329	121	26	39	.171

TABLE 3 (continued)

Days from Announcement	Number of firms	Number of increases	Number of decreases	Significance of binomial test
-15	135	43	40	.854
-14	169	41	50	.422
-13	177	44	53	.441
-12	179	47	47	.775
-11	181	41	52	.349
-10	182	47	41	.916
-9	184	33	64	.008 -
-8	198	45	60	.249
-7	207	52	49	.859
-6	203	45	58	.308
-5	198	44	67	.083
-4	186	56	59	.704
-3	186	48	39	.956
-2	186	44	51	.516
-1	176	31	52	.056
0	159	44	47	.668
1	156	43	43	.768
2	147	29	44	.143
3	144	33	41	.407
4	135	31	44	.210
5	130	29	45	.121
6	117	24	45	.031
7	121	26	41	.122
8	111	23	37	.123
9	124	27	41	.153
10	119	29	41	.226
11	116	21	37	.071
12	118	29	36	.421
13	126	34	31	.851
14	125	34	36	.672
15	113	24	37	.155

Note: + means that significantly (significance .99 or more) more spreads increased than would be expected on a typical day.

- means that significantly (significance .01 or less) more spreads decreased than would be expected on a typical day.

TABLE 4.

Contingency Tables for determining whether the probability distribution of the availability of quotes differs before and after the crash (announcement date).

(a) Before and after the Crash.

	Both Quotes	Buy Only	Sell Only	Neither Quote	Totals
Before	4944	569	437	95	6045
	81.8%	9.4%	7.2%	1.6%	
After	6051	725	1094	124	7994
	75.7%	9.1%	13.7%	1.6%	
Totals	10995	1294	1531	219	14039

Chi-squared = 148.3 (3 d.f.) $p < .00001$

(b) Before and after the Announcement Date.

	Both Quotes	Buy Only	Sell Only	Neither Quote	Totals
Before	3414	335	435	56	4240
	80.5%	7.9%	10.3%	1.3%	
After	3181	1584	286	85	5136
	61.9%	30.8%	5.6%	1.7%	
Totals	6595	1919	721	141	9376

Chi-squared = 779.4 (3 d.f) $p < .00001$

FIGURE 1.

Median and 5%-trimmed mean of the normalised spreads (based on NZ-wide quotes) for calendar dates and days relative to the announcement date for each firm. • = medians; ■ = trimmed means.

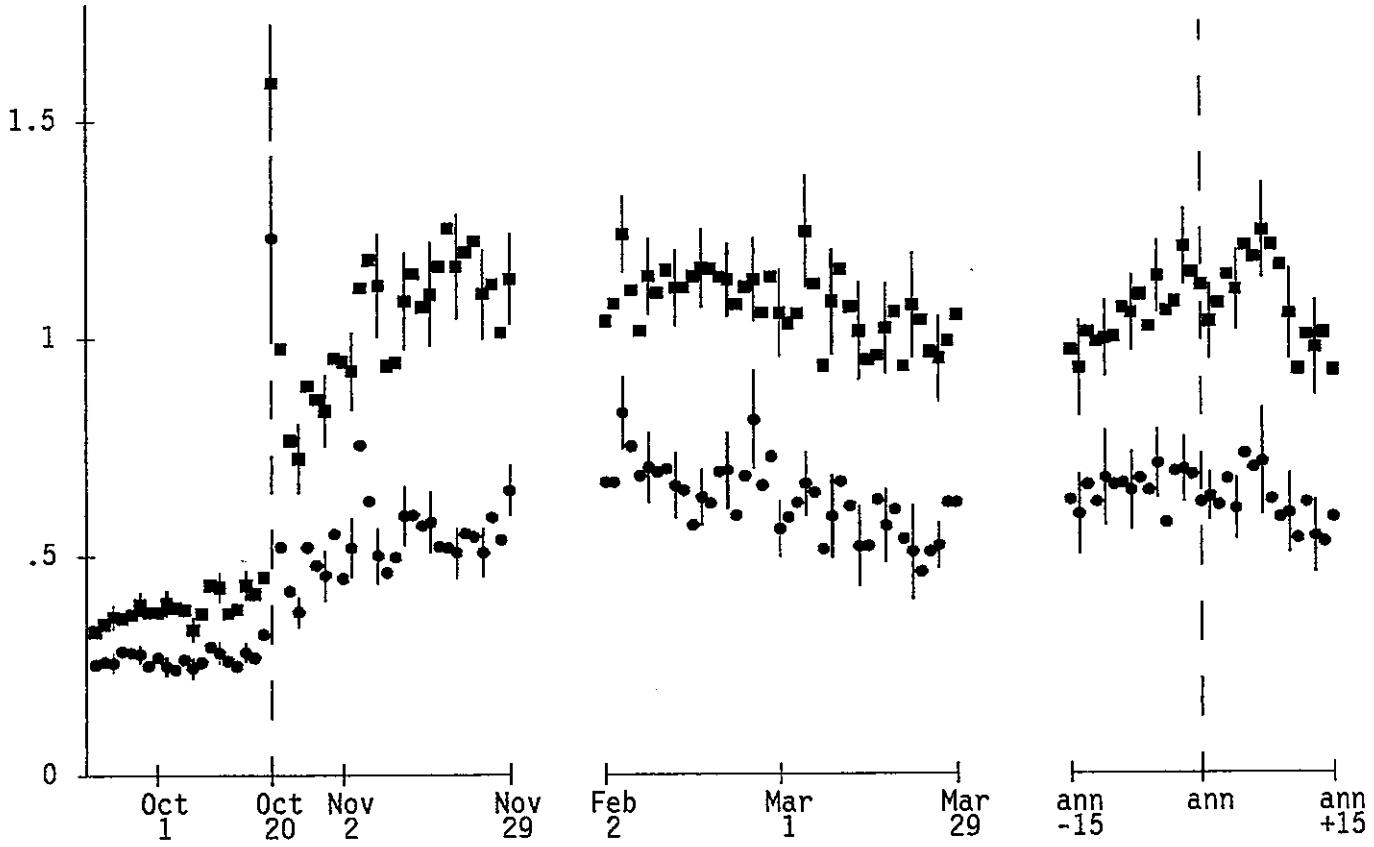
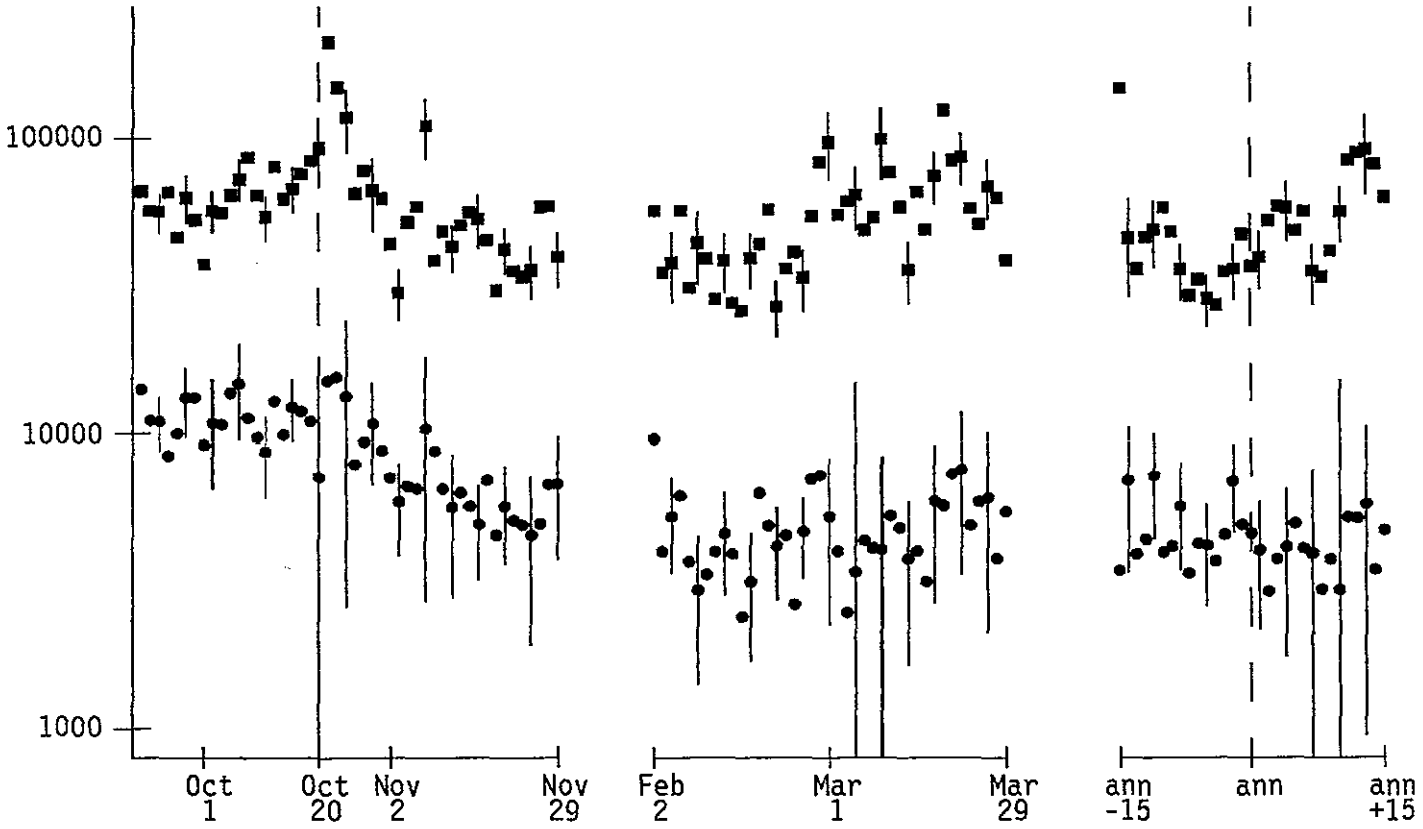


FIGURE 2.

Median and 5%-trimmed mean of the trading volumes (value of shares traded) for calendar dates and days relative to the announcement date for each firm. Value scale is logarithmic. • = medians; ■ = trimmed means.



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Footnotes

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[1] This assumes that the investors have discretion about whether to trade, e.g. their positions are not being forcibly liquidated by creditors.

[2] Source: daily National Business Review sharemarket tables.

[3] Quotes on the NZ market are referred to as buy and sell rather than bid and ask. Since the discussion in this article will switch frequently from spreads set by a specialist dealer to those arising from investor orders transmitted to the exchange by a broker, it will be convenient to refer to bid and ask prices for the former and buy and sell prices for the latter.

[4] There was, for example, no requirement that firms disclose their cost of sales, and many firms chose not to do so. The Companies Act required that financial statements shall present a "true and fair view", but that term is undefined and no sanctions were prescribed for non-compliance. Statements were audited, and auditors were required to disclose any departures from Statements of Standard Accounting Practice issued by the NZ Society of Accountants, but again there were no sanctions against a company for such departures; in particular, neither the Stock Exchange, nor the Registrar of Companies, nor the Securities Commission took any action.

[5] In late 1988, the law was changed to declare insider trading illegal and to require disclosure of the identity of ultimate shareholders. Other market participants who lose in dealings with insiders may now sue for damages, but there is no government enforcement of the ban on insider trading. No lawsuits have yet occurred, and at

least one recent controversy suggests that the intent of the disclosure requirements can be readily evaded.

[6] Most negative spreads were only one or two cents. Thus, if the quotes were from investors who wished to trade only 1,000 or so shares, the potential arbitrage profits would not be large and might well be smaller than information search costs.

[7] In respect of the particular firms involved, revelation of the terms of a previously undisclosed deal obviously reduces information asymmetry: before the revelation, only insiders know of the deal, and afterwards everyone knows. The effect on outsiders of learning that directors of some highly regarded companies had been deliberately misleading their shareholders is assumed to be to increase perceived information asymmetry in the market as a whole, as shareholders of other firms begin to wonder what information their directors might have been concealing or misrepresenting.

[8] About 10 days earlier, The Australian National Companies and Securities Commission and the Australian Stock Exchange had imposed a more limited requirement on Australian listed companies, requiring them to disclose the market and book values of their quoted investments, showing the effects of the crash.

[9] Morse and Ushman (1983) found significant effects on the trading volume from the day before until 6 days after an earnings announcement or large price change. Significant increases in spreads, however, were found only on the day of a large price change.

[10] Karpoff heads this section of his article "The Bid-Ask Spread", but his discussion in fact concerns the difference between what the buyer pays and what the seller receives. In a pure dealership market, this is of course the dealer's spread. In an auction market, the difference represents brokerage commissions and has no connection with the buy-sell spread.

[11] A discussion of the analogous point in using ratios to control for size appears in Lev and Sunder (1979).

[12] Some firms never reported their losses; some were believed to have reported but the Stock Exchange could not identify the date; some firms made voluntary announcements of their losses before the Exchange required them to do so.

[13] Treating the spread as missing would not be correct, because it would bias the liquidity measure downwards.

[14] If true spreads are distributed asymmetrically (with a few small negative ones) but recording errors are distributed symmetrically, then it is quite reasonable that all large negative spreads might be data errors while only a small proportion of others (including large positive spreads) are errors.

[15] The simple mean is very unstable because it is sensitive to the small number of outlying large spreads. Trimming the sample for each date by 5% stabilised the mean to a reasonable extent.

[16] Because of poor communication between the regional exchanges, the interpretation of these spreads as the

spread in a single market is somewhat suspect. It would have been desirable to repeat the calculations using the spreads on a single regional exchange; unfortunately, the New Zealand Stock Exchange did not keep records of buy and sell quotes from individual regional exchanges after late February 1988.