New Zealand Equity Market Cleanliness for the years 2010-2016

Abstract

This report assesses the cleanliness of New Zealand equity markets. The assessment is based on the prevalence of abnormal price movements ahead of material price sensitive announcements -measured by the market cleanliness statistic (MCS). The report assessed the New Zealand market cleanliness for the years 2010-2016 and found that the MCS appears to be fluctuating and does not display a clear increasing or decreasing trend. The report also assessed whether the introduction of additional laws relating to equity market conduct in 2013 made a difference to the MCS. This was found not to be the case. There were limited opportunities for international comparison. It was possible to conduct a formal comparison with Australia. The results of this did not suggest a statistically significant difference between the MCS here and in Australia. However, a graphical comparison of the New Zealand and Australian statistics did suggest that the New Zealand statistic was more variable than the Australian statistic. The lack of statistical significance is likely due to the small sample size involved. This increases the variability of the MCS meaning that a very large change is required to qualify as statistically significant. In addition, enforcement is more likely than the introduction of legislation to result in a statistically significant impact. The first prosecution for insider trading in New Zealand was not completed until 2017 so the significance of this was not able to be assessed.

Acknowledgements

Anna Hensen, author of this study, which was conducted for a Victoria University Wellington Summer Research Scholarship, thanks Colin Magee (Financial Market Authority), Joost van Amelsfort (New Zealand Stock Exchange) and Martien Lubberink (Victoria University Wellington) for helpful comments and suggestions.

Executive summary

This study assesses the cleanliness of New Zealand's equity markets based on the prevalence of abnormal price movements ahead of material announcements. The MCS was calculated for each year over a seven-year time period ranging from 2010 to 2016.

Initially the MCS was calculated using a two-day event window. This produced a statistic that graphically appeared to be showing a decrease but also displayed a high level of variability. Though most overseas studies used the two-day event window, some used a five-day event window instead. For this reason, the MCS was recalculated using a five-day event window. There was no statistically significant trend over the event window and the MCS remained highly variable.

To more formally assess whether the MCS had changed over time, a univariate test was conducted on the two-day statistic. The event chosen for this test was the year 2013. This coincided with the introduction of the Financial Markets Conduct Act 2013 which was introduced to strengthen the legislative framework around disclosure and reporting requirements. The result of this test suggested that there had not been a statistically significant change in the MCS before and after 2013. This suggested that the introduction of new legislation did not have an impact on insider trading behaviour in New Zealand.

This result was not unexpected in light of a 2002 study conducted by Bhattacharya and Daouk (2002) which found that enforcement of insider trading regulations, rather than the existence of insider trader regulations, is needed for the level of insider trading to decrease.[1] The first prosecution for insider trading in New Zealand was completed in 2017. It was therefore not possible to assess the affect this had on the MCS.

The lack of statistical significance was also partly due to the small sample size. This lead to quite a variable statistic meaning a significant change in the MCS would be required for it to qualify as statistically significant. It is therefore important to note that there is still an apparent decrease in the MCS, but it is not big enough to qualify as significant given the sample size available.

Other studies have cautioned against conducting international comparisons of the MCS. This is due to countries operating with different regulatory frameworks and having different

[1] Uptal Bhattacharya and Hazem Daouk "The World Price of Insider Trading" *The Journal of Finance*, vol. 57 issue 1, February 2002, pp 75–108.

structures for corporate governance.[2] There are also timing and methodology differences in several of the studies that make a comparison difficult.

New Zealand does, however, have a very similar regulatory framework to Australia. Parliament made an effort to bring our legislation more into line with that of Australia when passing the Financial Markets Conduct Act 2013.[3] In addition, the regulations used for companies regarding the disclosure of price sensitive information are very similar.[4] [5] Because of the similarity of our legislative frameworks a comparison was attempted. There were some limitations on the validity of the comparison, namely, the comparative size of our equity markets, with New Zealand hosting a significantly smaller equity market compared to Australia.

To ensure the comparison was as accurate as possible, some amendments were made to the original method to make it as consistent as possible with the Australian study. This involved calculating the MCS with a five-day event window and modifying the liquidity filter used to bring it into line with Australia's methodology. The thresholds used for the identification of material and significant announcements were the same as those used in the Australian study.

A formal comparison with Australia was calculated for each year that the studies overlapped as well as for the average statistic for each year that was compared. The result of this comparison was that the New Zealand statistic was not statistically different from the Australian statistic.

In addition to this, a graphical comparison was also conducted. This showed no clear difference in the MCSs for the two countries but did demonstrate that the New Zealand statistic was considerably more variable than the Australian statistic. This can be attributed to the relatively small New Zealand sample size.

To check the robustness of the MCS it was re-calculated using different event window lengths. These ranged from two to ten days. A graph of the results displayed some variation

[2] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4

[3] (6 March 2012) 678 NZPD 872, < https://www.parliament.nz/en/pb/hansard-debates/rhr/document/50HansD_20120306_00000032/financial-markets-conduct-bill-first-reading>

[4]NZX Main board/debt market listing rules (1 October 2017) at 131 <c84t3un4/comfy/cms/files/files/000/002/619/original/NZX_Main_Board_Rules_-_1_October_2017-_clean___secure.pdf>

[5]ASX guidance note 8 (1 May 2013) <http://www.asx.com.au/documents/about/guidance-note-8-clean-copy.pdf>

in the trend of the MCSs depending on the event window length selected. This suggests that the findings of such an event study may vary depending on the event window chosen. While not ideal, it is unfortunately unavoidable given the small sample size used.

The result of the study was that the MCS for New Zealand appears to have been stable over time and did not show any significant change as a result of the introduction of the Financial Markets Conduct Act 2013. Our statistic is comparable to that of Australia.

Introduction

Financial markets play a central role in today's economy. They ensure that businesses and corporations are able to raise funds. It is important that our financial markets are both efficient and fair in order to encourage investor participation.

Insider trading creates problems for the efficiency and proper functioning of equity markets. When trading in an environment where there are perceived inequalities of information investors will trade in a more cautious manner. This causes decreased liquidity in the market and increased search costs. In more extreme cases, investors may pull out of the market entirely. This raises the cost of capital for businesses trading in equity markets, reducing their ability to acquire capital and limiting their ability to operate. This has broader impacts on the economy as many major companies rely on the stock exchange as a means for acquiring the capital they need to finance their businesses.[6]

A study conducted by Bhattacharya and Daouk found that when insider trading legislation is effectively enforced the cost of capital can be reduced, by between 0.3% and 7%. This is a significant amount of money from the perspective of both businesses and investors.[7]

The same study highlighted that the presence of insider trading regulations does not, in itself, reduce insider trading. Enforcement of these regulations is required to render them effective.

Measuring the level of insider trading is a growing area of research with studies having been conducted in the UK and, more recently, Australia and Brazil. This is the first study to examine the New Zealand equity market.

Purpose

[6] "The Cost of Inequity" *The Economist* (online ed, 20 January 2002)

[7] Uptal Bhattacharya and Hazem Daouk "The World Price of Insider Trading" *The Journal of Finance*, vol. 57 issue 1, February 2002, pp 75–108.

The purpose of this report is to assess the presence of indicators for insider trading in New Zealand equity markets. It is intended to give an initial overview of the appearance of indicators for insider trading in New Zealand equity markets. This will enable greater understanding of the operation of New Zealand equity markets.

The report analyses the New Zealand equity market based on the established measure of equity market cleanliness employed in studies conducted in the UK and in Australia. It also examines the measure produced for changes over time.

The report varies the estimation and event windows used in the calculations. This ensures that the MCS produced is robust and, to the extent possible, accurately captures the estimated level of insider trading in New Zealand equity markets.

Though only the established measure for market cleanliness will be assessed in this report, the report will highlight other possible measures that could be used to assess equity market cleanliness.

Possible measures of market cleanliness

The overseas studies which have been undertaken have established two potential methods for assessing the prevalence of insider trading: abnormal price movements and suspicious trading activity.

Abnormal price movements

The abnormal price movements measure focusses on the price of a security immediately prior to a price sensitive announcement. It is based on the rationale that, in efficient markets, the prices of securities will react instantaneously to the release of price sensitive information. The method looks for abnormal increases or decreases (depending on the nature of the announcement) in the price of a security in the lead up to a price-sensitive announcement. If these changes are significantly different from normal volatility, they could indicate that investors are aware of price sensitive information prior to its official release and trading based on this information.

This measure is well-established. It was used in the UK in 2006[8] and has been used in subsequent studies in 2007[9] and 2014[10]. It was also replicated in studies done on the Australian[11] and Brazilian[12] stock exchanges.

It is important to note, however, that there are flaws in the methodology, notably, that price jumps immediately prior to a price sensitive announcement can occur for a variety of reasons, including general speculation caused by rumours or other legal sources of information.[13]

Due to how the measure is calculated, there is also the potential for there to be upward bias in the estimation of the MCS.[14] This is because the announcements selected as material are more likely to exhibit abnormal price movements ahead of the announcement, creating a

[8] Ben Dubow and Nuno Monteiro "Measuring Market Cleanliness" (March 2006), FSA Occasional Paper Series 23

[9] Nuno Monteiro, Qamar Zaman and Susanne Leitterstorf "Updated Measurement of Market Cleanliness" (March 2007), FSA Occasional Paper Series 25

[10] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4

[11] Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487

[12] Tatiana Tiemi Nagata "Assessment of informed trading in the Brazilian equity market: Market cleanliness methodology" (August 2017) <http://www.pp.u-tokyo.ac.jp/wp-content/uploads/2016/02/51158208.pdf>

[13] Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487

[14] Ben Dubow and Nuno Monteiro "Measuring Market Cleanliness" (March 2006), FSA Occasional Paper Series 23

higher than expected statistic. This happens because the criteria used to select an announcement as material are very similar to those used to assess whether an announcement exhibits an abnormal pre-announcement price movement (APPM). If the abnormal return is high enough to meet the materiality threshold it is also likely to be high enough to meet the threshold for qualifying as an APPM, more so than it would be if the announcement had not qualified as material.

Equally the measure may not pick up on all insider trading activity. Depending on the release of the information, it may be possible for insiders to start trading well in advance of an announcement and to spread their trades out over time to avoid significantly impacting the share price. It may also be that they trade in smaller volumes that are insufficient to impact the price of the security.[15] [16]

The measure does, however, indicate inefficiencies in markets as it suggests that some investors are more informed at certain points in time than others. It is a useful measure to apply because it has a simple rationale and methodology and thus can provide a broad and indicative measure of market cleanliness.

Suspicious trading activity

In addition to looking at abnormal price movements, the 2016 Australian study also sought to develop a new measure of market cleanliness. The new measure involved assessing each individual trade in the lead up to a price sensitive announcement. Because they were able to track which accounts made particular trades, they were able to assess normal trading patterns to determine which accounts were trading in a suspicious manner (suggesting that they were aware of price sensitive information prior to its official release).[17]

This measure allowed them to assess the following two statistics:

- The number of accounts trading in the shares at the time of the announcement and the percentage of these that exhibited suspicious activity. This consisted of timely and profitable trading which was decided based on the profits made and the amount of the stock normally traded by the account compared to the amount traded in the lead up to the announcement;

[15]FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series

[16] 4Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487

[17] Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487

- The overall volume of shares traded immediately prior to the announcement and the percentage of that volume that was traded by accounts that were exhibiting suspicious activity.

This measure does not suffer from many of the difficulties associated with the measure relating to price movements, including:[18]

- upward bias in the measure due to the way that material and significant announcements are selected
- Identifying suspicious behaviour for securities that have more volatile returns.

It is also less open to uncertainty about its driving factors. Because the suspicious trading measure examines individual trades against ordinary trading patterns, it is easier to see where suspicious behaviour is taking place.

However, this method requires substantially more extensive statistical analysis. For every announcement it requires assessment of each account trading in the stock and the volume of shares traded by each account. The analysis consists of calculating several factors, including the amount of the stock normally traded, and the profit made, ahead of the material announcement. In addition, the significance of each of these factors needs to be assessed by comparing them with usual trading patterns.

Due to the more detailed data required for the measure and the recent introduction of the surveillance system required, the Australian study was only able to produce the measure for one year. Because of time constraints associated with the project it was not possible to explore this measure in depth.

[18] Ibid

Measuring equity market cleanliness

Methodology of the established measure

The established market cleanliness measure involves assessing whether the returns on a stock in the days immediately prior to a material price sensitive announcement (MPSA) are considered to be abnormal. [19]

The data required for the study consisted of all announcements that were tagged as material on the NZX main board between the years of 2010 and 2016. It used the return on the stock for the day after the announcement, the day of the announcement and the 250 days prior to the announcement. In addition, the return on the NZX All index for the years 2009 to 2016 was used to approximate the market return.

The first step was assessing what the actual return on the stock was. The daily return data was provided by the NZX. The return was calculated by taking the natural log of the price on the day divided by the price of the stock on the previous day. The assumption was made that dividends were re-invested into the market. This was done using daily data:

$$Ln\frac{P_t}{P_{(t-1)}} \quad (1)$$

The next step was to calculate the expected return on the stock. This was done using the market model.[20] This was calculated by running a linear regression of 240 actual daily returns of the stock against 240 daily observations of the market return to calculate α_i.and β_i. The market return was approximated using the return for the NZX All index. The regression used the stock return from 250 days prior to the announcement up to 10 days prior to the announcement (the estimation window). This was regressed against the return on the NZX All index for the corresponding dates. The estimation window was stopped 10 days prior to the announcement to ensure that any suspicious activity during that period did not affect the market model. This avoided increased difficulty in identifying APPMs. The regression produces a market model which can be used to calculate the expected return on the stock.

$$E(R_{it}) = \alpha_i + \beta_i R_{mt} \ (2),$$

Where t is [-250, -11].

[19] This was calculated using the method developed in the UK 2006 study. The thresholds used were those from the Australian study.

[20] A. Craig MacKinlay "Event Studies in Economics and Finance" *Journal of Economic Literature,* vol. 35, March 1997, pp 13-39

The expected return is then subtracted from the actual return to calculate the abnormal return.

$$AR_{it} = R_{it} - E(R_{it}) \text{ (3)},$$

A materiality filter was applied to ensure that the impact of the announcements on the price of the share would be meaningful. Materiality was based on the abnormal return of the stock cumulated over the two days prior to the announcement, the day of the announcement and the day after the announcement.

$$CAR_{4day} = AR_{(t-2)} + AR_{(t-1)} + AR_t + AR_{(t+1)} \text{ (4)}$$

This was then compared to a bootstrapped sample of 10,000 four-day returns comprised of randomly selected, non-consecutive sets of four days taken from the estimation window, these abnormal returns were then added up. For an announcement to be considered material the cumulative abnormal return (CAR) had to be less than the value of the 1st percentile or greater than the values of the 99th percentile of the bootstrapped distribution.

Those announcements that did qualify as material were then assessed for the significance of their pre-announcement return. This involved comparing their pre-announcement return with the return on the stock over the estimation window. This was done by generating a bootstrapped distribution of 10,000 two-day CARs consisting of randomly drawn sets of two non-consecutive days from the estimation window. This was the compared with the actual CAR for the two days prior to the announcement.

$$CAR_{2day} = AR_{(t-2)} + AR_{(t-1)} \text{ (5)}$$

For a two-day CAR to be considered significant it had to be less than the value of the 1st percentile or greater than the value of the 99th percentile of the distribution of simulated bootstrapped CARs. It was also important that the two-day CAR was in the same direction as the overall abnormal return associated with the four-day CAR. Thus, for both materiality and pre-announcement movements the CARs were expected to be positive for a positive announcement (i.e. an announcement with a positive four-day CAR) and negative for a negative announcement (i.e. an announcement with a negative four-day CAR). Announcements that did not satisfy this requirement were still counted as material but excluded from the list of APPMs. Tables detailing the numbers of positive and negative four-day and two-day CARs can be found in **Appendix 3**.

The MCS was computed as the percentage of material announcements that also had abnormal pre-announcement price movements (APPMs).

$$MCS = \frac{Number\ of\ material\ announcements\ with\ APPMs}{Number\ of\ material\ announcements} \quad (6)$$

The market cleanliness statistic measures the percentage of announcements that exhibit indicators for insider trading. A lower statistic is desirable as this suggests insider trading activity is occurring for fewer announcements.

A more detailed explanation of the selection of the thresholds for the methodology can be found in **Appendix 2**.

Data

The data used was provided by the NZX. The stocks assessed were all those listed on the NZX Main Board as these provided a good cross section of the New Zealand equity market and the volume involved was manageable.

The original data set consisted of all announcements tagged as material. Though some studies engaged in additional filtering,[21] the New Zealand stock market contains significantly less stocks than most overseas markets which meant that all material announcements were retained rather than limiting the study to certain categories of announcement.

Also notable was that, in the UK studies, takeover announcements were dealt with separately from other announcements. Due to the smaller volume of data available for this study, the separate testing was not possible as there were too few takeover announcements to calculate a reliable statistic

In addition to the materiality requirements above the data required some additional filtering:

1. Where two announcements from the same company were identified as material and these announcements took place within 10 days of each other, the second of the announcements was filtered out. This was because any increased return as a result of a material announcement could potentially skew the pre-announcement price movement for the later announcement making it harder to identify abnormal returns. It is also possible that some of the abnormal return associated with such a proximate announcement could be linked to the earlier announcement.
2. In addition, any companies that made several announcements on the same day were treated as having made one announcement rather than several. This is because the study would involve working with the same returns and same calculations for each announcement. Under this measure any materiality or significance would be the

[21] The 2006 UK study limited their analysis to announcements tagged as “trading statement”, “trading update”, “contract award” or “drilling report”.

result of the combined effect of those announcements rather than attributable to each individual announcement.

Using a two-day event window resulted in a total of 511 announcements that qualified as material. APPMs were exhibited by 70 of these announcements. These are separated by year and the corresponding MCS is calculated in **Table 1** located in **Appendix 1**. The MCS has also been produced in a line graph to assess the general trend.

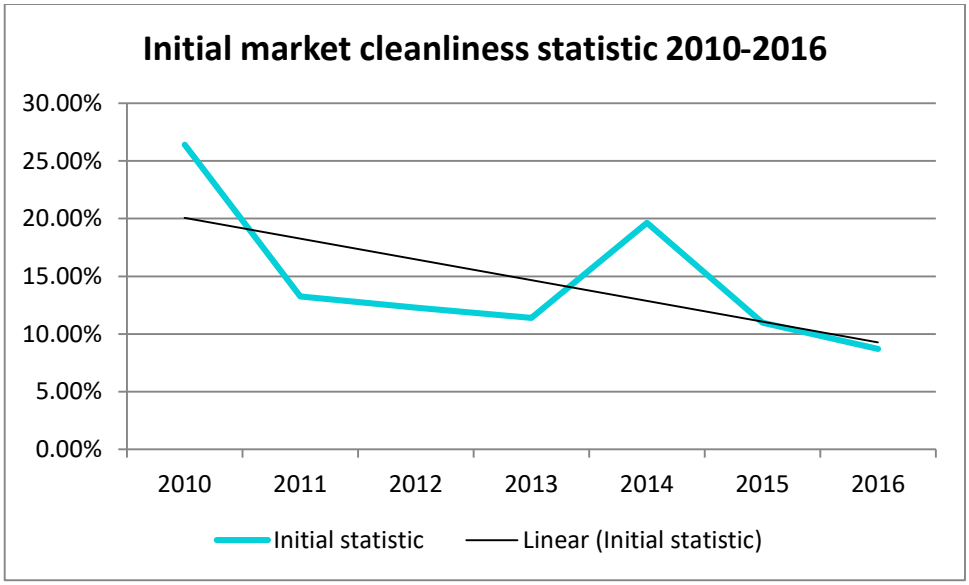

Figure 1: *Graph showing the MCS over the sample period prior to any liquidity filtering*

The graph shows a generally downward trend in the MCS. There is a particularly steep decline between the years of 2010 and 2011. This coincides with the establishment of the Financial Markets Authority which provides additional oversight of New Zealand's equity markets. There is a significant spike in 2014 suggesting that this particular year had a higher number of announcements exhibiting APPMs than those either side of it. The MCS for 2015 and 2016 appears to be decreasing, which suggests a lower level of suspicious trading.

Limitations of the measure

While the MCS is potentially indicative of insider trading activity it does not exclusively pick up insider trading activity. APPMs can also be caused by a variety of other factors, including rumours, companies scheduling announcements in advance and other means of information distribution.[22] The level of this may vary year on year and it is not possible to assess the

[22] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4

extent to which it contributes to the MCS. It is therefore important to regard this statistic as an indicator, rather than a definitive figure, for insider trading activity.

On the other hand, it is also important to note that insider trading will not always impact the price of the security enough to be identified as an APPM. This is because investors may be able to trade in sufficiently small volumes that they do not impact the price of the security. They may also be able to spread their trades out over a longer period of time to have the same effect.[23] The MCS will therefore not identify all insider trading activity.

Recalculating the measure with illiquid stocks filtered out

To address liquidity concerns stocks that failed to meet a certain threshold for the number of trading days were filtered out. Event study literature suggests that for a reliable study the stock must be trading for at least 126 of the 252 trading days in a year.[24] Therefore, stocks that were trading on fewer than 120 days out of the 240 in the estimation window[25] have been filtered out, and in addition to the above graph and table, a separate statistic was calculated using data that had been filtered for liquidity. **Table 2** in **Appendix 1** shows the number of MPSAs and APPMs that were filtered out and the revised statistic.

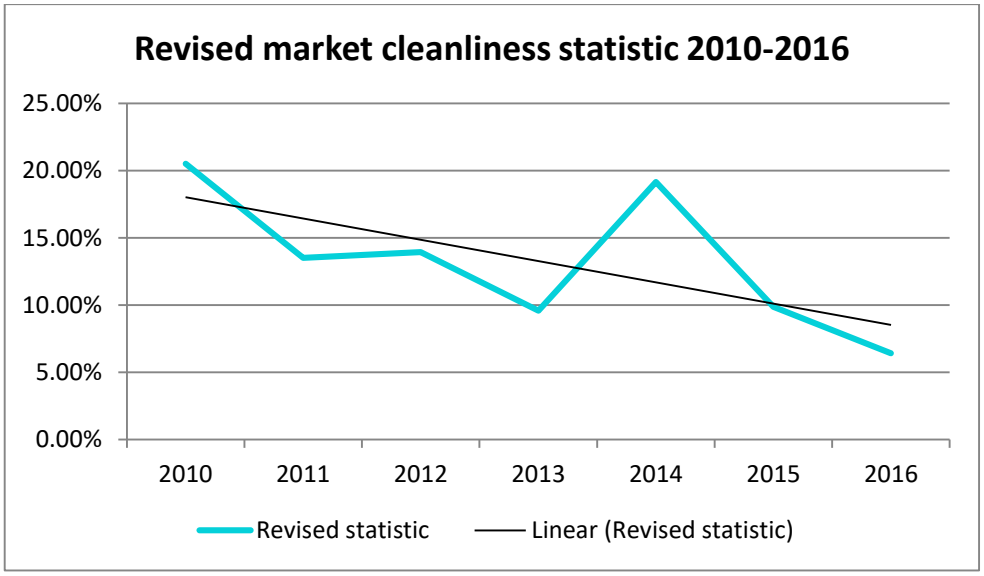

Figure 2: *Graph showing the revised MCS for the years 2010-2016*

[23] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4 at 21-23
[24] Simon Benninga *Financial Modelling* (4th ed, MIT Press, Massachusetts, 2014) at 333
[25] Volume data was sourced using Thompson Reuters Eikon software.

The impact of taking out the illiquid stocks varied year on year causing a significant decrease in the MCS in 2010 but a small increase for both 2011 and 2012. Small decreases were observed in the remaining years. The illiquid stocks are quite interesting in that they exhibit very little price change due to their limited trading. Because of this it would be harder for insiders to disguise their trades to ensure they have a minimal impact on the price. This may mean that more illiquid stocks, and stocks with more stable prices, are more responsive to a measure such as this that focusses on price movements.

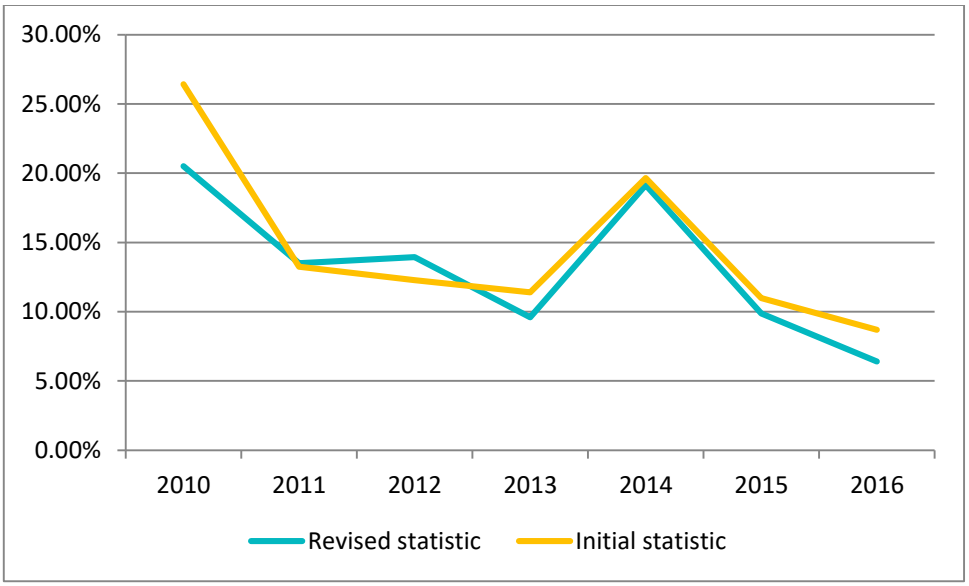

Figure 3: *Graph comparing the initial and revised MCSs for the two-day event window*

Comparing the two statistics shows a relatively similar trend without the liquidity filter. However, it is interesting to note that the liquidity filter had a very significant effect on the 2010 statistic, substantially more so than on the MCS for the other years. The result of this is that the 2010 statistic is significantly closer to the MCS for the 2014 peak than it was in the initial statistic. This suggests that the data could potentially be fluctuating rather than decreasing as was initially suggested. However, adding a trend line to the graph suggests there still appears to be a downward trend in the graph with the MCSs for 2015 and 2016 both appearing to be lower than they were prior to the liquidity filtering. Comparing the trend lines suggests that the initial statistic had a steeper decline than the revised statistic. To be more confident of the trend of the MCS more data would be needed to more accurately determine whether the data was fluctuating or decreasing.

Variations on the MCS

Initially a two-day event window was used. This was consistent with the studies done in the UK[26] and lines up with the timing of the four-day CAR used to assess materiality. The four-day CAR is considered to capture the overall return of the stock from both insider activity and post announcement reaction.

In addition to the two-day event window, a five-day event window was also of particular interest due to its use in other studies, including the Australian study.[27] This was calculated using the data that had been filtered for liquidity. **Table 3** in **Appendix 1** includes the values for the MCS. Changing the event window produced the following graph.

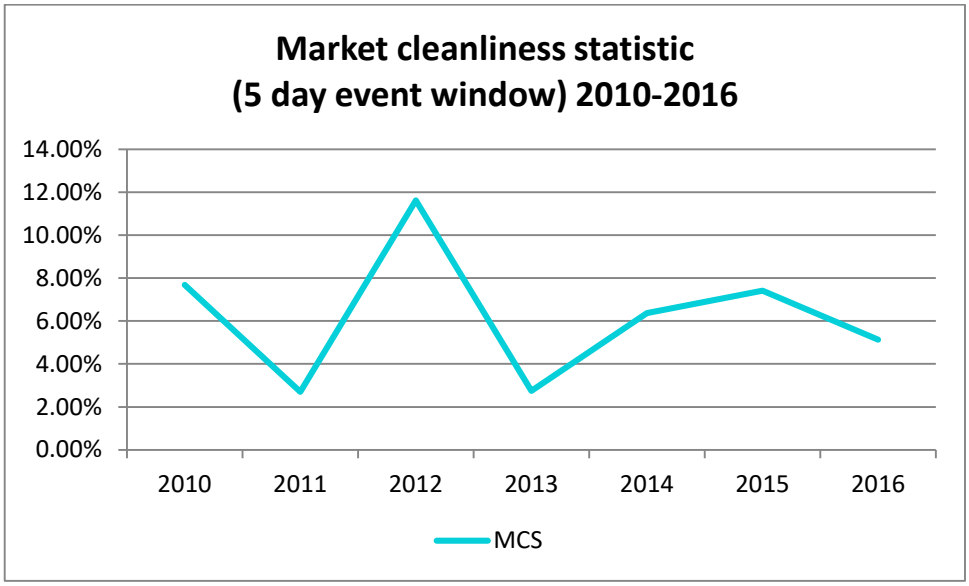

Figure 4: *Graph showing the MCS calculated with a five-day event window*

The graph produced for the five-day window displays a far less clear linear trend and more suggests that the MCS is fluctuating over time rather than trending downwards. There is also a significant peak in 2012 which did not appear with the two-day event window. It is interesting to note that the peak in 2014 is no longer as clearly defined but spreads over both 2014 and 2015. The MCS in 2016 is also now higher than the MCS in both 2011 and 2013 despite initially being substantially lower. This could suggest that more suspicious activity in 2016 took place further out from the announcement than it did in 2011 and 2013. It is important to note that some of this change may be due to sample variability as small

[26]Ben Dubow and Nuno Monteiro "Measuring Market Cleanliness" (March 2006), FSA Occasional Paper Series 23, Nuno Monteiro,

[27]Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487

fluctuations in the number of significant announcements picked up by the bootstrap can have a relatively large impact on the MCS.

It is an interesting feature of the graph that the two lowest points (in 2011 and 2013) coincide with significant reforms in financial market regulation. In 2011 the Financial Markets authority was established. This greatly increased the oversight undertaken by the government of the financial markets. In 2013 the Financial Markets Conduct Act was passed. This Act updated the regulatory framework by replacing the Securities Act 1978 and parts of other Acts. It also strengthened the regulatory framework with regard to disclosure and reporting requirements for companies.[28]

[28] https://fma.govt.nz/assets/Guidance/_versions/5244/131101-a-guide-to-the-financial-markets-conduct-act-reforms.1.pdf

Assessing the change in market cleanliness over time

Univariate test

To assess the extent to which the MCS had changed over time a univariate test assessing the MCS before and after an event, in this case the introduction of the Financial Markets Conduct Act 2013, was conducted.

Bhattacharya and Daouk 2002 found that the existence of insider trading laws does not, in itself, act as a deterrent for insider trading. Rather, effective enforcement of insider trading regulations is required to deter undesirable behaviour.[29] As noted earlier, the first New Zealand prosecution for insider trading was completed in 2017. The result of this is that there is not enough data after the event to test whether or not this prosecution has had an effect on the insider trading behaviours in New Zealand.

The univariate test conducted therefore focussed on the most recent introduction of legislation around market conduct, namely the Financial Markets Conduct Act which was enacted in 2013 and strengthened the regulatory framework relating to disclosure and reporting requirements.

It is possible that this may not result in a significant change in the MCS because it does not involve the enforcement of insider trading laws. Because our first prosecution for insider trading took place so recently it was not possible to explore the effect of enforcement on the MCS.

The univariate test followed the same approach adopted in the Australian study using the formula:

$$Z = \frac{P_1 - P_2}{\sqrt{(P(1-P))(n_1^{-1} + n_2^{-1})}}$$ [30] [31] (7)

Period	APPM	MPSA	MCS	Z-statistic
2010-2012	24	186	12.90%	
2014-2016	22	206	10.68%	
Difference	-2	+20	-2.22%	-0.68

[29] Uptal Bhattacharya and Hazem Daouk "The World Price of Insider Trading" *The Journal of Finance*, vol. 57 issue 1, February 2002, pp 75–108.

[30] Where P is equal to the average proportion over the two samples

[31] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4

Table 6: *Table showing the univariate test for a difference between the MCS before and after 2013*

Like the 2006 UK study, the event year - in this case 2013 - has not been included.[32] This is because news about the legislation coming into force during the year could change behaviour prior to the event. There is also the possibility of an adjustment lag after the event as businesses become accustomed to the new regime. Excluding 2013 prevents these factors from skewing the data and affecting the results of the event study.

The equation produces a test statistic of -0.68. This is not a statistically significant test statistic.[33] This suggests that the introduction of the financial markets conduct act in 2013 did not have a statistically significant effect on the MCS. This is not an unexpected result in light of the Bhattacharya and Daouk study which stated that the existence of regulation alone is unlikely to impact insider trading behaviour.[34] It is however an interesting result given that the graph for the two-day event window was displaying a downward trend. Because of the small sample size, a very significant change would be required to qualify as statistically significant. However, in the case of the two-day graph and to a lesser extent the five-day graph, the MCS does appear to be decreasing, just not at a rate dramatic enough to qualify as statistically significant.

It may be that the first prosecution for insider trading completed in 2017 does have an impact on the MCS but this cannot be assessed until more data becomes available.

[32] Ben Dubow and Nuno Monteiro "Measuring Market Cleanliness" (March 2006), FSA Occasional Paper Series 23

[33] At the 10% level for a two-sided t-test

[34] Uptal Bhattacharya and Hazem Daouk "The World Price of Insider Trading" *The Journal of Finance*, vol. 57 issue 1, February 2002, pp 75–108.

Robustness checking

To check the robustness of the MCS it was recalculated with event windows ranging from two to ten days in length.[35] This was intended to ensure that there was a consistent trend operating across different event windows. Calculating the MCS for each year with event windows ranging from two to ten days produced the following graph. The corresponding values can be found in **table 4** located in **Appendix 1**.

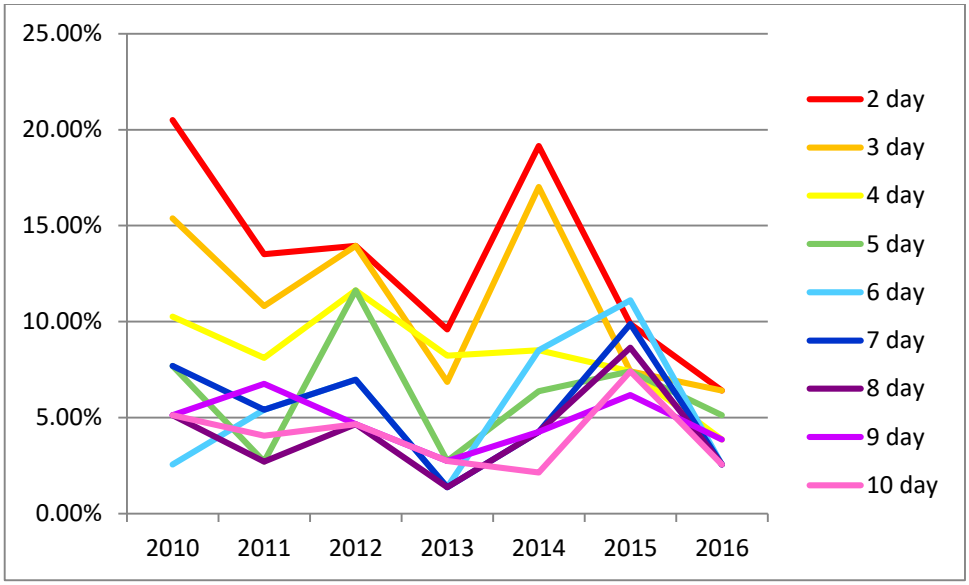

Figure 5: *Graph showing the MCS calculated for 2010-2016 using event windows ranging from 2-10 days*

The MCSs produced for different event windows seem to exhibit a somewhat similar trend and pattern to that produced for the two-day and five-day event windows. However, there are some differences suggesting that the results of the study may exhibit some variation depending on the choice of the event window.

The variation between years lessens as the event window gets longer however the trend followed is still relatively similar. There is some variation in the trend particularly in 2014 and 2015 between the two to four day and the five to ten day event windows. There is a strong similarity between the values of the 8-10 day event windows. This is partially due to the small sample size meaning that there is less room for small variations between announcements.

[35] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4

The longer event window was expected to lower the MCS. This is due to the fact that, as a general rule, most insider trading behaviour is considered to take place in the two days immediately prior to the announcement.[36] The later days in the event window mean that days with lower abnormal return are included. This results in a CAR that is closer to that simulated from the estimation window. The result is that it is harder for announcements to meet the threshold for significance.

Most years in the sample exhibit a statistic that is generally decreasing as the event window length increases. The exception to this is 2015 which shows a more undulating statistic that peaks around the six-day window length. An increased statistic in longer event windows suggests that more extreme returns are also occurring further out from the announcement. This can be indicative of earlier awareness of price-sensitive information and trading on that information that would not be picked up by the two-day measure.

Further to this a closer look at the data reveals that some of the announcements making up the MCS are not included in the shorter event window lengths but are only picked up as the event window increases. These announcements exhibit significant abnormal return increases in the later part of the event window. In terms of insider trading this suggests that information leakage may be happening several days out from the announcement in some instances. It could also be indicative of insiders trying to disguise their trades by spreading them out ahead of the announcement. It is, however, unlikely that the entire increase is due to insider trading.

It is also interesting to note that in most years the differences between the eight to ten day event windows are minimal. This could suggest that there is minimal information leakage outside of eight days prior to the announcement however is largely attributable to the variation in the MCS that results from such a small sample size.

It is important to note that the calculated statistic is open to a fairly high degree of variation. Variations in the results of the bootstrap simulation can cause the number of significant announcements to vary by one or two announcements. Because our sample is fairly small this can cause significant variation in the MCS.

[36] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4

Further analysis

International comparisons

It is important to note that there several difficulties with international comparisons due to differences in the methodologies used by overseas countries. In addition, the different regulatory frameworks used in different countries mean that the release of price sensitive information may take place in a different manner.

The 2014 study released by the FCA into the UK MCS for takeover announcements noted that in countries with weaker regulatory frameworks announcements do not have to be made as immediately as they do in countries that have stricter regulatory frameworks. This means that information insiders can spread their trades out having less of an impact on the market. This means that the measure relating to price movements does not work as well and may suggest a lower level of insider trading than actually occurs.[37]

Comparison with Australia:

The MCS was calculated with the same thresholds for identifying material and significant announcements used in the Australian study. In addition, the regulatory frameworks that operate for the New Zealand and Australian equity markets are quite similar.[38] [39] Due to this similarity a formal comparison between the Australian and New Zealand statistics was conducted for the five-day event window. This was done on for both the individual years where the study overlapped and for the average statistic for those overlapping years. The following formula was used to calculate the test statistic.

$$Z = \frac{P_1 - P_2}{\sqrt{(P(1-P)(n_1^{-1} + n_2^{-1})}} \quad (7)$$

In order to ensure the comparison was as accurate as possible the liquidity filter was adjusted to be consistent with that used in the Australian study. This meant that stocks had to be trading on 180 days out of the 240 in the estimation window in order to remain in the sample. The comparison was conducted using the five-day event window. The comparison

[37] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4

[38] NZX Main board/debt market listing rules (1 October 2017) at 131 <c84t3un4/comfy/cms/files/files/000/002/619/original/NZX_Main_Board_Rules_-_1_October_2017-_clean___secure.pdf>

[39] ASX Guidance note 8 (1 May 2013) <http://www.asx.com.au/documents/about/guidance-note-8-clean-copy.pdf>

was only done for the years for which the studies overlapped. This involved the years 2010-2015 inclusive. The MCSs for each year can be found in **Table 5** located in **Appendix 1**.

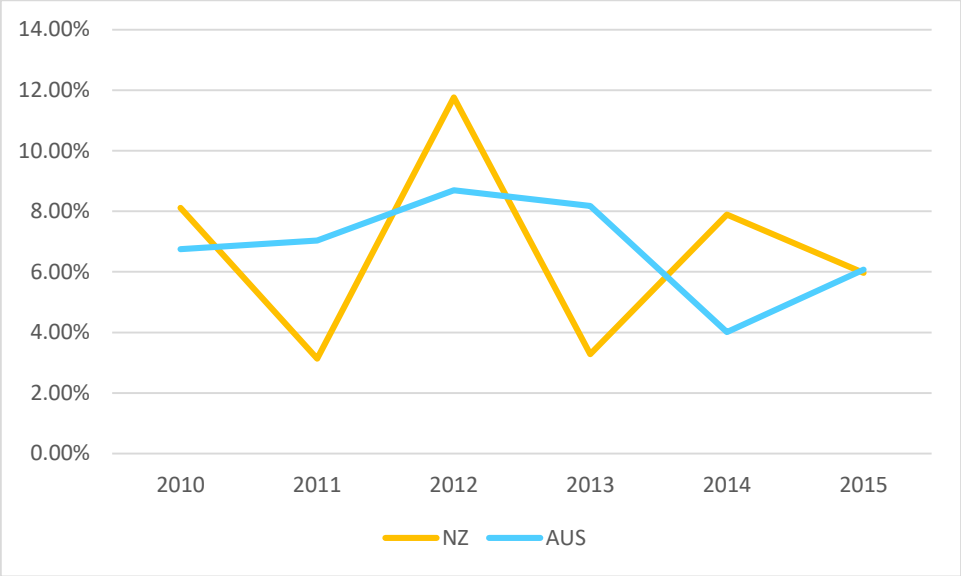

Figure 6: *Graph showing the MCS calculated for New Zealand and Australia both using a five-day event window and a 180-day liquidity filter*

From the graph the MCSs appear to be quite similar over the time period involved. The New Zealand statistic appears to be considerably more variable than the Australian statistic. The higher variability for the New Zealand statistic is somewhat expected given the smaller sample size and therefore the greater potential for small variations in the number of announcements identified as APPMs to have a substantial effect on the MCS.

Year	New Zealand APPMs	New Zealand MPSAs	Australian APPMs	Australian MPSAs	Z-statistic
2010	3	37	33	489	0.31581
2011	2	64	64	909	-1.20410
2012	4	34	71	816	0.61711
2013	2	61	61	746	-1.37106
2014	3	38	23	573	1.14774
2015	4	67	46	758	-0.03237
			Average		
All	18	310	298	4291	-0.76530

Table 7: *Table showing a comparison between the MCS for New Zealand and Australia:*

The statistical tests conducted above show that the difference between the New Zealand and Australian MCSs is not statistically significant.[40] This means that we cannot say that the New Zealand MCS is statistically different to that of Australia.

The New Zealand regulatory framework bears many similarities to that of Australia. This makes it possible to compare these two countries. It is important to note, however, that there are significant differences in the operation of New Zealand and Australian equity markets that need to be considered when interpreting the comparison. These include the fact that the Australian equity market is considerably larger than the New Zealand equity market and that within countries there are different corporate governance regimes which may affect the MCS. In addition, because of its smaller size the New Zealand statistic is substantially more variable and less robust to changes in the methodology than the Australian statistic. This creates difficulties for the reliability of the comparison and it should be considered as indicative of the comparison between the two countries rather than as a definitive analysis.

Other international comparisons

A comparison with the UK would be difficult. This is due to similar concerns regarding the comparative size and operation of their equity market. There are additional factors specific to the method used that make a comparison with the UK less feasible than one with Australia.

The UK studies separate the takeover announcements from other types of announcement. New Zealand does not have a sufficiently high number of takeover announcements to enable them to be separated from other announcements.

The UK studies focussing on the other types of announcements were conducted over an earlier time period than this study. Even if takeover announcements were taken out a comparison between the two statistics would not be possible due to the different time frames.

A comparison is further complicated by the fact that the studies used data from the FTSE350. This means they are dealing with stocks from comparatively bigger companies to all those listed on the NZX main board. Evidence from the Australian study demonstrates that larger companies tend to have a lower MCS than smaller companies due to an ability to devote more resources to compliance with regulations.[41] This may cause a disparity

[40] At the 10% level for a two-sided t-test

[41] Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487

between the New Zealand and UK statistic that is not related to the level of insider trading but due to sample selection instead.

Limitations of the research

The time period examined for the research was relatively small. For future research it would be interesting to examine the MCS prior to 2010 to see if the MCS continues to fluctuate or if it was previously higher or lower than it has been over the last few years.

Once more data becomes available it would also be interesting to examine the MCS after 2017 to see what kind of impact the first prosecution for insider trading has. It would also be quite interesting to examine what the MCS looked like during and prior to the GFC, which prompted many of the legislative reforms seen in the market in recent times.

In addition to this it would also be interesting to assess the new measure of market cleanliness developed by the Australian study to compare it with the established measure.[42] In the Australian study this measure was found to be positively correlated with the measure focussing on APPMs it would be interesting to see if this is the same in New Zealand.

There were also further measures regarding bias, serial correlation and heteroscedasticity that were taken in the UK which may also be interesting to apply in a New Zealand context.

[42] Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487

Conclusion

The study investigated the prevalence of insider trading in New Zealand equity markets by examining abnormal price movements ahead of material price sensitive announcements. The study was conducted on all the announcements on the NZX main board that were tagged as material. The abnormal return was calculated based on a comparison between the actual return and the expected return calculated using the market model.

These announcements were then filtered for materiality – based on whether the total return immediately before and after the announcement was significantly different to the return that was expected. The announcements that qualified as material were then assessed for the significance of the abnormality of their pre-announcement returns.

The MCS was calculated as the percentage of material price sensitive announcements that exhibited APPMs.

The study found that the MCS varied year on year. In the initial stages, when it was calculated for a two-day event window the MCS appeared to be decreasing. However, when the study was re-run using a five-day event window this trend was no longer present.

It was also observed that the MCS calculated was highly variable due to the relatively small size of our equity market. This meant that small changes in the number of significant announcements identified by the bootstrap method had a very large impact on the MCS. This may explain the difference in the trends between the two and five-day event windows.

The study also assessed whether there was a significant difference in the MCS before and after the introduction of the Financial Markets Conduct Act 2013. Based on the test conducted, the difference in the MCS before and after the introduction of the Act is not statistically significant. This test was conducted using the figures obtained from a two-day event window. The graph for the two-day event window does exhibit a decreasing trend however the change before and after 2013 is not statistically significant. This is likely due to the small sample size involved in the study which results in a significant change in the MCS being needed in order for it to qualify as statistically significant.

To check the robustness of the MCS it was recalculated using event windows ranging from two to ten days. This resulted in some variation in the trend suggesting that the results of the study may vary depending on the event window selected. This was also demonstrated in the graphical difference between the two and five-day event windows. This is due in part to the small sample size involved which reduces the reliability of the MCS.

This is an unfortunate consequence of the small size of the New Zealand equity market. The result of the limited number of material announcements is that a small change in the number of significant announcements identified by the bootstrap has a significant impact on the MCS. This results in far more variability in the MCS meaning that the MCS will not be as robust to changes in event window length as it would be in other jurisdictions.

There were limited opportunities to compare the MCS internationally. This was due to concerns raised by previous studies about differences in corporate governance and legislative frameworks affecting the measure. There were also problems associated with the methodological differences between the New Zealand statistic and those from other countries. A comparison between New Zealand and Australia was attempted.

Legislative amendments in 2013 brought New Zealand's legislative regime more into line with Australia's.[43] The thresholds used in this study for identifying material and significant announcements were the same as the Australian thresholds. For this reason, a comparison was deemed to be possible.

In order to ensure the comparison was as accurate as possible the five-day statistic was used in order for the event windows to be consistent. The liquidity filter was also adjusted for the comparison to ensure as much consistency as possible between the New Zealand and Australian methodologies. The result of this adjustment was that several more announcements were filtered out. This decreased the sample size and therefore the reliability of the MCS as it became more variable.

The study compared each year where the studies overlapped individually and then took the average proportion for these years and conducted a further comparison of the averages. The test statistics calculated suggested that difference between the New Zealand and Australian statistics was not statistically significant for the individual years and the average of those years.

Overall the study found that the New Zealand MCS appears to be fairly stable in terms of a general trend but exhibits significant variation on a year to year basis. The introduction of the Financial Markets Conduct Act in 2013, affected the MCS: its value after the introduction is lower than before. However, the effect of the Act is not statistically significant. The MCS calculated for New Zealand was not statistically different to that of Australia but was considerably more variable, largely due to the difference in sample sizes.

[43] (6 March 2012) 678 NZPD 872, < https://www.parliament.nz/en/pb/hansard-debates/rhr/document/50HansD_20120306_00000032/financial-markets-conduct-bill-first-reading>

Appendix 1: Tables

Table 1: *Table showing the MCS for each year in the sample period prior to any liquidity filtering (calculated using a two-day event window):*

Year	No. of MPSAs	No of APPMS	MCS
2010	53	14	26.42%
2011	83	11	13.25%
2012	57	7	12.28%
2013	79	9	11.39%
2014	56	11	19.64%
2015	91	10	10.99%
2016	92	8	8.70%

Table 2: *Table showing the MCS after filtering out illiquid announcements:*

Year	Original statistic	Number of illiquid MPSAs	Number of illiquid MPSAs with APPMs	Revised statistic
2010	26.42%	14	6	20.51%
2011	13.25%	9	1	13.51%
2012	12.28%	14	1	13.95%
2013	11.39%	6	2	9.59%
2014	19.64%	9	2	19.15%
2015	10.99%	10	2	9.88%
2016	8.70%	14	3	6.41%

Table 3: *Table showing the MCS calculated with a five-day event window:*

Year	No of MPSAs	No of APPMs	MCS
2010	39	3	7.69%
2011	74	2	2.70%
2012	43	5	11.63%
2013	73	2	2.74%
2014	47	3	6.38%
2015	81	6	7.41%

2016	78	4	5.13%

Table 4: *Table showing the MCS recalculated with event windows ranging from two to ten days:*

Year	2 day	3 day	4 day	5 day	6 day	7 day	8 day	9 day	10 day
2010	20.51%	15.38%	10.26%	7.69%	2.56%	7.69%	5.13%	5.13%	5.13%
2011	13.51%	10.81%	8.11%	2.70%	5.41%	5.41%	2.70%	6.76%	4.05%
2012	13.95%	13.95%	11.63%	11.63%	6.98%	6.98%	4.65%	4.65%	4.65%
2013	9.59%	6.85%	8.22%	2.74%	1.37%	1.37%	1.37%	2.74%	2.74%
2014	19.15%	17.02%	8.51%	6.38%	8.51%	4.26%	4.26%	4.26%	2.13%
2015	9.88%	7.41%	7.41%	7.41%	11.11%	9.88%	8.64%	6.17%	7.41%
2016	6.41%	6.41%	3.85%	5.13%	2.56%	2.56%	2.56%	3.85%	2.56%

Table 5: *Table showing the New Zealand MCS re-calculated using the Australian liquidity filter (five-day event window):*

Year	No of MPSAs	No of APPMs	MCS
2010	37	3	8.11%
2011	64	2	3.13%
2012	34	4	11.76%
2013	61	2	3.28%
2014	38	3	7.89%
2015	67	4	5.97%

Appendix 2: Explanation of thresholds

There were several options for estimating the expected return. The first involved taking the average of the abnormal returns over the clean period. This worked well for the takeover announcements in the UK studies.[44] This measure was only used in relation to the takeover announcements and not used for the other announcements. In addition, it fails to take into account general movements in the market where everything is on an upward or downward trend, meaning abnormal returns in some parts of the estimation window may be over or understated.[45]

A further option which was used in the Australian study and in the 2014 UK study was the CAPM.[46] Though isolated to takeover announcements in the 2014 UK study the CAPM was found to lower the measure slightly over the method of taking the mean return over the clean period.[47]

Event study literature cites the market model as a good method of approximating the expected return on a stock.[48] The use of the market model was also consistent with the earlier UK studies[49] [50] and the study conducted into the Brazilian stock exchange.[51]

A four-day CAR was used to filter for materiality. This was consistent with previous studies and is sufficient to encompass most of the announcement activity related to the stock allowing for any suspicious activity prior to the announcement and giving the stock price time to properly adjust to the announcement.

The length of the event window was more flexible as it involved a trade-off between several factors. A shorter CAR would reduce the risk of picking up behaviour that was normal trading

[44] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4
[45] ibid
[46] Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487
[47] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4
[48] A. Craig MacKinlay "Event Studies in Economics and Finance" *Journal of Economic Literature,* vol. 35, March 1997, pp 13-39
[49]Ben Dubow and Nuno Monteiro "Measuring Market Cleanliness" (March 2006), FSA Occasional Paper Series 23, Nuno Monteiro
[50] Qamar Zaman and Susanne Leitterstorf "Updated Measurement of Market Cleanliness" (March 2007), FSA Occasional Paper Series 25
[51]Tatiana Tiemi Nagata "Assessment of informed trading in the Brazilian equity market: Market cleanliness methodology" (August 2017) <http://www.pp.u-tokyo.ac.jp/wp-content/uploads/2016/02/51158208.pdf>

rather than suspicious activity.[52] The downside of using shorter CAR is that it results in the risk that earlier suspicious activity won't be picked up by the measure.[53] These effects work in reverse where a longer time period is used to calculate the CAR.

It was important to note that a longer event window decreases the MCS as it includes more legitimate trading which can reduce the difference between CARs aggregated from the event window and those from the estimation window. This decreases the measure.[54]

In order to filter for materiality a filter of 1% either side of the distribution of simulated CARs was used. This was equivalent to the filter used in the Australian study[55] and somewhat wider than that used in the UK study.[56] The wider threshold was chosen because, while the CARs had to be sufficiently large in order for them to be considered a material price movement rather than general market reaction the dataset involved was comparatively quite small. This meant that it was unwise to limit the dataset too extensively, so a larger threshold was chosen.

To select the significant announcements a threshold of 1% on each side of the simulated distribution of two-day CARs was used. This was consistent with the threshold used in the Australian study.[57] It was chosen to ensure that the abnormal returns selected were significantly different from what could normally be expected in the market. It was also chosen to better enable international comparisons with Australia.

[52] Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487
[53] ibid
[54] FCA "Why has the FCA's market cleanliness statistic for takeover announcements decreased since 2009?" (July 2014), FCA Occasional Paper Series 4
[55] Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487
[56] The UK study interpreted a 1% filter as being split 0.5% on both sides
[57] Australian Securities and Investments Commission "Review of Australian equity market cleanliness" (August 2016), Report 487

Appendix 3: Tables detailing the numbers of positive and negative two-day and four-day CARs for each event window length

These examined only the announcements that exhibited APPMs

Two-day event window (covering all years in the study):

	Positive two-day CAR	**Negative two-day CAR**
Positive four-day CAR	**37**	**1**
Negative four-day CAR	**1**	**16**

Three-day event window (covering all years in the study):

	Positive two-day CAR	**Negative two-day CAR**
Positive four-day CAR	**26**	**1**
Negative four-day CAR	**0**	**12**

Four-day event window (covering all years in the study):

	Positive two-day CAR	**Negative two-day CAR**
Positive four-day CAR	**23**	**1**
Negative four-day CAR	**0**	**11**

Five-day event window (covering all years in the study):

	Positive two-day CAR	**Negative two-day CAR**
Positive four-day CAR	**18**	**4**
Negative four-day CAR	**1**	**7**

Six-day event window (covering all years in the study):

	Positive two-day CAR	**Negative two-day CAR**
Positive four-day CAR	**13**	**2**
Negative four-day CAR	**0**	**11**

Seven-day event window (covering all years in the study):

	Positive two-day CAR	Negative two-day CAR
Positive four-day CAR	**13**	**3**
Negative four-day CAR	**0**	**8**

Eight-day event window (covering all years in the study):

	Positive two-day CAR	Negative two-day CAR
Positive four-day CAR	**11**	**3**
Negative four-day CAR	**1**	**7**

Nine-day event window (covering all years in the study):

	Positive two-day CAR	Negative two-day CAR
Positive four-day CAR	**13**	**2**
Negative four-day CAR	**1**	**8**

Ten-day event window (covering all years in the study):

	Positive two-day CAR	Negative two-day CAR
Positive four-day CAR	**12**	**2**
Negative four-day CAR	**0**	**6**