MANIPULATION IN SINGAPORE EQUITIES AROUND COMPANY ANNOUNCEMENTS

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Abstract

In September 2015, CFA Institute, in collaboration with CRISIL, produced a 111-page research report on portfolio pumping in Singapore. The report, titled "*Portfolio Pumping in Singapore: Myth or Reality?"* examined the effectiveness of regulatory enforcements on deterring portfolio pumping by analysing tick-by-tick data of 189 listed companies under the FTSE Straits Times All-Share Index from Singapore Exchange (SGX) between 2003–2013. Given the interest shown by the investment community, especially in Singapore, CFA Singapore decided to undertake a follow-up research project that further examined if the equities market in Singapore is free from manipulation. Manipulation compromises market integrity and is detrimental to the development of capital markets. The project aims to determine the presence of market manipulation around company announcements in equities listed on SGX. By analyzing data on price, volume and announcements in the six-year period between 2011 and 2016, the study investigates if the Singapore equities market is prone to manipulation with announcements as the trigger at both the broader market level as well as at any subset level.

This research report, along with other materials, can be found on the Asia-Pacific Research Exchange (ARX) website: https://www.arx.cfa

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Executive Summary

Manipulation is defined as the deliberate creation of a false market in publicly traded securities with the aim of profiteering. There are many ways in which a false market may be created, for example, by spreading false information or placing multiple small orders at price levels much higher or lower than the market price. Manipulation is illegal in most instances but it is not easy to detect and prove.

To help inform the current state of market integrity and regulatory effectiveness in Singapore, CFA Singapore decided to undertake a research study to examine if there is systematic market manipulation in publicly-listed equities in Singapore. By reviewing company announcements of all the listed companies on Singapore Exchange (SGX) in the six-year period from January 2011 to December 2016, and examining the price and volume movements before and after the announcements, this study seeks to determine the presence, if any, of market manipulation around company announcements.

The prevalence of manipulation and a lack of market integrity can reduce investor confidence and increase the cost of capital. This has an adverse impact on the real economy when less funds are channelled to productive uses, stunting the development of capital markets and economic growth. It is important to note that market integrity cannot be achieved by regulation alone — it also depends on an understanding among all stakeholders of the importance of their actions and responsibilities. While the primary objective of this study is to examine potential market manipulation, it also serves as a reminder to all market participants that each one of us has a critical role to play.

Recommendation

The results from the study points to there being no statistically significant evidence to indicate the presence of manipulation:

I. At the broader market level

II. Within a particular category or sub-category of announcements

III. Within a sector or sub-sector

IV. Among other corporate characteristic groups based on market capitalisation, listing board and operational domicile (S-chip)

We conclude that any observed potential instance of manipulation around company announcements on SGX is a standalone event and not part of a broader phenomenon. Based on this, we proceed to make the following specific recommendations for various stakeholders.

For Policy Makers

We believe that the efforts of regulators in Singapore, including the Monetary Authority of Singapore (MAS) and SGX to prevent manipulation have contributed to this set of positive results. Current regulations, including market surveillance mechanisms are robust and effective in ensuring the integrity of the Singapore equity market. MAS also makes public the market misconduct cases and associated penalties which also serves as a deterrent in curbing market manipulation activities.

Notwithstanding the above, we offer the following recommendations to regulators as well as policymakers based on the findings from this study:

1. Expand the categorisation of corporate announcements: Increasing the sub-categories beyond the current level of 60 would allow more precise analysis with regards to manipulation. This is because not all announcements have the potential to move prices of securities. For

example, announcement of an acquisition is more likely to move the market, compared to conclusion of an acquisition, which is considered a formality and typically fully priced-in. The current practice is for both types of the above announcements to be filed under "Asset Acquisitions and Disposals". Moreover, through differentiation and being more specific in categorising announcements, monitoring will be simpler and more precise.

2. Increased monitoring: Even though there were instances of abnormal movement in share prices and trading volume around company announcements, there were plausible explanations and may not constitute manipulation. We note however that such instances were more widespread in certain announcement categories and certain sectors and hence we would recommend closer scrutiny on the following categories and sectors:

    a. Category of announcement

        i. Treasury shares - Transfer

        ii. Treasury shares - Use of Proceeds

        iii. Change of Ownership Interest

        iv. Ownership Interest Disclosure

        v. Dividend Declaration

        vi. Acquisition of New Business

    b. Sector

        i. Financials

        ii. Real Estate

3. Further research to gather more direct evidence: We recommend enhanced research with specialised data, including details of individual trades and participant groups, to go beyond the level of finding no evidence of manipulation to firmly establishing the absence of manipulation.

For Listed Companies

1. The Board of Directors, senior management, employees and related-external parties of listed companies must be aware when they are in possession of material non-public information and that they are obliged to maintain its confidentiality. Failure to do is a breach of fiduciary duty and can constitute a criminal offence.

2. Companies should establish robust internal policies and systems (for example, personal account dealing, training in material non-public information) to eliminate leakage or prevent illicit uses.

3. We have recommended that regulators keep a closer watch on potential manipulation cases involving:

    a. Category of announcement

        i. Treasury shares - Transfer

        ii. Treasury shares - Use of Proceeds

        iii. Change of Ownership Interest

        iv. Ownership Interest Disclosure

        v. Dividend Declaration

        vi. Acquisition of New Business

    b. Sector

        i. Financials

        ii. Real Estate

Similarly, listed companies due to make announcements in the above categories and falling under the above two sectors should exercise extra caution when they are in possession of material non-public information.

For Investors

1. Institutional investors entrusted to manage other people's money should behave as fiduciaries and should not engage in practices that distort prices or artificially inflate trading volume with the intent to mislead market participants. Senior management should set a culture of integrity with clear expectations on proper behaviour, recognising that this will ultimately drive value for their firm and for their clients.

2. Retail investors should be aware of their own risk tolerances and investment objectives when making investments and must do their own due diligence instead of following a herd mentality.

Overview of Research Process

We began with collation and cleaning of relevant stock-level and announcement data. Announcements were custom categorised to facilitate more granular analysis. Visual inspection of price and volume performance around announcements provided us the needed inputs for working out the methodology and key parameters to be adopted for a more formal study.

Accordingly, we evaluated whether price returns and volume trends of stocks prior to announcements were significantly different from the post announcement period and an average comparable period by running hypothesis tests. We ran this across three forms of returns (absolute, relative and beta-adjusted) and for multiple cumulative periods, pre and post announcement (one-day, two-day, three-day, five-day and seven-day). Subsequently the analysis was extended for specific subsets of the universe, based on (sub-) category of announcements, (sub-)sectors, market capitalisation groups and other corporate characteristics.

Finally, we corroborated our results with a validation study that first identified the potential manipulated cases and compared the composition of this universe

with the overall universe to identify instances of variation. Thereafter, a robustness check (stress test) was conducted under a couple of scenarios – in a standardised return environment and by adopting a stricter definition for identifying the potential manipulated cases – to confirm the stability of our findings.

The following table provides a more detailed step-by-step overview of the complete research process:

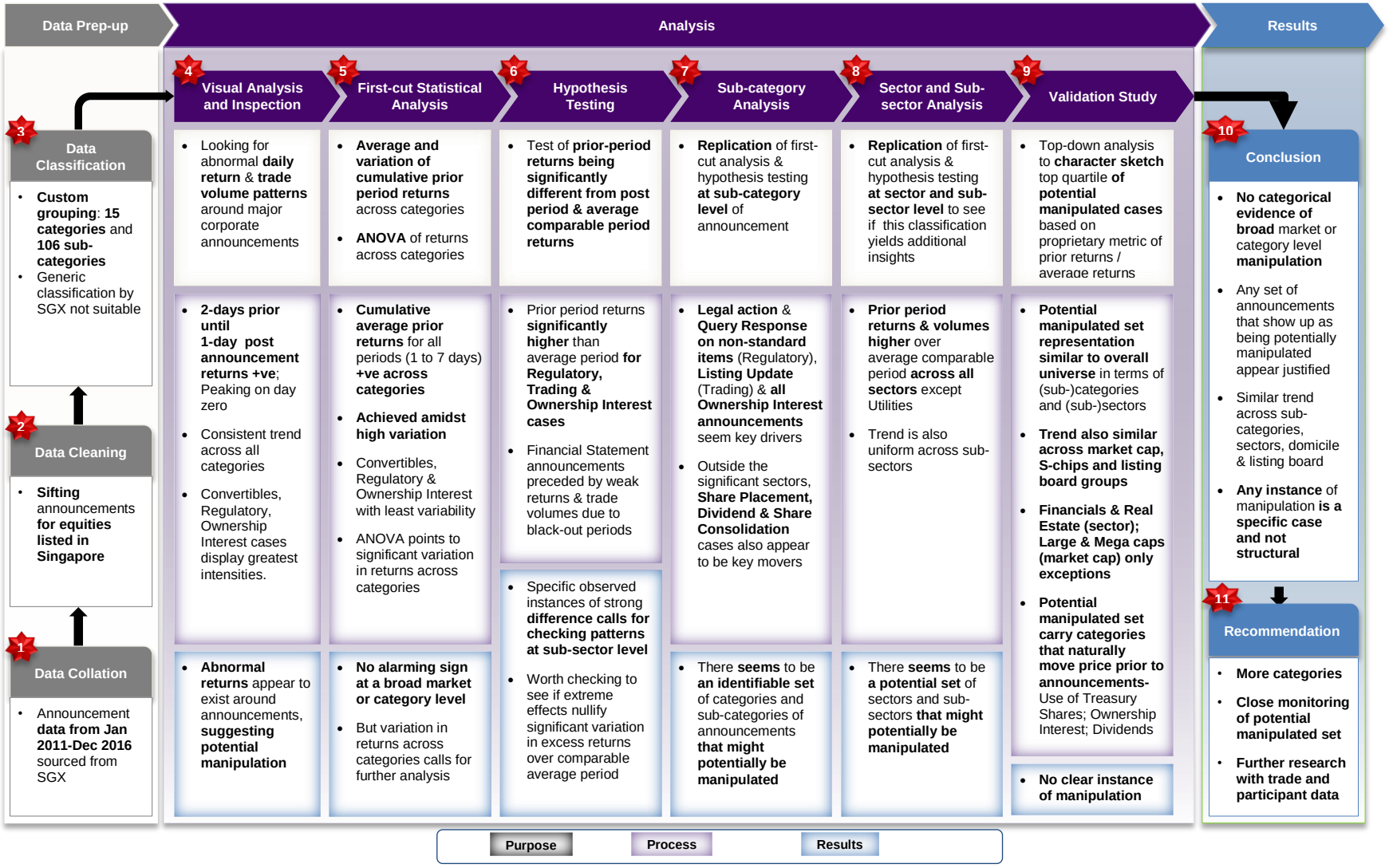
Phase	Step	Approach
Data Prep-up	Data Collation	• Announcement data from January 2011 to December 2016 sourced from Singapore Exchange (SGX) official website
	Data Cleaning	• Sifted out announcements relating to equities listed in Singapore
	Data Classification	• Reclassified announcements to custom fit into 15 categories and 106 sub-categories
Analysis	Visual Analysis and Inspection	• Visually inspected the price and volume charts to identify abnormal daily returns and trade volumes around corporate announcements • Obtained initial cues for setting up the parameters for formal statistical tests
	First-cut Analysis	• Computed average and variation of cumulative prior period returns across announcement categories. This helped determine if returns are abnormal for a category and their variation around the average value provided a confidence measure of such abnormality • Established variation in returns across

		categories using Analysis of Variance (ANOVA) technique. This determined if variation in returns across all categories are significantly higher compared to the variation within each of these categories • This helped confirm if there is a need to analyse further within each category and also to drill into sub-category level analysis
	Hypothesis Testing	• Evaluated if prior period returns were significantly higher or lower versus post period and average comparable period returns across categories and cumulative holding periods • This helped establish if some category was more prone to manipulation
	Sub-Category Analysis	• Replicated first-cut analysis and hypothesis testing for announcement sub-categories • This helped identify the key contributors within each announcement category identified as being prone to manipulation
	Sector and Sub-Sector Analysis	• Replicated the same for sectors and sub-sectors (GICS sector and industry groups) • This helped ascertain if a specific sector/sub-sector was more prone to manipulation
	Validation Study	• Employed top-down analysis to sketch the characteristics of the top quartile of potential manipulation cases based on a proprietary metric of prior period

		returns/average comparable period returns • Compared the character profile of the potential manipulated universe with the overall universe to identify specific pockets of announcement categories, sectors and other corporate characteristic based groups such as market cap, listing board and operational domicile (S-chips) cases where the potential manipulated set had an excess representation versus the universe • This helped corroborate if any (sub-) category or (sub-)sector that showed up as being potentially prone to manipulation in the previous few steps still holds good with this validation exercise by posting a larger-than-anticipated representation in the potential manipulated set • Robustness Check: A stress test was conducted under a couple of scenarios – in a standardised return environment and by adopting a stricter definition for identifying the potential manipulated cases – to confirm the stability of the findings
Results	Conclusion and Recommendation	• Established conclusion based on the previous steps and made specific recommendations to various stakeholders

Research Snapshot: Chart and Tables

Research Flowchart



SGX Announcement Classification versus Our Categories

SGX Sub-Category	Our Custom Sub-Category	Findings	Our Category
Merger	Merger - Initiation	●	Acquisition
	Merger - Completion		
	Merger - Termination		
Tender / Acquisition / Takeover / Purchase Offer	Open Offer		
	Open Offer - Adjustment		
	Open Offer - Completion		
	Open Offer - Termination	●	
Asset Acquisitions and Disposals	Acquisition - New Business	●□	
	Acquisition - Additional Stake		
	Acquisition - Completion		
	Acquisition - Termination		
	Disposals - Completion		Disposals
	Disposals - Proceeds		
	Disposals - Termination		
Spin-off / Demerger	Disposals - Initiation		
	Dissolution - Initiation		
	Dissolution - Completion		
	Deregistration		
Interested Party Transaction	Interested Party Transaction		Business Update
Corporate Debt Restructuring	Restructuring		
Other Schemes of Arrangement	Restructuring - Completion		
	Accounting change		
	Business Update		
	Capex		
	Credit ratings		
	Guidance		
	Impairment		
	Profit Warning		
Change in Capital	Change in Capital		Capital Structure
Employee Stock Options / Share Scheme	Share options - ESOP		
Placements	Placements - Completion		
	Placements - Issue		
	Placements - Proceeds		
	Placements - Termination		
Share Buy Back-on Market	Buyback		
Share Purchase Mandate			
	Buyback - Adjustment		
Bonus Issue / Capitalisation Issue	Bonus - Issue		
Dividend / Distribution paid in Scrip / Unit			
Capital Reduction	Capital Reduction		
Exchange Offer / Capital Reorganisation	Capital Structure Change		
	Capital Structure Change - Completion		
Rights	Rights - Issue		
	Rights - Adjustment		
	Rights - Proceeds		
	Rights - Completion		
	Rights - Termination		

SGX Sub-Category	Our Custom Sub-Category	Findings	Our Category
Partial Redemption with reduction of nominal value	Debt - Redemption		Debt
Repurchase Offer / Issuer Bid / Reverse Rights			
	Debt - Issue		
	Debt - Adjustment		
	Debt - Drawdown		
	Debt - Proceeds		
	Debt - Completion		
	Debt - Termination		
	Establishment – New Business		Est. – New Business
Financial Statements	Interim Results		Financial Performance
	Interim Results-Adjustment		
	Annual Results		
	Annual Results-Adjustment		
	Auditor Comments		
General Announcement	General Announcement		General Announcement
Amendments to Articles			
Annual General Meeting			
Annual Reports and Related Documents			
Change in Corporate Information			
Change in Trading Currency			
Change of Catalist Sponsor			
Extraordinary / Special General Meeting			
Moratorium			
Notice of 3 Consecutive Year's Losses			
Notice of Valuation of Real Assets			
Capital Distribution			
Capital Gains Distribution			
Scrip Election / Distribution / DRP			
Change of Terms			
Buying-In			
Announcement of Appointment	Appointment		Management Update
Announcement of Cessation	Cessation		
	Re-Designation		
Disclosure of Interest / Changes in Interest	Change of Interest	●❖	Ownership Interest
	Change of Interest - Completion		
	Interest Disclosure	●❖	
Cash Dividend / Distribution	Payments - Dividend	●□	Payments
Coupon Payment	Payments - Interest		
	Payments – Fee		
Court Meeting	Regulatory - Arbitration		
Regulatory Actions by SGX	Regulatory – Legal	●	Regulatory
Announcements in relation to Regulatory Actions by SGX or Other authorities			
Waiver	Regulatory - Extension		
Response to SGX Queries	Query Response	●	
	Regulatory - Approval		
	Regulatory - Settlement		

Warrant Exercise	Share Options - Exercise		
	Share Options - Issue		
	Share Options - Adjustment		
	Share Options - Completion		
	Share Options - Termination		
	Preferred Stock - Issue		
	Preferred Stock - Adjustment		
	Preferred Stock - Redemption		
	Preferred Stock - Termination		
	Capital Addition		
Conversion	Convertibles – Conversion		Convertibles
	Convertibles - Issue		
	Convertibles - Adjustment		
	Convertibles - Approval		
	Convertibles - Change of Capital		
	Convertibles – Int. Payment		
	Convertibles - Proceeds		
	Convertibles - Redemption		
	Convertibles - Completion		
	Convertibles - Termination		

Stock Split / Subdivision	Share Consolidation		Share Capital
Share Consolidation	Share consol. – Completion		
	Share pledge		
	Treasury Shares - Proceeds	●✡❖	
	Treasury Shares - Sale		
	Treasury Shares - Termination		
	Treasury Shares - Transfer	●✡❖	
	IPO - Issue		
	IPO - Proceeds		
Listing Confirmation	Listing Update	●	Trading
Listing - Equity			
Query regarding Trading Activity			
Request for Suspension			
Request for Lifting of Trading Halt			
Transfer from Catalist to Mainboard			
Transfer from Mainboard to Catalist			
Transfer from Primary to Secondary Listing			
Transfer from Secondary to Primary Listing			
Delisting of Security	Delisting		
	Delisting - Completion		

	SGX Announcements
	Announcements
	Corporate Action
	Product Announcement & Listing
	Trading Update
Abc	New line items introduce in our classification

Findings	**Comments**
● (●)	Significantly Positive (negative) under Hypothesis tests
✡	Significantly Positive under Validation Study
❖	Significantly Positive under Robustness check with Standardised values
◘	Significantly pos. under Robustness check with stricter definition of potential manipulation

GICS Sectoral Map and Other Corporate Characteristics

GICS Sector	GICS Industry Group	Findings
Consumer Discretionary	Automobiles & Components	●
	Consumer Durables & Apparel	●
	Consumer Services	●
	Media	
	Retailing	●
Consumer Staples	Food & Staples Retailing	●
	Food Beverage & Tobacco	
	Household & Personal Products	●
Energy	Energy	●
Financials	Banks	●✡❖□
	Diversified Financials	●✡❖
	Insurance	
Health Care	Health Care Equipment & Services	●
	Pharmaceuticals, Biotechnology & Life Sciences	●
Industrials	Capital Goods	●
	Commercial & Professional Services	●
	Transportation	●
Information Technology	Semiconductors & Semiconductor Equipment	●
	Software & Services	
	Technology Hardware & Equipment	●
Materials	Materials	●
Real Estate	Real Estate	●✡❖□
	REIT	●✡❖□
Telecommunication Services	Telecommunication Services	●
Utilities	Utilities	

Market Capitalisation Levels	Market Capitalisation Groups	Findings
<S$10 million	Micro caps	●
S$10-S$50 million	Small caps	●
S$50-S$100 million	Low mid-caps	●
S$100million-S$1 billion	Mid-caps	●
S$1-S$5 billion	High mid-caps	●
S$5-S$10 billion	Large caps	✡□
> S$10 billion	Mega caps	●✡❖□

Operational Domicile Groups	Findings
Non S-Chips	●
S-Chips	

Listing Board Groups	Findings
Mainboard	
Catalist	

Findings	Comments
● (●)	Significantly Positive (negative) under Hypothesis tests
✡	Significantly Positive under Validation Study
❖	Significantly Positive under Robustness check with Standardised values
□	Significantly Positive under Robustness check with stricter definition of potential manipulation

1. Introduction

In September 2015, CFA Institute, in collaboration with CRISIL, produced a 111-page research report on portfolio pumping in Singapore. The report titled "*Portfolio Pumping in Singapore: Myth or Reality*?" examined the effectiveness of regulatory enforcements on deterring portfolio pumping by analysing tick-by-tick data of 189 listed companies under the FTSE Straits Times All-Share Index from Singapore Exchange (SGX) between 2003–2013.

The research was motivated by a landmark court case involving the Monetary Authority of Singapore (MAS, plaintiff) and Tan Chong Koay and Pheim Asset Management Sdn Bhd (defendants). In August 2009, a formal civil suit was filed against the defendants for creating a false or misleading appearance relating to the price of a security. On 17 September 2010, the defendants were pronounced guilty of priming the stocks of United Envirotech (UET) over a three-day period from 29 December 2004 to 31 December 2004. At a subsequent hearing on 22 July 2011, the original verdict was upheld by the Court of Appeal.

The above case provided the ideal opportunity to explore the effectiveness of regulatory enforcement in deterring portfolio pumping. The research found no evidence of portfolio pumping at the market level for the period in question, and concluded that the identification and successful conviction of fraud cases as well as having a stronger penalty system in place have an influence in reducing absolute and excess returns at quarter-ends. The findings were welcomed by the Singapore investment community and garnered much interest in both specialist and popular media.

In view of the interest generated, CFA Singapore decided to undertake a follow-up research study with a wider scope that examines further if the Singapore equities market is free from manipulation. Using price, volume and announcements data in the six-year period between Jan 2011 and December

2016, the project aims to determine the presence of market manipulation around company announcements on the Singapore equity market.

This study is timely as SGX has implemented a number of measures to enhance market surveillance and enforcement. The results of this study would provide meaningful feedback on the effectiveness of these measures and inform the design and fine-tuning of relevant regulations. Ms. Tan Lay Hoon, CFA and Mr. Daryl Liew, CFA, Co-Chairs of the Advocacy Committee at CFA Singapore noted that research into this area of the equities market is long overdue. The research project is also highly anticipated by the investment community and stakeholders for the following reasons:

1. In 2013, three Singapore-listed companies – Blumont Group (SGX: A33), Asiasons Capital (SGX: 5ET), and LionGold Corp (SGX: A78) – were suspended from trading following a collapse in their share prices. This collapse was preceded by a massive increase in the share price in all three counters. When trading suspension was lifted, the three companies had lost in excess of 80% of their market value prior to collapse. As a result, investors suffered significant losses. Confidence took a hard knock and daily volumes on SGX declined markedly. According to SGX data, average daily traded volume fell more than 60 per cent fall in the 12 months after September 2013.

   Although the scope of this report does not cover all engineered forms of manipulation, it may shed light on the current state of affairs in the wake of the above event.

2. Research in this area, with Singapore as a focus, has been few and far between. One study, published in 2004, titled '*Ranking World Equity Markets on the Basis of Market Efficiency and Integrity*'[1] did not rank the

[1] *Siow, Audris S. and Aitken, Michael J., Ranking World Equity Markets on the Basis of Market Efficiency and Integrity. THE HP HANDBOOK OF WORLD STOCK, DERIVATIVE & COMMODITY EXCHANGES 2003, Herbie Skeete, ed., pp. xlix-lv, Mondo Visione Ltd., 2003. Available at SSRN: https://ssrn.com/abstract=490462*

Singapore equity market highly either on efficiency or integrity metrics.

It is indeed time to update the 2004 findings.

3. This report contributes positively to the development of the Singapore capital markets and signals to all stakeholders that market manipulation must not be tolerated. Indeed, manipulation should be fought at the same level as corruption. A level playing field for all stakeholders ensures the continuous growth and healthy development of capital markets.

2. Data

Regulation in Singapore Governing Corporate Disclosures

Under its listing guidelines ("SGX Listing Rules[2]"), SGX spells out the continuous obligations for listed entities under Chapters 7 to 12. Corporate disclosure requirements, in particular, are covered in Chapter 7[3]. In spirit, the requirements mandate a company to disclose immediately any matter associated with itself, its subsidiaries or associated companies that could lead to creation of a false market for its securities or could materially affect the price of the securities.

The rules further list out requirements for specific disclosures, covering among others, appointment or cessation of service, acquisitions, winding up, treasury shares, employee share options and use of proceeds. In terms of financial reporting, companies are expected to disclose the results immediately on availability of figures with an outer-bound of 45 days before quarter-end (for interim results) and 60 days before the fiscal-year end date (for annual results). Listed entities in SGX are also mandated to issue clarifications on any rumours or reports (such as publication of a news article about the company) that could be considered material by investors. A similar clarification is also expected around unusual trading activity in the company's securities.

The listing rulebook also mandates public disclosure through SGXNET[4]. Simultaneous disclosures to news agencies are also allowed. SGX also recommends companies to maintain an "*open door*" policy in dealing with analysts, journalists, shareholders and others. However, companies are expected to ensure that no special disclosures are made to specific individuals or select groups.

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[2] SGX Mainboard rulebook is accessible at http://rulebook.sgx.com/en/display/display_main.html?rbid=3271&element_id=4830. A similar rulebook is also available for stocks listed on Catalist board

[3] Chapter 7 of SGX Listing Rules covering Continuing Obligations can be accessed at http://rulebook.sgx.com/en/display/display_viewall.html?rbid=3271&element_id=5062&print=1

[4] SGXNET is a system hosted by SGX to facilitate companies, brokers and other stakeholders to submit announcements securely for public dissemination on SGX website

Company Announcements with SGX

SGX makes available on its website[5] announcements made by its listed entities for the current year and also carries a history for a rolling period of five previous years. As on report date, data from January 2012 was publicly available. Given that we initiated data collation around August 2016, we have collated data for 2011. Accordingly, for our study, we have considered data over a six-year period starting from January 2011 to December 2016.

The SGX website does not allow filtering of announcements by asset class. In effect, all announcements pertaining to equities, ETFs, funds, warrants, debt and any other instruments are all made available collectively. Also, certain announcements could pertain to ADRs/GDRs of global companies which are not technically listed or domiciled in Singapore. Given our interest pertains to equities listed in Singapore, we culled out data on our specific sub-set for analysis. Post the clean-up, we were left with a relevant universe of 165,136 announcements on 1,077 companies[6], including dead and delisted entities.

Custom categorisation of announcements

The next step in data management was classification of announcements into more granular categories. SGX currently provides four categories and 60 sub-categories of announcements. While the current categorisation is a significant improvement[7] from the set maintained until end-2016, we faced the following limitations during our analysis:

A) Categories that are customary in nature

Certain categories such as Notice of valuation of real assets, Capital Gains Distribution and Scrip Election are standard disclosures. We expect limited

[5] *Corporate Announcements on SGX website can be accessed at* http://www.sgx.com/wps/portal/sgxweb/home/company_disclosure/company_announcements

[6] *Over the period 2011-16, we started with a total announcement set of 251,626 cases. We pulled in the announcement titles from the main corporate announcement webpage of SGX. Actual announcements were not pulled or considered for analysis*

[7] *The latest categorisation was introduced in January 2017 and has been applied retrospectively. Until end 2016, only 12 sub-categories of announcements were available*

movement in stock prices in response to these standard disclosures and all of them could essentially be clubbed under General Announcements.

B) Categories without a meaningful representation

Over the period of our study, we observe less than 10 instances of announcements pertaining to certain categories such as Moratorium. Even if we were to observe a significant trend associated with such announcements, lack of a minimum quorum might provide us little confidence to derive credible conclusions based on these limited instances.

C) Categories that combine contrasting activities

Asset acquisitions and disposals are presented as a single category. However, we believe price reaction to acquisitions could be quite different from disposals. In a similar vein, disclosure of interest and change of interest are combined into a single group. All financial performance related announcements including interim and annual results as well as disclosure of auditor comments are clubbed under the Financial Statement category.

D) Categories that are too broad in scope

Some categories, especially those pertaining to corporate action, could have multiple dimensions and their potential relevance for investors or market manipulators could be different based on the specific shade of announcement. A case in point here could be mergers, where the initial announcement pertaining to an intended merger, subsequent follow-on announcements and the announcement on completion or termination of the merger could have their own relative importance. Combining all of them under a single category, such as Merger, might limit the insights we could draw from our analysis. Similarly, announcements around convertible bonds, ranging from issuance, use of proceeds, interest payments, term adjustments to actual conversion and redemption might have their own relevance and hence should ideally be handled separately.

E) Categories that are not explicitly defined but relevant

Credit ratings, capex announcements, impairments and guidance are all presented as General Announcements. For our study, we believe it is worth segregating these specific instances as individual categories to better understand investor interest and price behaviour. Additionally, certain cases such as a new contract win for the business get classified under General Announcements or Asset Acquisition and Disposals, depending on their underlying nature. It may be worthwhile for us to observe these announcements through a common prism rather than under multiple categories.

Given these limitations, we have adopted a custom grouping for our analysis based on our expectation of an activity being independently relevant, reasonably represented and homogeneous in characteristics. Accordingly, our custom grouping has 15 broad categories and 106 sub-categories.

Figure 1. Our custom announcement categories and sub-categories

Acquisition	Rights - Issue	**Financial Performance**
Acquisition - Additional Stake	Rights - Adjustment	Annual Results
Acquisition - Completion	Rights - Proceeds	Annual results - Adjustment
Acquisition - New Business	Rights - Completion	Auditor Comments
Acquisition - Termination	Rights - Termination	Interim Results
Merger – Initiation	Share Options - Issue	Interim Results - Adjustment
Merger - Completion	Share Options - ESOP	**General Announcement**
Merger - Termination	Share Options - Adjustments	**Management Update**
Open Offer - Initiation	Share Options - Exercise	Appointment
Open Offer - Adjustment	Share Options - Completion	Cessation
Open Offer - Completion	Share Options - Termination	Re-designation
Open Offer - Termination	**Convertibles**	**Ownership Interest**
Business Update	Convertibles - Issue	Change of Interest - Initiation
Accounting Change	Convertibles - Approval	Change of Interest - Completion
Business Update	Convertibles - Adjustments	Interest Disclosure
Capex	Convertibles - Change of Capital	**Payments**
Credit ratings	Convertibles - Proceeds	Payments - Fee
Guidance	Convertibles - Conversion	Payments - Dividend
Impairment	Convertibles - Interest Payment	Payments - Interest
Interested Party Transaction	Convertibles – Redemption	**Regulatory**
Profit Warning	Convertibles - Completion	Regulatory - Approval
Restructuring - Initiation	Convertibles - Termination	Regulatory - Arbitration
Restructuring - Completion	**Debt**	Regulatory - Extension
Capital Structure	Debt - Issue	Regulatory - Legal
Bonus - Issue	Debt - Adjustments	Regulatory - Settlement
Buyback	Debt - Drawdown	Query Response
Buyback - Adjustment	Debt - Proceeds	**Share Capital**
Capital Addition	Debt - Redemption	IPO - Issue
Capital Reduction	Debt - Completion	IPO - Proceeds
Cap. structure chg. - Initiation	Debt - Termination	Share Consolidation - Initiation
Cap. structure chg. - Completion	**Disposals**	Share Consol. - Completion
Change in Capital	Deregistration	Share Pledge
Placements - Issue	Disposals - Initiation	Treasury shares - Proceeds
Placements - Proceeds	Disposals - Proceeds	Treasury shares - Sale
Placements - Completion	Disposals - Completion	Treasury shares - Transfer
Placements - Termination	Disposals - Termination	Treasury shares - Termination
Preferred stock - Issue	Dissolution - Initiation	**Trading**
Preferred stock -Adjustment	Dissolution - Completion	Listing Update
Preferred stock - Redemption	**Establishment - New Business**	Delisting - Initiation
Preferred stock - Termination		Delisting - Completion

Source: *SGX, CFA Singapore, CRISIL*

Daily price and volume data from Bloomberg

Price and volume data of the securities were sourced from Bloomberg. However, mapping the market data information with the announcements was a key challenge given the lack of common identifiers between the announcements and the Bloomberg data set. Company names tend to be represented differently across different data sources and could not be used as the mapping agent. ISIN lookups provided by SGX elsewhere[8] were used as the starting point. This helped in achieving a fair set of auto-matches[9]. The remaining names had to be manually mapped.

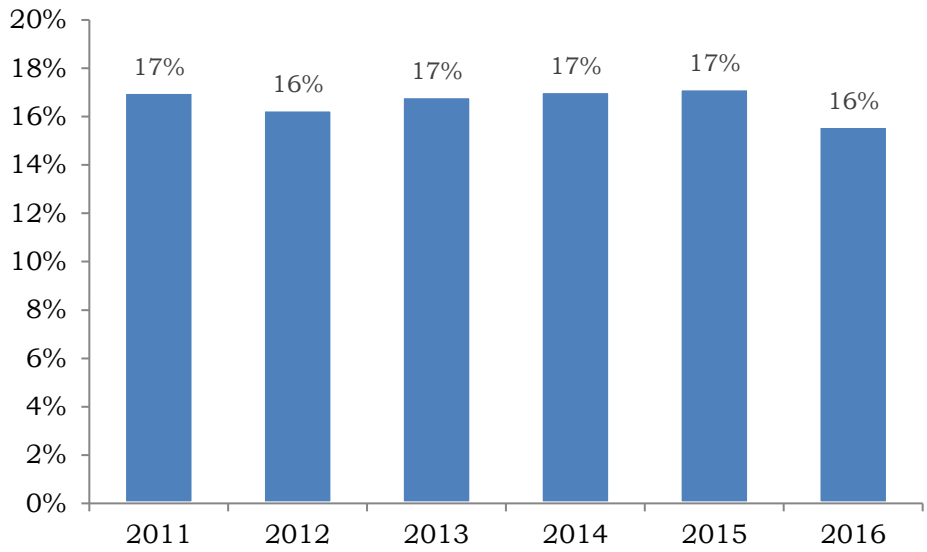
[8] *ISIN code downloads for the current active universe for the day are made available by SGX at http://www.sgx.com/wps/portal/sgxweb/home/company_disclosure/isin_code_download.*
[9] *Since ISINs were available only for the current universe, all dead and delisted names had to be manually mapped*

3. Descriptive Statistics and Visual Inspection

Descriptive statistics

Figure 2 shows the distribution of announcements by year. The six years considered for our analysis appear well represented with a near equal share of announcements disseminated each year.

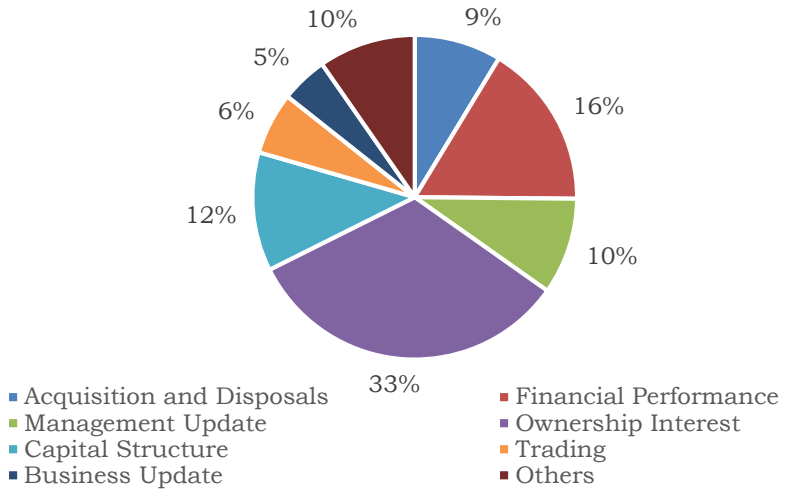
Figure 2. Distribution of announcement universe by year



Source: *SGX*

Figure 3 shows the distribution of announcements by categories. Among the categories, we observe Ownership Interest and Financial Performance related announcements leading the pack, accounting for nearly 50% of our data set. Capital Structure, Management Update and Acquisition and Disposal cases have about one-tenth representation each in our chosen announcement universe.

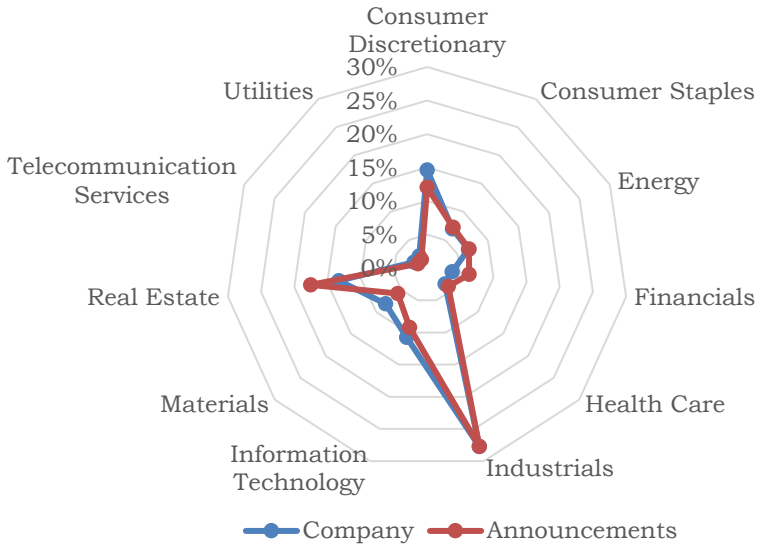
Figure 3. Distribution of announcements by categories



Source: *SGX*

Looking at the sectoral composition of number of announcements in Figure 4, we note that Industrials (28%) account for the largest share of the pie, perfectly in line with the proportion (based on number of companies) of industrial names in our company universe. In fact, the relative balance between the proportions of a sector among announcements versus the total company universe is almost in sync across most sectors. Real Estate and Consumer Discretionary are the limited exceptions, with the proportion of announcements by Real Estate sector companies outweighing their proportion in the company universe, potentially driven by greater regulatory disclosure requirements. The trend is largely offset by Consumer Discretionary names with a relatively lower representation among announcements.

Figure 4. Sectoral distribution by announcements and company coverage



Source: *SGX, Bloomberg Finance LP*

Performance heat maps show positive prior period trend

We then explore the average absolute daily return pattern 10-days prior and 10-days post the announcement date, split by category on Figure 5. This helps us crystallise the overall direction of analysis and helps choose the right parameters for more formal statistical tests.

We observe the returns are generally positive around announcements and in particular, in the periods leading up to the announcement. Extending this further, the period between two days prior to the announcement to a day after announcement, returns are significantly positive across categories with a peak observed on the day of announcement, where all categories without exception show a positive return. Among the categories, announcements belonging to Regulatory, Convertibles, Trading Updates and Ownership Interest have among the strongest positive moves.

Figure 5. Heat-map of avg. daily absolute returns around announcements

Average absolute returns (in %)	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.3	0.3	0.4	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Broad categories	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Acquisition	0.1	0.2	0.2	0.2	0.0	0.1	0.2	0.2	0.2	0.2	0.4	0.7	0.1	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
Business Update	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.0	0.0	0.2	0.0	-0.2	-0.1	0.0	0.1	-0.1	-0.1	0.0	0.0	0.1	0.1
Capital Structure	0.2	0.1	0.3	0.3	0.2	0.2	0.2	0.0	0.2	0.2	0.3	0.4	0.1	-0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.2
Convertibles	0.7	0.5	0.4	0.5	0.6	0.4	0.6	0.3	0.9	0.4	0.7	0.0	0.7	0.3	0.0	0.1	0.3	0.5	0.2	0.3	0.2
Debt	0.6	-0.4	0.9	-0.3	0.4	0.2	0.0	-0.3	0.2	0.4	0.2	-0.1	-0.3	1.0	0.1	-0.7	0.3	0.3	0.2	0.1	0.6
Disposals	0.2	0.2	0.1	0.1	-0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.7	0.1	0.1	0.1	0.0	0.3	0.0	0.1	-0.2	-0.1
Establishment - New Business	0.2	0.1	0.1	0.0	0.1	-0.1	0.0	0.2	0.2	-0.1	0.1	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.0	0.1	-0.1
Financial Performance	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.2	0.0
General Announcement	0.2	0.1	0.2	0.1	0.1	0.1	0.3	0.1	0.2	0.2	0.4	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Management Update	0.3	0.1	0.3	0.1	0.0	0.2	0.2	0.3	0.1	0.2	0.2	0.1	0.2	0.1	0.0	0.1	-0.1	0.2	0.1	-0.1	0.0
Ownership Interest	0.2	0.2	0.1	0.2	0.1	0.2	0.2	0.1	0.3	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1
Payments	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.1	0.0	-0.3	-0.1	-0.1	-0.1	0.0	0.0	0.0
Regulatory	0.3	0.3	0.3	0.3	0.3	0.3	0.6	0.1	0.6	1.0	2.2	-0.1	0.2	0.1	0.0	0.1	-0.1	0.2	0.0	0.3	0.1
Share capital	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.2	0.2	0.0	-0.1	-0.1	0.1	-0.1	0.1	0.0	0.0	0.1	0.0	0.0
Trading	0.3	0.5	0.1	0.4	0.2	0.3	0.5	0.3	0.6	0.6	0.3	1.0	0.2	0.2	-0.1	-0.1	0.0	0.0	0.1	0.1	0.2

Source: *SGX, Bloomberg Finance LP*

Exploring this on a relative basis, adjusting for market returns (absolute returns less FTSE STI returns) also presents a similar result with the positive trend significantly picking up two days prior to the announcement as shown below.

Figure 6. Heat-map of avg. daily relative returns around announcements

Average relative returns (in %)	0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.3	0.3	0.4	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0
Broad categories	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Acquisition	0.1	0.2	0.2	0.2	0.0	0.1	0.2	0.2	0.2	0.2	0.4	0.6	0.0	0.1	0.0	0.0	0.0	0.0	-0.1	0.0	0.0
Business Update	0.1	0.0	0.1	0.1	0.0	0.1	0.2	0.0	0.1	0.2	0.1	-0.2	-0.2	0.0	0.2	-0.1	-0.1	0.0	0.0	0.1	0.0
Capital Structure	0.2	0.1	0.3	0.3	0.2	0.2	0.2	0.0	0.2	0.2	0.3	0.4	0.1	-0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.0
Convertibles	0.7	0.5	0.4	0.5	0.6	0.4	0.6	0.2	0.9	0.4	0.7	0.0	0.7	0.2	-0.1	0.1	0.3	0.5	0.2	0.3	0.0
Debt	0.6	-0.3	0.9	-0.3	0.5	0.2	0.1	-0.2	0.1	0.4	0.3	0.0	-0.3	1.0	0.2	-0.6	0.4	0.3	0.2	0.0	0.1
Disposals	0.2	0.2	0.1	0.1	-0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.7	0.0	0.1	0.1	-0.1	0.3	0.0	0.0	-0.2	0.0
Establishment - New Business	0.2	0.0	0.1	0.0	0.1	-0.2	0.0	0.2	0.2	0.0	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	0.1	0.0
Financial Performance	0.2	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.2	0.0	-0.1	-0.1	-0.1	0.0	0.1	0.0	0.2	0.1
General Announcement	0.2	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.2	0.2	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Management Update	0.3	0.1	0.3	0.1	0.0	0.1	0.2	0.3	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.1	-0.1	0.2	0.1	0.0	0.0
Ownership Interest	0.2	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Payments	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.0	-0.1	-0.3	-0.1	-0.1	0.0	0.0	-0.1	0.0
Regulatory	0.2	0.3	0.3	0.3	0.2	0.2	0.6	0.1	0.6	1.0	2.2	-0.1	0.2	0.2	0.0	0.2	-0.1	0.2	0.0	0.3	0.1
Share capital	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.2	0.2	0.0	-0.2	-0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0
Trading	0.3	0.5	0.2	0.4	0.2	0.3	0.5	0.3	0.7	0.6	0.4	1.0	0.2	0.2	-0.1	0.0	0.0	0.0	0.1	0.0	0.0

Source: *SGX, Bloomberg Finance LP*

A common argument when testing returns across the entire listed universe would be to factor risk appropriately for each company rather than adopt a common market return as a proxy since this typically tends to have an over-representation of large cap names. Accordingly, we ran through a similar heat map with beta-adjusted[10] returns. Here again on Figure 7, we observe the results to be identical to absolute and relative return-based metrics.

Figure 7. Heat-map of avg. daily beta-adj. returns around announcements

Average beta-adj. returns (in %)	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Broad categories	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Acquisition	0.1	0.3	0.1	0.2	-0.1	0.1	0.2	0.1	0.2	0.2	0.4	0.6	0.1	0.1	-0.1	0.0	0.0	-0.1	0.0	0.0	0.0
Business Update	0.1	0.0	0.1	0.0	0.0	0.1	0.2	0.0	0.0	0.2	0.0	-0.2	-0.2	-0.1	0.1	-0.1	-0.1	0.0	0.0	0.0	0.1
Capital Structure	0.2	0.1	0.2	0.3	0.2	0.2	0.2	0.0	0.1	0.2	0.2	0.3	0.1	-0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.0
Convertibles	0.7	0.6	0.3	0.4	0.5	0.3	0.6	0.1	0.8	0.2	0.6	0.2	0.6	0.2	0.0	0.0	0.3	0.6	0.1	0.3	0.0
Debt	0.1	-0.4	0.5	-0.1	0.1	0.0	-0.2	-0.5	0.1	0.4	0.2	-0.4	-0.2	0.6	0.0	-0.5	0.2	-0.1	0.2	-0.3	0.4
Disposals	0.2	0.1	0.1	0.1	-0.1	0.0	0.2	0.2	0.0	0.2	0.1	0.8	0.1	0.0	0.0	0.0	0.2	-0.1	0.1	-0.2	0.0
Establishment - New Business	0.1	0.0	0.1	0.0	0.1	-0.1	0.0	0.1	0.2	-0.1	0.1	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	-0.1	0.1	0.0
Financial Performance	0.2	0.0	0.0	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.2	0.0	0.0	-0.1	-0.1	-0.1	-0.1	0.0	0.1	0.0
General Announcement	0.2	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.2	0.4	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Management Update	0.2	0.1	0.3	0.1	0.0	0.2	0.2	0.3	0.1	0.1	0.1	0.0	0.2	0.1	0.0	0.1	-0.1	0.1	0.1	-0.1	0.0
Ownership Interest	0.1	0.2	0.1	0.2	0.0	0.3	0.2	0.1	0.2	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Payments	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.1	-0.1	-0.3	-0.1	-0.2	-0.1	0.0	0.0	0.0
Regulatory	0.2	0.4	0.3	0.3	0.2	0.3	0.6	0.1	0.7	1.0	2.3	-0.2	0.2	0.1	0.0	0.1	-0.1	0.1	0.0	0.3	0.0
Share capital	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.1	0.1	0.0	-0.1	-0.2	0.0	-0.1	0.1	-0.1	0.0	0.0	0.0	0.0
Trading	0.3	0.4	0.1	0.4	0.2	0.2	0.5	0.3	0.6	0.5	0.4	1.0	0.3	0.2	-0.1	-0.1	-0.1	0.1	0.1	0.1	0.0

Source: *SGX, Bloomberg Finance LP*

Similar to returns, we then observed the average trade volume pattern across categories. However, given that trade volumes tend to structurally inch up over time, we looked at daily standardised trade volumes as opposed to the actual numbers. Standardisation of daily trade volumes is done against the volume observed over the previous six months and the subsequent six months, akin to the approach adopted in literature[11]. Accordingly, we have trade volume in standard deviation terms represented between -3 and +3. A value closer to zero on any day thus implies a volume level closer to its recent observations. Here,

*[10] Beta for each stock is computed on a daily rolling basis based on co-movement of daily stock returns with FTSE STI over the past six months. CAPM framework, defined as risk-free rate + beta * (market return – risk-free rate), is then used to arrive at expected return of a stock as on a particular day. This is deducted from absolute returns earned by the stock that day to arrive at beta-adjusted returns*

[11] For instance, Carhart, Kaniel, Musto and Reed (CKMR 2002) in their work "Leaning for the Tape: Evidence of Gaming Behaviour in Equity Mutual Funds" have adopted this standardisation approach on trade volumes to establish portfolio pumping

we observe heightened action two days prior to the announcement and this stretches until a day after the announcement.

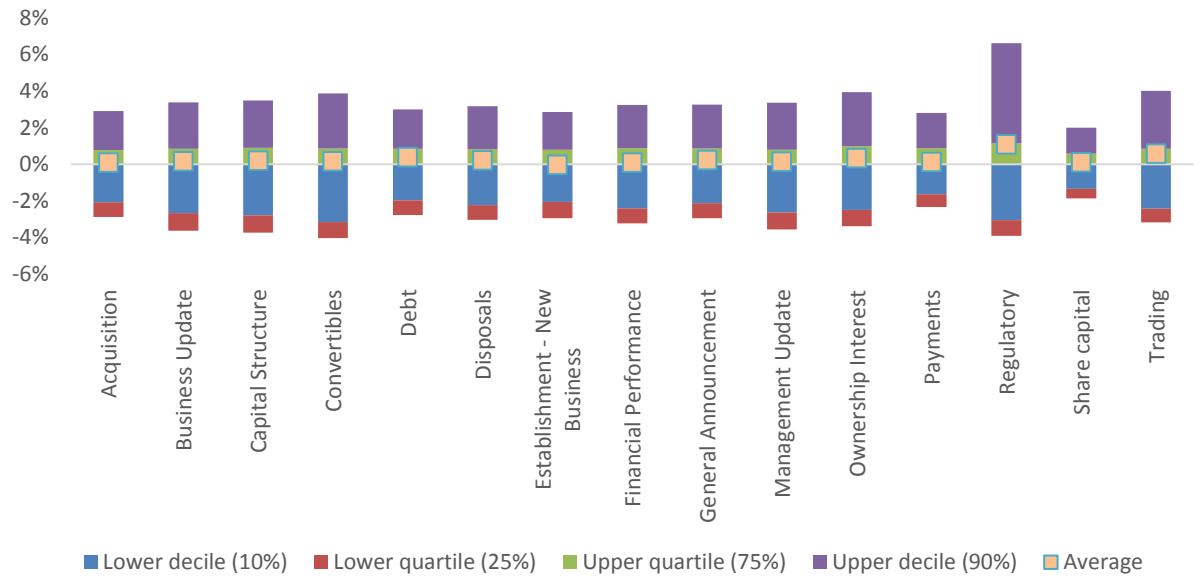
Figure 8. Heat-map of avg. daily standardised trade volume around announcements

Average std. trade volume	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1
Broad categories	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Acquisition	0.3	0.0	0.1	0.0	0.1	0.1	0.0	-0.1	0.1	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	-0.1
Business Update	0.1	0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.2	0.2	0.0	0.2	0.0	-0.1	0.2	0.0	-0.1	0.1
Capital Structure	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.1
Convertibles	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.4	0.1	0.2	0.1	0.1	0.2	0.0	0.0	0.1	0.0	0.4	0.1	0.2
Debt	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.5	0.3	-0.1	0.1	0.0	0.1	0.0	0.1	0.2	-0.1	0.0	0.1	0.5
Disposals	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0
Establishment - New Business	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0
Financial Performance	0.0	-0.1	-0.2	-0.1	-0.1	0.1	0.0	-0.1	0.0	0.0	0.2	0.2	0.4	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0
General Announcement	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Management Update	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Ownership Interest	0.1	-0.1	0.1	0.0	0.2	0.0	0.8	1.0	1.0	1.1	0.5	0.1	0.0	0.1	0.0	0.0	-0.1	0.1	0.0	0.2	0.0
Payments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.0
Regulatory	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.6	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Share capital	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.1	0.2	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Trading	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.6	0.8	0.4	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1

Source: *SGX, Bloomberg Finance LP*

While prior period returns have been positive across categories visually, it is important to understand their distribution across individual instances to draw enough confidence. The chart (Figure 9) presents the variation in daily relative returns observed around the average returns across categories.

Figure 9. Variation in avg. daily relative returns around announcements



Source: *SGX*

The variation has been presented in terms of lower and upper quartile ranges (representing the 25th and 75th percentile values) as well as the lower and upper decile values (representing the 10th and 90th percentile values).

Co-efficient of variation analysis against any broad-based manipulation

We observe the variation of average returns to be quite significant across categories. Therefore, we compile the Co-efficient of Variation (CV) across categories to understand average returns better in the context of the observed variation. We also ran this process across multiple time frames of prior period cumulative returns: one-day, two-day, three-day, five-day and seven-day.

In simple terms, CV is defined as the extent of variation per unit of mean. It is obtained as observed standard deviation of the sample element values / average of the sample element values[12]. A CV analysis helps present the variability in the observations in the context of its average value, thus making it unit independent. The higher the CV, the greater is the variation around the

[12] *It is typically multiplied by 100 and expressed as a percentage for easy reference*

average value and hence the lower the confidence level that the average value is representative of the underlying population.

Table 1: Average and Variation in absolute returns across time horizons

Announcement Categories	Prior period cumulative absolute returns (in %) across time periods														
	1-day			2-days			3-days			5-days			7-days		
	Avg.	Std.	C.V	Avg.	Std.	C.V	Avg.	Std.	C.V	Avg.	Std.	C.V	Avg.	Std.	C.V
Acquisition	0.1	1.1	13.2	0.1	0.9	14.1	0.1	0.8	16.3	0.0	0.7	15.0	0.1	0.7	13.3
Business Update	0.0	1.0	56.4	0.0	0.9	576.6	0.0	0.8	-109.5	0.0	0.7	-30.7	0.0	0.6	-25.4
Capital Structure	0.0	1.0	22.9	0.0	0.9	22.5	0.0	0.8	20.4	0.0	0.7	19.1	0.0	0.6	16.5
Convertibles	0.2	1.1	6.1	0.2	1.0	5.5	0.2	0.9	5.5	0.1	0.8	5.2	0.1	0.7	4.9
Debt	0.0	1.2	NM	0.0	0.9	-21.5	0.0	0.8	-30.2	0.0	0.7	-26.8	0.0	0.7	-31.4
Disposals	0.0	0.9	-128.7	0.0	0.8	-81.1	0.0	0.7	-41.6	0.0	0.7	-34.9	0.0	0.6	-26.4
Est. - New Business	0.0	1.1	349.9	0.0	0.9	-733.5	0.0	0.8	-29.1	0.0	0.7	-22.4	0.0	0.6	-23.8
Fin. Performance	0.0	0.9	-28.7	0.0	0.8	-19.5	0.0	0.7	-14.8	-0.1	0.6	-11.7	-0.1	0.6	-23.8
Gen. Announcement	0.1	1.1	10.0	0.1	0.9	10.8	0.1	0.9	11.5	0.1	0.7	12.5	0.0	0.7	13.7
Management Update	0.0	0.9	23.4	0.0	0.9	21.7	0.0	0.8	27.1	0.0	0.7	51.4	0.0	0.6	108.3
Ownership Interest	0.5	1.7	3.9	0.4	1.5	3.5	0.4	1.3	3.5	0.3	1.1	3.7	0.3	1.0	3.8
Payments	0.1	1.0	12.2	0.1	0.8	16.9	0.0	0.8	21.0	0.0	0.6	27.0	0.0	0.6	39.1
Regulatory	0.2	1.3	6.0	0.1	1.0	7.1	0.1	0.9	8.1	0.1	0.8	9.8	0.1	0.7	10.6
Share Capital	0.1	1.1	15.3	0.1	1.0	13.9	0.1	0.9	13.4	0.1	0.8	12.1	0.1	0.8	11.2
Trading	0.2	1.3	6.2	0.2	1.1	6.4	0.2	1.0	6.4	0.1	0.8	7.1	0.1	0.7	8.4

We observe that CV values are quite high across categories in Table 1, thereby providing us with little confidence to draw any conclusion at this stage about market manipulation in a category of announcement despite the observed average positive return. ***With the limited evidence gathered so far, there appears no alarming sign of broad market level or category level manipulation around announcements.***

A similar result is also observed when the CV analysis is run based on relative returns over the same cumulative time periods. Although not presented in this report, replicating the analysis with beta-adjusted returns proves to be no different.

Table 2: Average and Variation in relative returns across time horizons

Announcement Categories	Prior period cumulative relative returns (in %) across time periods														
	1-day			2-days			3-days			5-days			7-days		
	Avg.	Std.	C.V	Avg.	Std.	C.V	Avg.	Std.	C.V	Avg.	Std.	C.V	Avg.	Std.	C.V
Acquisition	0.2	6.6	36.3	0.4	7.7	21.2	0.5	8.9	19.7	0.7	11.2	15.7	0.8	12.4	14.7
Business Update	0.2	6.0	36.6	0.2	6.9	37.0	0.2	8.2	51.5	0.5	12.6	27.5	0.5	13.5	26.3
Capital Structure	0.2	7.1	38.1	0.3	8.5	31.1	0.2	10.0	44.0	0.6	13.4	22.3	1.1	15.9	14.9
Convertibles	0.2	10.7	45.0	1.1	13.6	12.7	1.2	14.8	12.4	2.2	18.7	8.6	3.0	19.9	6.5
Debt	0.4	10.3	25.2	0.5	9.1	17.8	0.0	10.3	388.8	-0.2	13.4	-78.8	-0.2	12.7	-57.9
Disposals	0.2	5.7	27.0	0.3	7.2	27.9	0.5	8.3	16.6	0.8	11.6	15.0	0.7	13.3	18.6
Est. - New Business	-0.1	3.2	-41.4	0.1	4.4	58.0	0.2	5.1	26.6	0.1	6.4	90.1	0.1	7.6	55.5
Fin. Performance	0.0	5.2	-226.8	0.0	6.4	-153.3	-0.1	7.8	-67.4	-0.1	9.9	-113.4	0.0	11.8	NM
Gen. Announcement	0.2	5.8	31.2	0.3	7.7	24.4	0.4	8.8	23.8	0.7	12.2	17.2	0.9	13.6	15.4
Management Update	0.2	6.5	38.3	0.3	10.4	38.0	0.5	11.5	21.2	0.9	14.5	16.1	1.0	16.1	16.3
Ownership Interest	0.3	6.7	25.4	0.5	8.7	17.9	0.6	10.1	17.7	1.0	14.1	14.1	1.2	15.8	13.6
Payments	0.1	2.5	37.0	0.2	3.2	20.1	0.1	4.0	28.0	0.1	4.7	50.5	0.2	5.4	31.8
Regulatory	1.1	12.4	11.3	1.7	14.9	8.5	1.8	15.6	8.8	2.6	18.8	7.3	3.1	21.5	7.0
Share Capital	0.1	7.4	51.2	0.3	10.0	37.3	0.3	12.2	42.9	0.3	14.3	41.1	0.2	14.4	59.8
Trading	0.5	9.6	17.4	1.2	13.5	11.7	1.4	14.8	10.2	2.2	18.7	8.5	2.8	21.8	7.9

However, on a relative basis, we can observe that the categories with the largest average positive movement prior to announcement - Regulatory cases, Convertibles, Ownership Interest and Trading – are also the ones that have a lower CV value across time periods. This calls for further analysis to deep dive into individual categories.

Analysis of Variance (ANOVA) also helps support our argument for a more detailed study here. ANOVA captures whether the observed variation across categories is significantly different from the variation observed within categories[13]. The key metric to observe in ANOVA, as in any statistical test, is the p-value. If the observed p-value is found to be less than an acceptable

[13] *In other words, it explains the proportion of total variation in the sample that is attributable to variation across categories and those arising due to variation within a category*

significance level[14] (also termed error rate, commonly set at 5%) then the test is said to be statistically significant at that error level. This in turn implies that variation in return between categories is different from return within categories.

Table 3: ANOVA of 2-day cumulative relative returns across categories

Source of Variation	SS	df	MS	F computed value	P-value	F critical value
Between Categories	19172.3	14	1369.5	22.85	0.00*	1.69
Within Categories	9697644.7	161828	59.9			
Total	9716817	161842				

** significant at 5% level*

The table above presents the *ANOVA* based on two-day cumulative returns. A significant p-value here *confirms the presence of considerable variation in returns across categories,* thereby signalling the need for a more formal statistical analysis at a category level. A similar interpretation is also drawn on ANOVA run for other cumulative periods of study (not presented in this report).

[14] *Significance level is viewed as contrary to confidence level. 95% is the commonly adopted confidence level, representing an acceptable error rate of 5%.*

4. Hypothesis Testing

Base hypothesis for rejection

With the results from ANOVA in the previous step we have established the need to understand the prior period return performance in greater detail for each of the categories. We now turn to hypothesis testing. This form of testing is essentially a test for rejection. We begin by defining a base or null hypothesis (typically referred as H_0) on a single or multiple set of parameters, and observe if there is sufficient evidence to reject the hypothesis.

A test statistic is usually defined for a hypothesis. This serves as the key metric to be computed and compared against statistically acceptable thresholds to determine if there is enough proof for rejection of the hypothesis. The test statistic is a standardised value derived based on the statistical properties of the underlying parameters being hypothesised. For instance, consider a null hypothesis equating sample mean to a known population mean. We know from statistical literature[15] that if null hypothesis were to be true, the sample mean will follow a normal distribution with mean equal to population mean and standard deviation equal to population standard deviation / square root (sample size), which is defined as the standard error of the sample mean. We could then create a test statistic, by standardising the sample mean, defined as (sample mean – population mean) / (standard error of the sample mean). This, in effect creates a standardised metric that follows a standard normal distribution[16] with mean of 0 and variance of 1. Acceptable thresholds for comparison are determined by leveraging these known standardised properties of the test statistic under the null hypothesis[17].

[15] *According to Central Limit Theorem, if sample size is sufficiently large (n>30), irrespective of the underlying distribution of the population, sample means will tend to normal distribution*

[16] *Defined as z-distribution. In cases where population standard deviation is not known, it is replaced with sample standard deviation. If n<30, the test statistic is said to follow a t-distribution with n-1 degrees of freedom*

[17] *In the above instance of hypothesising sample mean being equal to population mean, we would refer a standard normal table or a t-table to identify the thresholds*

Threshold levels are also influenced by the expected level of significance, which reflects the permissible level of error in rejecting the null hypothesis. It is typically defined as 5%, indicating a 95% accuracy rate. In other words, we expect to reject the null hypothesis correctly in 95%[18] of the times we run this exercise. Alternatively, we could interpret it as being 95% confident that our rejection of null hypothesis based on our test will be right.

Finally, we define a test rule that presents the logic to be adopted for rejecting H_0. The logic adopted will depend on the nature of the hypothesis set. If H_0 is taken as being greater than a particular value, then we define the test rule as the computed test statistic being lower than the identified threshold for a given significance level and vice-versa. If H_0 is set as being equal to a particular value, then the test statistic value falling outside an acceptable range is viewed as evidence enough for rejection[19].

Defining the hypotheses

Accordingly, given the significant variation observed across categories as spelt out by ANOVA in the previous step and the significant positive average returns observed across certain categories, we start with our first null hypothesis being average prior (to announcements) period returns of a category not significantly different from comparable post period returns. Given the pick-up in prior period returns begin two days prior to announcements, as shown in our heat maps in the previous section, we concentrate on the cumulative two-day prior and post period returns for this analysis. Furthermore, given the common trend observed across all three categories of returns[20] and also in line with academic literature, we base our hypothesis on relative returns.

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[18] A higher confidence level implies the need for a greater sample size

[19] Technically, this is referred as the tail of the test. If H_o is defined as a metric being equal to a certain value, then we adopt a two-tailed test, representing looking for potential errors of rejection on both sides of the distribution. If H_o is defined as directionally being greater or less than a certain value, then we look for errors on one-side of the expected distribution of the metric and accordingly these are called one-tailed tests

[20] Three categories of returns considered for our study include absolute returns, relative (to FTSE STI) returns and beta-adjusted returns

We define our hypothesis as:

H_0: Average two-day prior period relative returns of a category are not significantly different from two-day post period relative returns

Similarly, we also compare the prior period returns with an average return[21] observable on any given day, for the same periodicity under consideration. Thereby, we define the null hypothesis as:

H_0: Average two-day prior period relative returns of a category are not significantly different from two-day average relative returns

The hypotheses essentially involve a comparison of two sample means, average two-day prior period relative returns versus comparable two-day post period returns (case 1) and two-day average returns (case 2).

Hypotheses tests call for further study

Accordingly, a two-sample t-test with the assumption of equal variances[22] is used to test the hypotheses. Based on the null hypotheses definition, we consider a two-tailed test with a 5% significance level. The following table presents the average returns by category across the cases with a "*"mark to denote categories where the prior period returns are found to be significantly different[23] from post-period returns or average returns.

Among the categories that showed strong positive returns amid relatively low co-efficient of variation, we observe prior period returns of Regulatory announcements and Trading Updates to be significantly higher than an average comparable time period, while coming largely in-line with the post-period returns. These are possibly key cases for a deeper analysis given that

[21] *Average two-day returns represent the average of daily rolling two-day cumulative returns over six-months prior and six-months post the day of announcement*
[22] *Function t test() in MS-Excel is used to compute the p-value associated with the two-sample t-test. This is then compared against the significance level of 5%. The t test() functionality runs on four parameters: the two sample arrays, number of tails and assumption on equality or non-equality of variance. Adopting a non-equal variance assumption does not lead to a significant change in results*
[23] *This essentially implies that the computed test statistic value falls outside the acceptable thresholds*

the run-up in the relevant counters seems to have picked up ahead of the announcement going public.

Table 4: Comparison of relative return around announcements by category

	Cumulative 2-day average relative returns (in %)		
Announcement Categories	**Prior-period**	**Post-period**	**Average period**
Acquisition	0.37	1.02 *	0.19 *
Business Update	0.21	-0.12 *	0.15
Capital Structure	0.37	0.63	0.23
Convertibles	1.24	0.69	0.61
Debt	0.50	0.29	0.72
Disposals	0.29	0.88 *	0.20
Establishment - New Business	0.17	0.12	0.12
Financial Performance	0.20	0.35	0.16
General Announcement	0.45	0.65 *	0.16 *
Management Update	0.28	0.21	0.22
Ownership Interest	0.67	0.38 *	0.22 *
Payments	0.23	0.50 *	0.05 *
Regulatory	1.91	2.04	0.28 *
Share Capital	0.38	-0.10 *	0.07 *
Trading	1.32	1.33	0.30 *

** significant at 5% level*

Ownership Interest related announcements exhibit prior-period returns that are significantly higher than both post-period and average comparable period returns. This could possibly be due to liquidity-induced effect of shares being traded leading up to the disclosure. There appears to be no broad investor interest beyond the disclosure potentially implying that it is a non-event for our analysis. Interestingly, the movement based on Convertibles related

announcements, despite being strongly positive in the prior period, is not found to be statistically different from the other two cases.

Outside the categories of interest from our previous sections, Payments, Acquisition and Share Capital related announcements, despite their lower average returns in terms of value, have significantly higher prior-period returns versus an average comparable period. A general pick-up in demand for stocks around expected dividend payout might possibly explain the former. However, the significantly higher returns among Acquisition and Share Capital cases might be worth further investigation.

For comparison purposes, we performed the analysis with absolute and beta-adjusted returns and the conclusions are the same.

Table 5: Comparison of abs. return around announcements by category

	Cumulative 2-day average absolute returns (in %)		
Announcement Categories	**Prior-period**	**Post-period**	**Average period**
Acquisition	0.39	1.01 *	0.27 *
Business Update	0.23	-0.14 *	0.22
Capital Structure	0.37	0.65	0.34
Convertibles	1.28	0.69	0.92
Debt	0.54	0.21	1.07
Disposals	0.31	0.89 *	0.29
Establishment - New Business	0.12	0.11	0.16
Financial Performance	0.00	0.31 *	0.23 *
General Announcement	0.38	0.68 *	0.22 *
Management Update	0.28	0.22	0.32
Ownership Interest	0.60	0.41 *	0.32 *
Payments	0.15	0.49 *	0.07 *
Regulatory	1.70	2.03	0.41 *
Share Capital	0.37	-0.08 *	0.09 *
Trading	1.22	1.33	0.45 *

** significant at 5% level*

Table 6: Comparison of beta-adjusted return around announcements by category

	Cumulative 2-day avg. beta-adjusted returns (in %)		
Announcement Categories	**Prior-period**	**Post-period**	**Average period**
Acquisition	0.35	0.97 *	0.15 *
Business Update	0.19	-0.21 *	0.11
Capital Structure	0.27	0.53	0.19
Convertibles	1.08	0.71	0.57
Debt	0.46	-0.21	0.67
Disposals	0.26	0.77 *	0.16
Establishment - New Business	0.08	0.05	0.07
Financial Performance	-0.04	0.27 *	0.12 *
General Announcement	0.32	0.59 *	0.11 *
Management Update	0.24	0.16	0.18
Ownership Interest	0.55	0.37 *	0.18 *
Payments	0.13	0.54 *	0.01 *
Regulatory	1.75	2.17	0.23 *
Share Capital	0.28	-0.13 *	0.02
Trading	1.18	1.36	0.25 *

** significant at 5% level*

Extending the same tests to standardised trade volumes, we put forward the following hypotheses:

H_0: Average two-day prior period standardised trade volumes of a category are not significantly different from two-day post period volumes

H_0: Average two-day prior period standardised trade volumes of a category are not significantly different from two-day average comparable period volumes

A similar two-sample t-test with equal variances indicates that prior-period trade volumes are broadly higher than an average comparable period, while they lag the trade volumes post an announcement.

Table 7: Comparison of trade volumes around announcements by category

	Cumulative 2-day average standardised volume (in standard deviation terms)		
Announcement Categories	**Prior-period**	**Post-period**	**Average period**
Acquisition	0.07	0.25 *	0.00 *
Business Update	0.00	0.19 *	-0.01
Capital Structure	0.04	0.26 *	0.00 *
Convertibles	0.18	0.24	-0.01 *
Debt	-0.04	0.04	0.00
Disposals	-0.01	0.10 *	0.00
Establishment - New Business	0.00	0.00	-0.01
Financial Performance	-0.04	0.25 *	-0.01 *
General Announcement	0.09	0.27 *	-0.01 *
Management Update	0.04	0.07 *	-0.01 *
Ownership Interest	0.41	0.26 *	0.00 *
Payments	0.05	0.29 *	0.00 *
Regulatory	0.14	0.68 *	-0.01 *
Share Capital	0.07	0.11	0.00 *
Trading	0.17	0.85 *	-0.01 *

** significant at 5% level*

As observed earlier, a pick-up in trade volumes prior to Ownership related disclosures and a weakening effect subsequently reiterates the liquidity induced factor at play here. Regulatory and Share Capital categories see the sharpest pick-up in volume post announcement, corroborating with the sustained investor interest and strong performance seen earlier. Acquisition,

Capital Structure and Convertibles related announcements show a strong pick-up in volumes prior to announcements and a sustained rise post the announcement, but returns, as observed earlier, did not commensurate with this trend. Financial performance related announcements tend to have weak prior-period volumes and a strong traction post the announcement. This is likely due to the black-out period typically in place with related parties immediately preceding the result announcements.

Given that a couple of categories continue to evoke interest and also to evaluate any sub-set within the broader category group presenting an interesting insight, we extend the hypothesis tests to the sub-categories.

5. Analyzing Sub-Categories

We perform a similar analysis on the sub-categories of announcements as has been done with the case of the broad category of announcements. The analysis could help validate if a phenomenon observed in a category is widespread across various sub-categories or driven by a limited set of announcements. Similarly, it could also identify certain sub-categories hidden within a broader group that might have significant pre-announcement moves when the category in itself was not statistically significant in the previous hypothesis test. Extending this further, sub-category level analysis helps identify if two or more groups with a contrasting behaviour are potentially nullifying the impact of each other at a broader category level.

In effect, running the analysis at the sub-category level calls for replication of descriptive statistics, coefficient of variation analysis and hypothesis test for comparable means – prior period returns versus post period and average comparable period returns at the sub-announcement level. Given that each sub-announcement category is evaluated in isolation and not compared with each other, we present the results category-wise in the form of one-pagers for each category for easy representation and insights.

Sub-categories reveal interesting insights

Among the broader categories which have shown a clear trend of significant prior period performance, Ownership Interest cases present a homogeneous trend with both its key sub categories, whilst Change of Interest as well as Interest Disclosure cases, carrying significantly high prior period returns. This could be the effect of a demand-driven rally due to the very purpose of the announcement.

Similarly, Listing Updates, which occupy the bulk of announcements under the Trading category, tend to move strongly prior to the dissemination of news and continue to post a strong return post the announcement.

Within the Regulatory universe, specific sub-categories pertaining to Legal action on the company or Query Response by the company to any non-standard queries from SGX seem to start rallying prior to announcements turning public and turn even stronger post the news release.

In the earlier section, we observed that Acquisition, Payments and Share Capital categories have also seen a significant positive performance prior to announcements but on a lower base of average returns. Among Acquisitions, New Business related announcements tend to dominate and they have a significantly positive return prior to announcement which strengthens post the news release. In a similar vein, prior to termination of Open Offer, returns are significantly negative and lower than an average period. Initiation of an Open Offer also leads to a positive prior period performance but the performance is not found to be significantly high compared to an average comparable period. These could be potential cases of manipulation and might need further investigation.

Among Payments, Dividend cases show a strong prior period performance and build on the same once the announcements are made public. This appears quite natural given that funds and investors tend to accumulate dividend-bearing stocks prior to the announcement. Such announcements happen around a consistent reporting cycle and hence the prior price movement should not be considered to be a surprise finding.

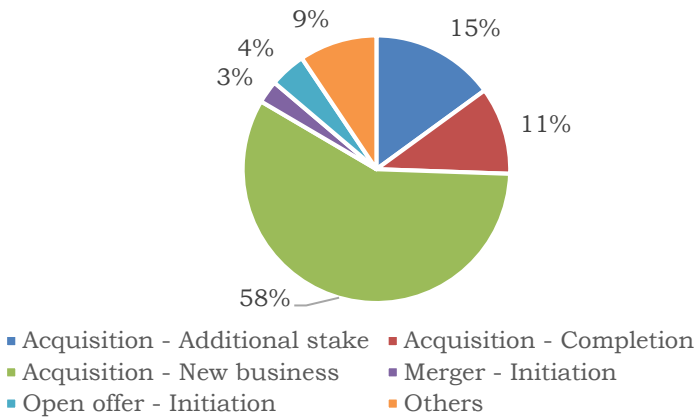
Within the Share Capital category, Share Consolidation announcements as well as announcements pertaining to Use of Treasury Shares tend to have a significant positive run prior to announcements and turn negative post the announcement dissemination. This needs further investigation.

These apart, there are a few sub-categories that behave quite contrary to expectations. In particular, Merger initiation announcements on an average are received with a negative response prior to the announcements being made public and remain so even after they are made. Impairment announcements generate a negative reaction prior to announcements but interestingly turn positive post the dissemination of news. Guidance announcements turn strongly negative post the announcement of news, which is also surprising.

Overall, through the sub-category of announcements, we observe certain abnormal price rises in the prior period to be justified, while certain other cases call for a more detailed investigation.

Acquisition: Prior returns positive for New business but Merger initiations show a contrary trend

Exhibit A. Announcements by sub-categories



Key Observations

- New business acquisitions account for over half the total acquisition related announcements. They also tend to have significantly higher returns two-days prior versus an average comparable period. Post period returns are even higher
- Merger intention news tend to be significantly negatively priced ahead of the announcement
- Announcement of Open Offer is preceded by a positive move but the move is not significantly different from an average period

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Acquisition – Addl. stake	0.0	104	0.1	47.6	0.1	59.1	0.2	40.1	0.3	25.4
Acquisition - New Business	0.3	26.3	0.6	15.0	0.8	12.8	1.2	10.9	1.4	9.9
Acquisition - Completion	-0.2	-18.4	-0.3	-14.3	-0.2	-32.1	0.0	NM	0.1	NM
Acquisition - Termination	-0.5	-9.4	-0.4	-22.4	-0.4	-41.9	1.3	15.7	3.6	7.8
Merger - Initiation	-0.3	-6.2	-0.7	-3.5	-0.3	-8.3	-0.9	-5.9	-2.6	-2.3
Merger - Completion	-0.1	-41.2	-0.2	-10.0	0.0	NM	0.1	44.7	0.2	23.8
Merger - Termination	-0.8	-2.5	-0.6	-4.4	-0.4	-6.8	-1.0	-3.8	0.0	709.5
Open Offer - Initiation	0.5	14.1	0.9	9.3	0.4	12.3	0.7	10.8	1.1	13.4
Open Offer - Adjustment	1.0	1.5	0.5	1.9	1.3	1.5	4.0	0.8	1.2	1.4
Open Offer - Completion	0.0	-43.9	0.1	13.4	0.4	6.6	1.2	4.0	1.8	3.2
Open Offer - Termination	-2.5	-1.1	-2.9	-1.2	-3.0	-1.1	-4.7	-0.8	-7.9	-1.0

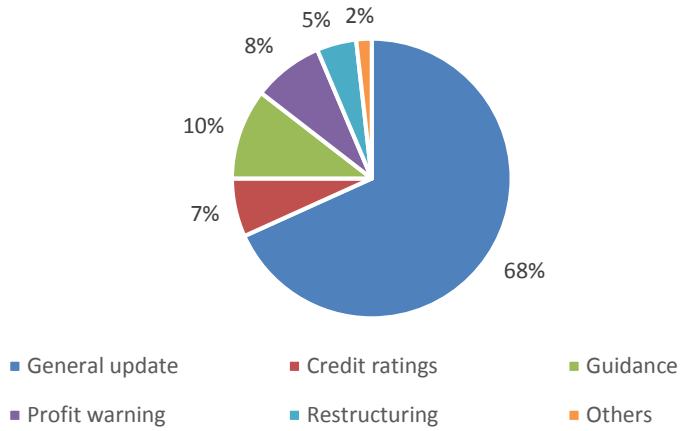
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)				
	Prior	Post		Average	
Acquisition – Addl. stake	0.10	0.17		0.09	
Acquisition - New Business	0.59	1.26	*	0.21	*
Acquisition - Completion	-0.31	0.48	*	0.18	*
Acquisition - Termination	-0.39	1.19		0.69	
Merger - Initiation	-0.75	-0.64		0.09	*
Merger - Completion	-0.23	-2.50	*	0.00	
Merger - Termination	-0.61	-0.58		0.26	
Open Offer - Initiation	0.73	3.26	*	0.16	
Open Offer - Adjustment	0.53	-0.96		0.10	
Open Offer - Completion	0.07	0.41		0.20	
Open Offer - Termination	-2.89	-0.77		0.09	*

** significant at 5% level*

Business Update: No strong move in any sub-group prior to announcement

Exhibit A. Announcements by sub-categories



Key Observations

- No sub-category presents a prior movement significantly different from the average benchmark
- Significant post period movement includes a positive move for general business updates and a strong negative move for post profit warnings, which is in line with expectations
- Interestingly, guidance announcements are followed by a strong negative performance
- Impairment announcements have a negative prior period performance but have a positive move post the announcement

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Accounting change	-0.2	-7.2	0.0	-201.3	1.7	2.1	2.8	1.4	2.8	1.8
Capex	0.7	2.7	0.1	50.7	-0.3	-13.0	-1.1	-6.6	-0.7	-11.2
Credit ratings	0.1	22.1	0.2	12.8	0.3	11.6	0.4	12.4	0.4	14.1
General update	0.1	85.0	0.1	71.2	0.1	55.6	0.4	27.1	0.6	21.1
Guidance	0.8	11.4	0.7	13.8	0.4	26.6	1.5	12.4	1.1	16.1
Impairment	-0.4	-0.8	-1.7	-0.3	-0.6	-2.3	-4.2	-0.8	-6.7	-1.1
Interested party	-0.2	-13.5	-0.3	-16.9	0.0	-314.9	0.2	31.1	3.7	7.0
Profit warning	0.0	NM	0.4	15.8	0.1	57.4	-0.1	-137.4	0.3	39.2
Restructuring	0.1	32.6	0.1	73.7	0.3	25.5	1.1	9.4	1.0	12.3
Restructuring - Completion	0.3	6.1	0.6	3.6	0.7	4.3	1.5	3.7	0.4	17.7

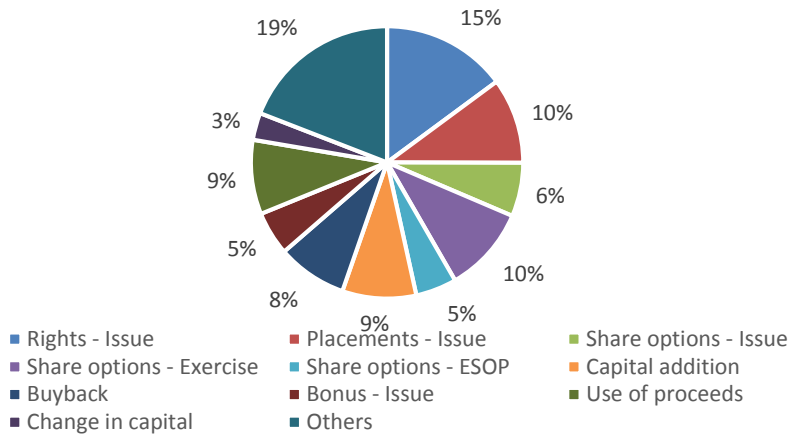
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)			
	Prior	Post		Average
Accounting change	-0.01	1.16		0.05
Capex	0.06	-2.01		-0.15
Credit ratings	0.20	0.13		0.02
General update	0.09	0.76	*	0.14
Guidance	0.69	-2.91	*	0.19
Impairment	-1.69	0.73	*	0.39
Interested party transaction	-0.27	1.30		0.13
Profit warning	0.42	-2.35	*	0.23
Restructuring	0.09	0.74		0.14
Restructuring - Completion	0.63	0.35		0.08

** significant at 5% level*

Capital Structure: Private placements returns significantly higher prior to announcement and turn stronger post announcement

Exhibit A. Announcements by sub-categories



Key Observations

- Announcements are fairly well-distributed across the sub-categories
- News of Private placement tends to get factored in early and they significantly outperform an average comparable period. The performance strengthens further post the announcement
- Positive move prior to announcements is also visible among Buyback cases, although the extent of movement is not found to be statistically significant

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Bonus - Issue	-0.1	-58.8	-0.1	-45.3	-0.4	-12.7	-0.5	-13.9	-0.5	-14.7
Buyback	-0.2	-13.4	0.5	24.6	0.0	149.1	0.3	40.1	0.1	90.7
Capital addition	0.1	36.9	0.2	21.0	0.4	20.6	0.8	13.3	0.9	13.1
Placements - Issue	0.7	13.9	1.3	9.1	1.2	10.8	2.2	7.9	3.5	5.5
Rights - Issue	-0.2	-52.8	-0.1	-98.6	0.0	NM	0.7	25.6	1.4	16.4
Share options - ESOP	-0.1	-31.0	0.1	53.0	-0.1	-44.9	0.3	20.8	0.3	26.7
Share options - Exercise	0.1	75.5	0.0	NM	0.1	136.7	0.1	87.6	0.6	17.5
Share options - Issue	0.0	80.8	0.4	12.3	0.2	21.5	0.4	18.1	1.6	8.7
Use of Proceeds	0.3	-20.4	0.3	-7.1	0.1	-27.6	0.3	-66.2	1.0	15.2
Others	0.3	42.7	0.5	5.0	0.6	7.5	0.1	2.7	0.0	1.3

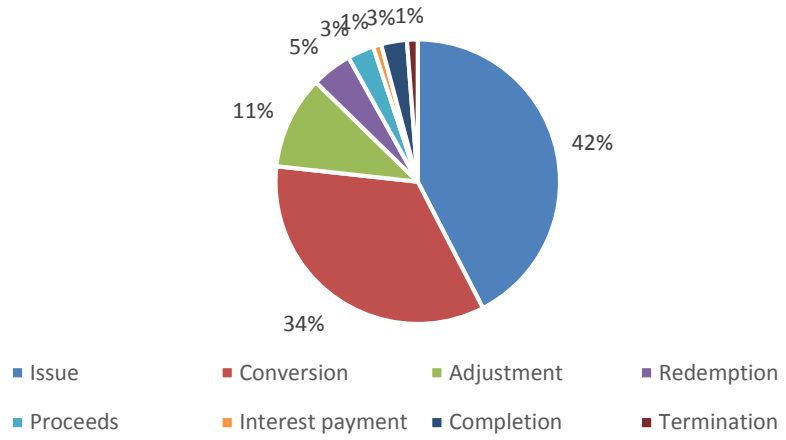
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)				
	Prior	Post		Average	
Bonus - Issue	-0.07	0.94	*	0.05	
Buyback	0.51	2.07		0.07	
Capital addition	0.22	0.21		0.09	
Placements - Issue	1.26	4.21	*	0.37	*
Rights - Issue	-0.08	-0.82		0.37	
Share options - ESOP	0.09	0.29		0.14	
Share options - Exercise	0.00	0.27		0.10	
Share options - Issue	0.41	0.42		0.13	
Use of Proceeds	0.33	0.22		0.30	
Others	0.52	0.01		0.32	

** significant at 5% level*

Convertibles: Appears to be a non-event

Exhibit A. Announcements by sub-categories



Key Observations

- No aspect of Convertibles related announcements, including issue, conversion or adjustments shows a significant move prior to announcements
- Announcements relating to adjustments to the conversion terms have a significant negative impact post the announcement
- Interestingly returns prior to announcements on Use of proceeds from Convertible issue appear significantly negative

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Issue	0.6	28.7	1.8	11.8	1.9	10.3	3.9	6.8	6.2	4.6
Conversion	0.1	52.0	1.0	9.7	0.7	11.1	1.3	10.1	1.5	8.8
Adjustment	0.9	11.9	1.4	7.3	0.2	32.2	1.6	7.3	0.9	11.4
Redemption	0.0	238.	0.6	10.6	0.1	20.4	1.3	4.8	0.3	18.4
Proceeds	-0.4	-7.1	-0.9	-5.8	-1.9	-3.7	0.7	19.7	2.1	7.0
Interest payment	0.0	71.1	-0.2	-12.3	-0.8	-3.5	0.4	10.4	-0.1	-29.8
Completion	0.8	5.5	1.3	4.9	2.1	6.6	3.0	5.6	3.3	5.3
Termination	-0.6	-1.4	-0.2	-12.6	-0.3	-9.1	-0.3	-12.4	-0.4	-13.5
Change of capital	0.5	2.1	-0.1	-11.4	0.8	2.1	0.1	12.8	-0.3	-9.7

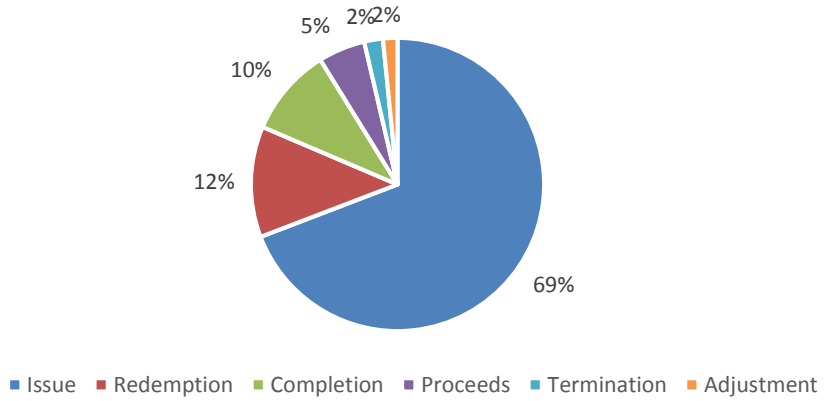
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)		
	Prior	Post	Average
Issue	1.76	1.86	0.88
Conversion	0.98	-0.18	0.24
Adjustment	1.00	-0.09	* 0.49
Redemption	0.65	0.93	0.06
Proceeds	-0.91	0.15	0.35 *
Interest payment	-0.21	-0.40	0.00
Completion	1.34	-0.45	0.78
Termination	-0.18	-2.24	0.08
Change of capital	-0.11	0.66	0.06

** significant at 5% level*

Debt: A routine affair with no surprises

Exhibit A. Announcements by sub-categories



Key Observations

- Movement of stock prices prior to any debt related announcements appear to be largely in line with average comparable periods
- Some categories such as Adjustments to debt characteristics and drawdowns attract strong positive moves prior to announcement but are not found to be statistically different

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Issue	0.4	13.4	0.2	25.5	0.0	-119.0	-0.3	-20.2	-0.4	-13.8
Adjustment	13.4	3.8	7.8	4.4	8.1	5.1	12.4	4.2	10.7	4.0
Redemption	-0.8	-6.7	0.1	60.6	0.0	-123.6	0.2	43.8	-0.6	-16.3
Proceeds	0.3	29.7	2.3	7.0	0.4	28.9	0.5	48.3	2.6	9.0
Drawdown	-1.0	-2.7	2.0	1.7	2.3	1.7	3.4	1.5	4.6	1.6
Completion	-1.4	-8.3	-0.9	-19.1	0.1	305.8	3.3	7.6	4.8	6.0
Termination	-1.7	-4.9	0.3	13.0	0.1	17.9	-2.8	-2.7	-6.7	-1.7

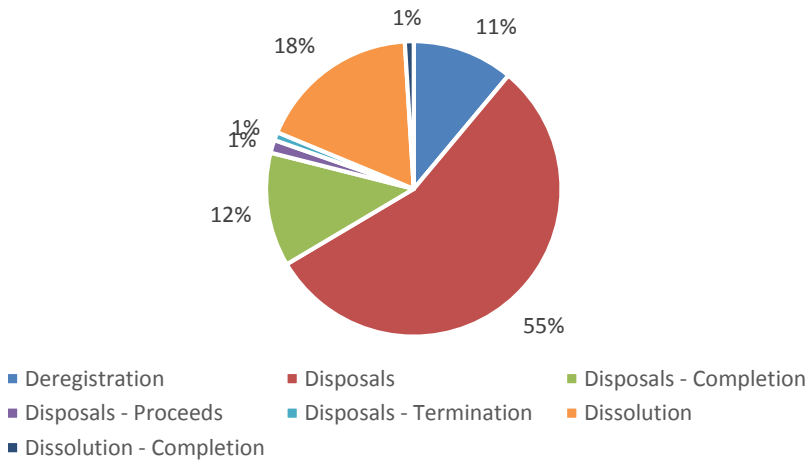
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)			
	Prior	Post	Average	
Issue	0.24	0.03	0.09	
Adjustment	7.83	-4.47	0.89	
Redemption	0.10	0.15	0.06	
Proceeds	1.88	-0.51	0.50	
Drawdown	2.04	-9.49	0.14	
Completion	-0.89	3.30	4.74	*
Termination	0.33	5.97	0.60	

** significant at 5% level*

Disposals: Insignificant positive pick-up in prices ahead of most sub-categories of announcements

Exhibit A. Announcements by sub-categories



Key Observations

- Across the board, there appears a stronger positive move prior to any disposal related announcement, be it its initiation, successful completion or use of proceeds. However, none of the moves are significantly different from an average period
- The strong moves are maintained post the announcements as well with cases post news of disposal initiation inching significantly higher in statistical terms

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Deregistration	1.2	8.7	0.3	25.4	0.7	14.7	1.2	11.6	0.7	17.7
Disposals - Initiation	0.0	263.	0.3	29.2	0.4	19.3	0.9	14.0	0.9	15.4
Disposals - Completion	0.6	13.5	0.7	12.9	0.5	16.2	0.8	13.6	0.6	20.9
Disposals - Proceeds	0.4	5.6	0.4	7.2	0.3	11.3	0.5	11.4	-1.1	-10.1
Disposals - Termination	-0.9	-4.8	-0.8	-15.2	-2.0	-5.7	0.8	20.2	0.1	117.6
Dissolution	0.1	49.9	0.0	398.9	0.3	26.2	0.7	19.3	1.2	15.0
Dissolution - Completion	0.5	8.2	1.0	3.7	1.4	3.3	1.5	4.3	0.7	11.7

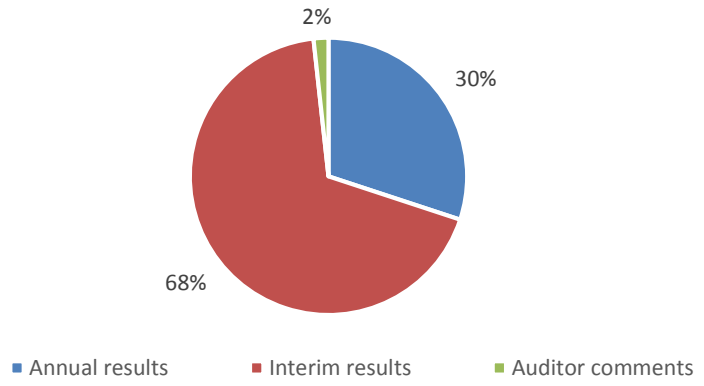
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)		
	Prior	Post	Average
Deregistration	0.32	0.22	0.23
Disposals - Initiation	0.27	1.26 *	0.19
Disposals - Completion	0.67	0.63	0.22
Disposals - Proceeds	0.44	0.67	0.18
Disposals - Termination	-0.85	-2.93	0.37
Dissolution	0.02	0.39	0.15
Dissolution - Completion	0.98	-0.59	0.66

** significant at 5% level*

Financial Reporting: No significant moves around company result announcements

Exhibit A. Announcements by sub-categories



Key Observations

- Movement is limited in relation to the average period; probably a reflection of the black-out period

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Annual results	0.3	24.1	0.3	24.0	0.2	35.6	0.3	30.9	0.6	20.5
Annual results - Adjustment	0.3	23.1	-0.1	-76.0	0.0	367.5	0.2	54.4	0.6	18.2
Auditor comments	0.1	72.5	0.0	-462.3	0.5	31.0	2.2	8.0	3.0	6.9
Interim results	0.0	214.	0.2	36.6	0.1	45.0	0.4	23.3	0.6	19.5
Interim results - Adjustment	0.2	6.5	-0.6	-4.1	0.3	10.4	1.3	3.7	2.8	2.5

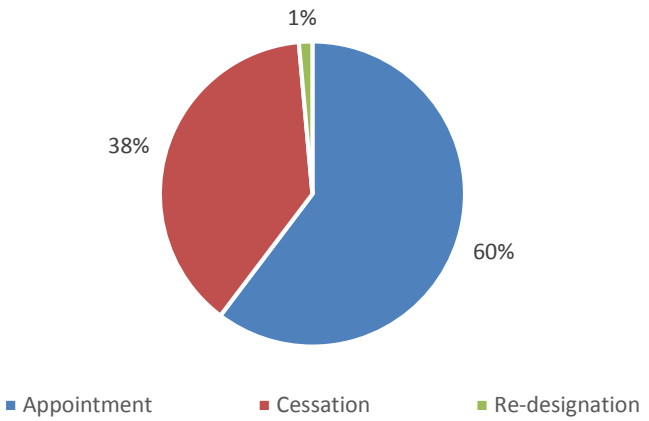
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)		
	Prior	Post	Average
Annual results	0.31	0.52	0.17
Annual results - Adjustment	-0.14	0.62	0.35
Auditor comments	-0.01	0.01	0.60
Interim results	0.17	0.28	0.14
Interim results - Adjustment	-0.59	0.73	0.10

** significant at 5% level*

Management Update: Business as usual with management changes

Exhibit A. Announcements by sub-categories



Key Observations

- At an overall level, news of appointments or cessation of the management team appears to have a limited impact pre or post the announcement

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Appointment	0.2	28.5	0.4	29.8	0.6	19.9	1.0	15.1	1.1	14.4
Cessation	0.1	55.3	0.3	35.7	0.5	21.9	1.1	13.6	1.2	14.2
Re-designation	0.3	14.4	0.3	25.9	0.3	24.2	0.5	19.3	0.7	14.0

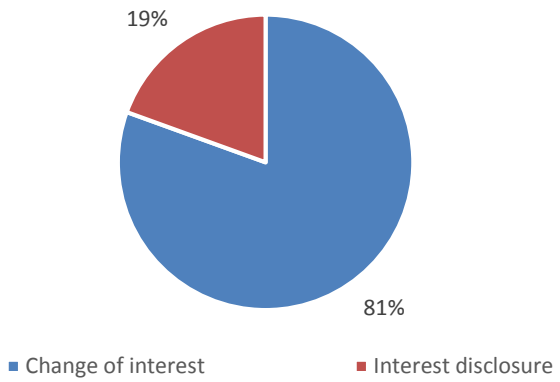
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)		
	Prior	Post	Average
Appointment	0.31	0.17	0.22
Cessation	0.24	0.28	0.22
Re-designation	0.28	-0.06	0.24

** significant at 5% level*

Ownership Interest: Prior movements on any announcement seem significant

Exhibit A. Announcements by sub-categories



Key Observations

- Any disclosure relating to Change of interest or even presence of interest (likely new purchases) are preceded by a strong positive move
- The strong pre move is probably driven by the deal itself with a pick-up in trade volumes and demand for the stock
- This is probably also reiterated with a lower post period performance in line with an average comparable period

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Change of interest	0.3	22.3	0.6	15.2	0.7	14.3	1.1	12.0	1.3	11.4
Change of interest - Completion	20.3	1.4	-4.4	-2.3	13.0	2.6	NM	-1.1	NM	-1.0
Interest disclosure	0.5	14.5	0.9	10.6	1.1	10.9	1.6	9.8	2.1	8.3

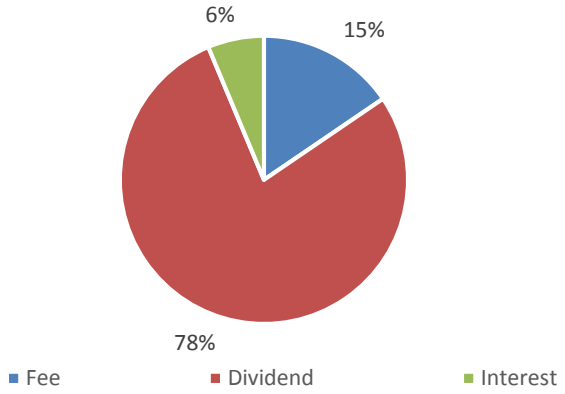
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)				
	Prior	Post		Average	
Change of interest	0.68	0.39	*	0.21	*
Change of interest - Completion	-4.42	-4.77		0.60	
Interest disclosure	0.62	0.31	*	0.24	*

** significant at 5% level*

Payments: Stocks rally ahead of dividend announcements

Exhibit A. Announcements by sub-categories



Key Observations

- Not surprisingly, we observe that stocks hold a positive rally significantly above average levels prior to dividend declaration
- Trend turns even stronger post the announcement
- Since funds and investors typically accumulate dividend paying stocks ahead of a declaration and since they are also declared over a consistent time frame, we see this more as a result of investor action rather than any instance of manipulation

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Fee	0.0	-160.8	0.1	21.7	0.1	28.5	0.0	NM	0.1	85.8
Dividends	0.2	14.9	0.3	11.3	0.3	13.7	0.3	13.5	0.4	12.9
Interest	0.0	-68.3	-0.1	-37.0	0.0	20.3	-0.2	-12.0	0.1	36.2

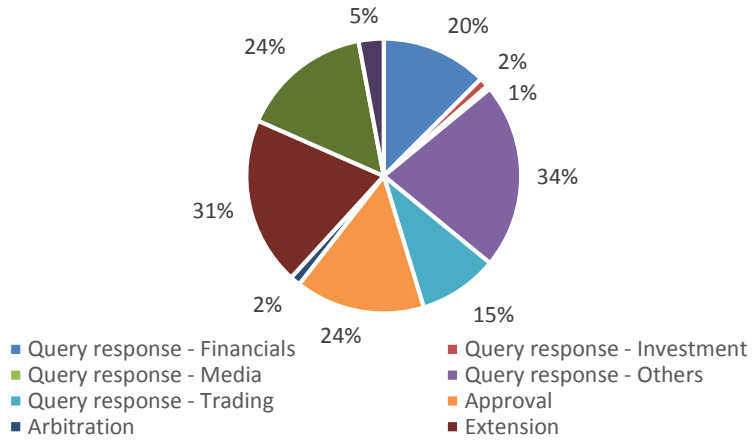
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)				
	Prior	Post		Average	
Fee	0.09	-0.08		0.03	
Dividends	0.27	0.66	*	0.06	*
Interest	-0.05	0.06		-0.07	

** significant at 5% level*

Regulatory: Legal action and responses to non-standard queries have a pre-announcement rally

Exhibit A. Announcements by sub-categories



Key Observations

- Markets tend to pick up before an impending announcement on any legal action associated with the company early. Pre and post period returns are significantly higher than normal times
- Among responses to queries raised by SGX, the standard queries seem insignificant, while those relating to abnormal trades or any other unique/one-off queries seem to be priced early

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

	1-day		2-days		3-days		5-days		7-days	
Sub-Categories	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Query response - Financials	0.0	-176.9	-0.2	-42.3	-0.2	-35.6	-0.3	-27.7	0.0	605.2
Query response - Investment	3.9	8.0	4.4	7.4	4.9	6.5	6.6	4.8	7.1	5.6
Query response - Media	-0.8	-3.7	-0.9	-5.4	-0.7	-6.4	-0.1	-94.8	0.4	22.4
Query response - Others	0.7	14.7	1.3	9.6	1.4	10.3	2.4	7.6	2.9	7.1
Query response - Trading	5.6	3.7	7.3	3.4	7.9	3.2	9.9	2.8	10.5	3.0
Approval	0.5	17.7	0.7	13.8	0.7	12.7	1.4	10.6	1.6	11.4
Arbitration	0.5	12.5	1.3	4.5	0.2	39.9	0.7	9.7	0.2	37.8
Extension	0.1	109.9	0.3	31.1	0.1	78.9	1.0	18.2	1.3	15.0
Legal	2.4	7.2	4.1	4.9	3.8	5.5	4.9	4.8	6.0	4.7
Settlement	0.2	52.6	1.4	10.6	1.4	9.7	2.1	8.1	3.2	5.4

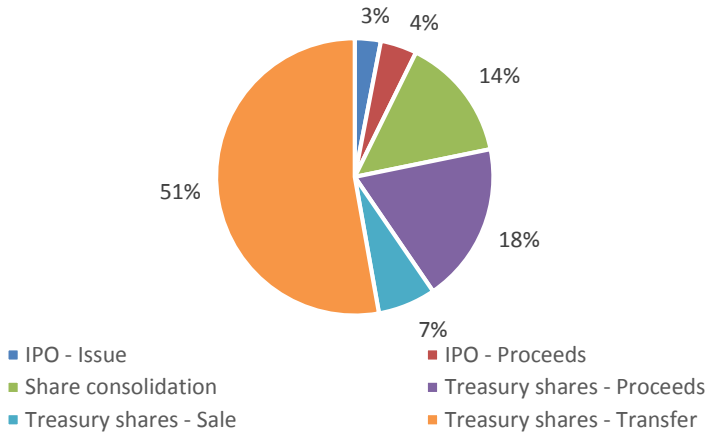
Exhibit C. Comparison of relative return around announcements

	Cum. 2-day avg. rel. returns (in %)			
Sub-Categories	Prior	Post	Average	
Query response - Financials	-0.14	0.12	0.19	
Query response - Investment	4.33	2.01	0.55	
Query response - Media	-0.87	0.02	0.13	
Query response - Others	1.30	0.85	0.22	*
Query response - Trading	1.91	2.17	0.28	*
Approval	0.73	0.53	0.26	
Arbitration	1.26	0.50	0.22	
Extension	0.30	-0.12	0.30	
Legal	4.10	5.06	0.33	*
Settlement	1.43	0.32	0.73	

** significant at 5% level*

Share Capital: Share Consolidation and Use of Treasury Shares significant pre-announcement movers

Exhibit A. Announcements by sub-categories



Key Observations

- Share Consolidation announcements seem to have a significant positive pre-announcement run. Post the announcement, returns tend to be significantly negative
- A similar significant prior period run is also observed among announcements relating to Use of Treasury Shares

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
IPO - Issue	0.0	-76.3	-0.2	-12.6	-0.2	-10.8	-0.2	-28.4	-0.3	-18.7
IPO - Proceeds	-0.1	-38.0	0.2	21.1	0.0	-127.6	-0.2	-41.7	-0.3	-25.4
Share Consolidation	1.2	15.2	2.2	11.5	2.1	12.5	3.1	10.3	3.4	9.4
Share Consolidation -	-0.5	-11.6	-0.2	-69.6	2.1	19.3	4.2	11.0	4.0	12.1
Share pledge	0.0	-76.5	-0.7	-11.6	0.1	84.3	-0.8	-10.7	0.2	32.7
Treasury shares - Proceeds	0.0	34.9	0.1	15.9	0.1	18.9	0.0	70.5	0.1	47.2
Treasury shares - Sale	0.0	32.0	0.0	-62.9	0.1	12.9	0.3	6.2	0.4	5.5
Treasury shares - Termination	0.9	4.0	0.3	18.0	0.2	19.9	0.8	5.5	2.1	4.3
Treasury shares - Transfer	0.1	29.7	0.1	21.7	0.1	19.2	0.1	23.1	0.1	42.0

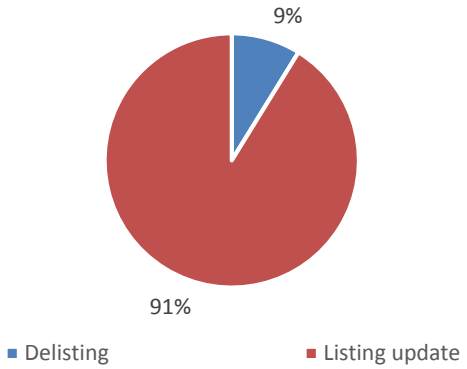
Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns				
	Prior	Post		Average	
IPO - Issue	-0.21	-0.14		0.04	
IPO - Proceeds	0.19	-0.33		0.04	
Share Consolidation	2.27	-0.41	*	0.34	*
Share Consolidation - Completion	-0.20	0.70		0.40	
Share pledge	-0.72	1.22		0.06	
Treasury shares - Proceeds	0.07	-0.11	*	-0.01	*
Treasury shares - Sale	-0.02	-0.07		0.02	
Treasury shares - Termination	0.25	1.52		0.06	
Treasury shares - Transfer	0.09	-0.05	*	0.01	*

** significant at 5% level*

Trading: Listing related updates exhibit a significant rally prior to an official release

Exhibit A. Announcements by sub-categories



Key Observations

- Listing Updates account for the bulk of the announcements under this category and tend to be a significant pre-announcement mover
- Typically these tend to be official announcements pertaining to application for listing while the intent is widely circulated ahead of announcement, thereby possibly leading to a pre-release rally

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Categories	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Delisting	0.4	15.4	0.7	10.7	0.5	18.4	0.7	14.3	1.3	10.2
Delisting - Completion	0.2	1.1	0.2	7.9	0.7	3.4	1.0	3.4	0.8	3.1
Listing Update	0.7	14.8	1.4	10.0	0.9	12.4	2.7	7.2	3.3	6.7

Exhibit C. Comparison of relative return around announcements

Sub-Categories	Cum. 2-day avg. rel. returns (in %)			
	Prior	Post	Average	
Delisting	0.71	-0.47	0.16	
Delisting - Completion	0.23	0.39	0.36	
Listing Update	1.42	1.60	0.32	*

** significant at 5% level*

6. Analyzing Sectors and Sub-Sectors

Before analysing trends exhibited by sub-categories of announcements in greater depth, we replicate the analysis done thus far with sectors and sub-sectors to understand whether they offer any additional insight that might also require further investigation. Accordingly, we extend running the descriptive statistics, coefficient of variation analysis and hypothesis test for comparable means – prior period returns versus post period and average comparable period returns at the sector and sub-sector level.

The figure below presents the heat map of average daily relative returns around announcements by sectors. As with categories, we observe a strong positive prior period trend prior to the announcement day with the peaking of returns happening on the day of announcement.

Figure 10. Heat-map of avg. daily relative returns around announcements by sectors

Average rel. returns (in %)	0.1	0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.2	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0
Broad sectors	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Consumer Discretionary	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.4	0.2	0.0	0.0	-0.1	0.0	-0.1	0.0	-0.1	0.0	0.0
Consumer Staples	0.2	0.3	0.1	0.1	0.0	0.2	0.2	0.1	0.1	0.2	0.3	0.1	0.1	0.0	0.2	0.2	0.0	0.0	0.1	0.1	0.0
Energy	0.1	0.1	0.3	0.0	0.0	0.0	0.2	0.2	0.1	0.3	0.3	0.1	0.1	0.0	0.0	-0.2	-0.1	0.2	0.2	-0.2	0.0
Financials	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.3	0.4	0.3	0.2	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0
Health Care	0.1	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.2	0.4	0.2	0.0	-0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0
Industrials	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Information Technology	0.2	0.0	0.1	0.2	0.2	0.2	0.3	0.1	0.2	0.2	0.5	0.3	0.0	0.0	-0.1	0.0	0.0	0.0	0.2	0.2	0.0
Materials	0.2	0.2	0.5	0.4	0.3	0.1	0.2	0.2	0.4	0.4	0.6	0.3	0.0	0.4	-0.1	0.1	0.2	0.1	0.1	0.1	0.0
Real Estate	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
Telecommunication Services	0.2	0.2	0.7	0.4	0.5	0.2	0.5	0.6	0.1	1.0	0.4	0.6	-0.2	0.3	0.0	0.1	0.3	0.1	-0.1	1.0	0.0
Utilities	0.2	0.0	0.0	0.2	0.0	-0.1	0.1	0.0	0.2	0.0	0.4	0.2	0.1	0.2	0.2	0.1	-0.2	-0.2	0.2	0.0	0.1

Source: *SGX, Bloomberg Finance LP*

This trend is reiterated in the coefficient of variation analysis where the prior period returns are positive across time horizons and sectors as shown in Table 8. Among the sectors, Telecommunication and Materials appear to have the strongest positive prior period move with the lowest coefficient of variation.

Table 8: Average and Variation in relative returns across time horizons by sectors

Announcement Categories	Prior period cumulative relative returns (in %) across time periods														
	1-day			2-days			3-days			5-days			7-days		
	Avg.	Std.	C.V	Avg.	Std.	C.V	Avg.	Std.	C.V	Avg.	Std.	C.V	Avg.	Std.	C.V
Consumer Discretionary	0.3	7.9	29.3	0.5	9.7	20.1	0.7	11.2	16.7	1.0	13.4	13.7	1.3	16.1	12.2
Consumer Staples	0.3	5.6	21.7	0.4	7.0	17.6	0.5	8.2	16.7	0.9	11.5	13.4	1.0	12.4	12.8
Energy	0.3	9.0	27.2	0.7	11.1	16.9	0.9	12.9	15.1	1.2	17.2	14.0	1.3	19.6	14.7
Financials	0.2	7.5	35.8	0.5	11.8	23.7	0.5	12.8	23.4	0.7	13.7	19.5	0.8	16.1	20.2
Health Care	0.2	3.0	15.1	0.3	4.0	12.1	0.3	4.5	13.1	0.4	6.7	15.2	0.5	8.0	15.2
Industrials	0.3	6.4	23.0	0.5	8.7	17.6	0.6	9.5	16.4	1.2	13.5	11.6	1.4	14.8	10.6
Information Technology	0.3	6.8	22.2	0.5	8.6	16.9	0.6	10.6	16.3	1.3	15.8	12.2	1.7	17.2	9.9
Materials	0.4	9.9	22.8	0.9	12.2	13.9	1.2	14.0	12.0	1.7	18.7	11.2	2.4	22.2	9.3
Real Estate	0.1	3.3	32.7	0.2	4.4	20.2	0.3	5.2	20.1	0.4	6.5	17.0	0.4	7.3	17.7
Telecommunication	1.0	9.3	9.1	1.3	10.9	8.7	1.8	12.8	7.1	2.5	14.9	5.9	3.7	18.7	5.0
Utilities	0.0	5.0	NM	0.3	5.9	18.6	0.3	6.5	21.4	0.2	8.4	42.3	0.7	9.4	14.4

Table 9: Comparison of relative return around announcements by sectors

Announcement Categories	Cumulative 2-day average relative returns (in %)		
	Prior-period	Post-period	Average period
Consumer Discretionary	0.60	0.67	0.13 *
Consumer Staples	0.38	0.43	0.15 *
Energy	0.68	0.49	0.33 *
Financials	0.45	0.44	0.08 *
Health Care	0.35	0.56 *	0.11 *
Industrials	0.51	0.46	0.16 *
Information Technology	0.56	0.93 *	0.24 *
Materials	0.95	1.00	0.68 *
Real Estate	0.26	0.30	0.08 *
Telecommunication	1.25	1.15	0.70 *
Utilities	0.28	0.58	0.21

** significant at 5% level*

The results for hypothesis test in Table 9 suggest that ***apart from Utilities, all the sectors enjoy a significantly positive return prior to announcements versus an average comparable period*** and the trend is found to typically turn stronger post the announcement.

In line with the strong positive prior period move across sectors, we observe the average daily standardised volumes to also be consistently above average levels across sectors. As with returns, volume pick-up is also strong across sectors post the announcement as exhibited in Table 10.

Table 10: Comparison of trade volume around announcements by sectors

	Cumulative 2-day average standardised volume (in standard deviation terms)		
Announcement Categories	**Prior-period**	**Post-period**	**Average period**
Consumer Discretionary	0.15	0.30 *	-0.01 *
Consumer Staples	0.18	0.30 *	-0.01 *
Energy	0.13	0.28 *	-0.01 *
Financials	0.13	0.18 *	-0.01 *
Health Care	0.10	0.21 *	0.00 *
Industrials	0.12	0.25 *	-0.01 *
Information Technology	0.11	0.29 *	-0.01 *
Materials	0.18	0.32 *	-0.01 *
Real Estate	0.13	0.25 *	0.00 *
Telecommunication	0.15	0.24 *	0.01 *
Utilities	0.17	0.20	-0.01 *

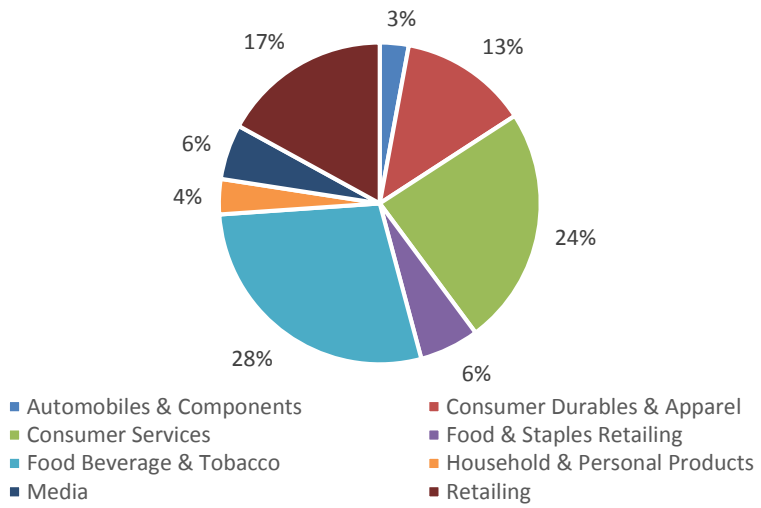
** significant at 5% level*

Given the homogenous trend across sectors, we seek to drill down using a sub-sector level analysis. For easy reference, we present the one-pagers by four broader sector groups after combining related sectors, given the limited number of sub-sectors under each sector.

As observed in the one-pagers, trends are fairly consistent across sub-sectors with few exceptions. Food & Beverage and Media among Consumer sectors, Insurance among Financials, Software & Services among Technology and Utilities are the key sub-sectors with a prior period performance in line with the average comparable period. All other sub-sectors show a stronger prior period performance and the trend broadly continues post the announcement.

Consumer: Food & Beverage and Media the only exception

Exhibit A. Announcements by sub-sectors



Key Observations

- The trend is broadly homogeneous across sub-sectors with Food, Beverage & Tobacco and Media being the only exceptions where prior period returns are not significantly higher than the average comparable period
- Strongest prior period returns are observed among Automobiles & Components and Household & Personal Products

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Sectors	1-day		2-days		3-days		5-days		7-days	
	Avg	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Automobiles & Components	0.2	18.3	2.2	3.6	2.1	3.9	2.7	3.7	2.3	4.7
Consumer Durables & Apparel	0.6	18.4	0.8	17.3	1.4	11.3	1.6	10.7	1.9	10.7
Consumer Services	0.0	NM	0.2	36.6	0.4	25.3	0.7	17.1	1.1	13.4
Food & Staples Retailing	0.1	16.8	0.2	19.0	0.2	23.6	0.5	9.2	0.5	11.5
Food Beverage & Tobacco	0.2	23.8	0.3	21.3	0.4	20.5	0.7	16.5	0.8	16.0
Household & Personal Products	0.8	12.9	1.6	8.3	2.0	7.2	3.0	6.6	3.5	5.5
Media	0.2	22.5	0.2	29.1	0.4	17.4	0.8	10.5	1.1	8.4
Retailing	0.4	23.2	0.5	22.7	0.5	25.7	0.7	19.7	1.1	15.4

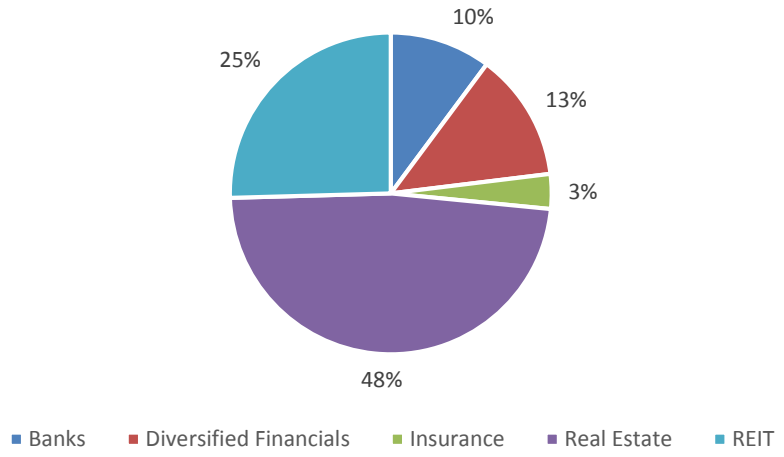
Exhibit C. Comparison of relative return around announcements

Sub-Sectors	Cum. 2-day avg. rel. ret. (in %)				
	Prior	Post		Average	
Automobiles & Components	2.31	0.99	*	0.18	*
Consumer Durables & Apparel	0.93	0.56		0.14	*
Consumer Services	0.35	0.73	*	0.13	*
Food & Staples Retailing	0.25	0.30		0.04	*
Food Beverage & Tobacco	0.24	0.38		0.14	
Household & Personal Products	1.66	1.03		0.40	*
Media	0.30	0.32		0.13	
Retailing	0.50	0.71		0.10	*

** significant at 5% level*

Financial: Except Insurance, all sub-sectors exhibit a significantly higher prior period return

Exhibit A. Announcements by sub-sectors



Key Observations

- Insurance sub-sector serves as the only exception where prior period returns appear to be in line with the average comparable period performance
- Across all other sub-sectors, we observe prior period returns to be significantly positive and higher than an average comparable period

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Sectors	1-day		2-days		3-days		5-days		7-days	
	Avg	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V	Avg.	C.V
Banks	0.0	23.8	0.1	16.8	0.1	16.4	0.0	66.1	0.1	38.5
Diversified Financials	0.4	28.5	0.9	18.5	0.9	18.6	1.3	14.9	1.4	15.7
Insurance	0.1	28.3	0.1	45.9	0.1	31.4	0.3	14.0	0.3	14.8
Real Estate	2.1	33.6	2.0	21.2	2.3	20.0	2.4	17.1	2.4	17.4
REIT	0.1	18.3	0.2	3.6	0.2	3.9	0.3	3.7	0.2	4.7

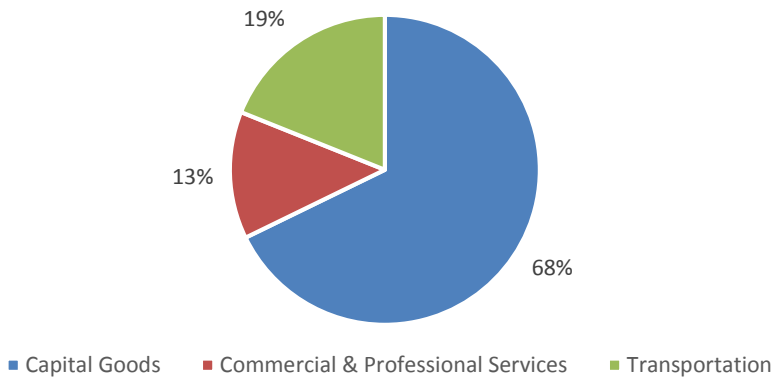
Exhibit C. Comparison of relative return around announcements

Sub-Sectors	Cum. 2-day avg. rel. returns (in %)				
	Prior	Post		Average	
Banks	0.09	-0.04	*	0.01	*
Diversified Financials	0.80	0.83		0.12	*
Insurance	0.11	0.30		0.11	
Real Estate	2.04	-0.24		0.03	*
REIT	0.26	0.30		0.08	*

** significant at 5% level*

Industrials: All sub-sectors have higher prior period return

Exhibit A. Announcements by sub-sectors



Key Observations

- The trend is homogeneous across all sub-categories

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Sectors	1-day		2-days		3-days		5-days		7-days	
	Avg	C.V	Avg.	C.V	Avg	C.V	Avg.	C.V	Avg.	C.V
Capital Goods	0.2	26.0	0.4	19.4	0.5	17.5	1.0	11.9	1.3	NM
Commercial & Professional Services	0.8	12.8	1.0	12.5	1.1	12.1	2.7	8.5	2.9	7.8
Transportation	0.1	44.0	0.3	16.3	0.4	16.6	0.6	13.7	0.7	12.8

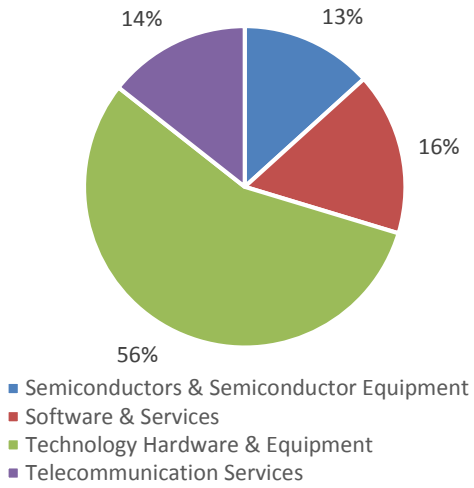
Exhibit C. Comparison of relative return around announcements

Sub-Sectors	Cum. 2-day avg. rel. ret. (in %)				
	Prior	Post		Average	
Capital Goods	0.41	0.41		0.10	*
Comm. & Professional Services	1.24	1.15		0.57	*
Transportation	0.36	0.15	*	0.06	*

** significant at 5% level*

TMT: All sub-sectors exhibit significantly higher prior period except Software & Services

Exhibit A. Announcements by sub-sectors



Key Observations

- All other sub-sectors exhibit significantly higher prior period returns
- Software & Services seems to be an exception where prior period returns are in line with average period returns

Exhibit B. Average and variation in prior-period relative returns (in %) across cumulative holding periods

Sub-Sectors	1-day		2-days		3-days		5-days		7-days	
	Avg.	C.V	Avg.	C.V	Avg	C.V	Avg.	C.V	Avg.	C.V
Semiconductors & Semiconductor	0.4	12.5	0.8	8.0	0.9	8.1	1.3	7.2	1.5	6.4
Software & Services	0.1	78.9	0.3	33.6	0.7	16.1	1.2	12.6	2.0	9.1
Technology Hardware & Equipment	0.4	20.0	0.5	17.1	0.6	18.9	1.3	12.9	1.7	10.7
Telecommunication Services	1.0	9.1	1.3	8.7	1.8	7.1	2.5	5.9	3.7	5.0

Exhibit C. Comparison of relative return around announcements

Sub-Sectors	Cum. 2-day avg. rel. returns				
	Prior	Post		Average	
Semiconductors & Semiconductor	0.75	0.56		0.18	*
Software & Services	0.39	0.78		0.37	
Technology Hardware & Equipment	0.56	1.06	*	0.22	*
Telecommunication Services	1.25	1.15		0.70	*

** significant at 5% level*

7. Validation Study

Given that certain categories and sub-categories have evoked interest and given that most sub-sectors have shown significant positive prior period returns, we look to corroborate the same by running a validation study.

Defining the Potential Manipulated Universe

In the previous sections, we attempted to understand the prior period and post period performance vis-à-vis an average comparable period, group by group and then looked to drill down deeper at the sub-group level. In effect, we specified characteristics such as announcement categories or sectors and then looked to gauge the presence of manipulation by observing certain parameters such as returns and trade volumes.

With validation study, we seek to do the reverse. We fix parameters at a global level, sort announcements by these parameters, carve out the subset that carries parameter value(s) beyond a certain threshold and then look to study the characteristics of the subset. In other words, the identified subset will serve as our universe of potential manipulation cases and we aim to understand its properties.

We hypothesise that if some of the strong trends seen in the prior analysis among certain announcement (sub-)categories and (sub-)sectors are indeed true and representative of market manipulation, we should then have a greater representation of these categories and sectors among the chosen subset of potential manipulated universe.

More formally, based on our prior analysis, we start with the following expectations about the potential manipulated universe:

1. Ownership Interest, Regulatory and Trading announcement categories to have a greater than proportional representation

2. At the sub-category level, we expect a similar higher-than-expected representation among the following:
    a. Acquisitions – New Business related announcements
    b. Regulatory – Legal Action, Response to non-standard queries from SGX
    c. Share Capital – Share Consolidation and Use of Treasury Shares
    d. Trading – Listing Updates
3. With the performance being contrary to expectations, we do not expect the potential manipulated universe to carry a greater-than-expected representation of the following sub-categories:
    a. Acquisition – Merger initiation
    b. Business Update – Impairment
4. Among the sectors, given the homogeneous performance of all sectors, we do not expect any specific sector(s) to have a greater representation among the potential manipulated universe

To test these hypotheses, we look at the following metrics to identify potential manipulated cases:

1. Prior period returns proportional to average comparable period returns
2. Prior period standardised trade volumes proportional to average comparable standardised trade volumes
3. Strength of trend (positive versus negative return days) during an observed study period

While exploring returns, given that all return forms[24] have produced similar results and conclusion, we restrict our analysis to relative return measures. This is also in line with the approach suggested by academic literature.

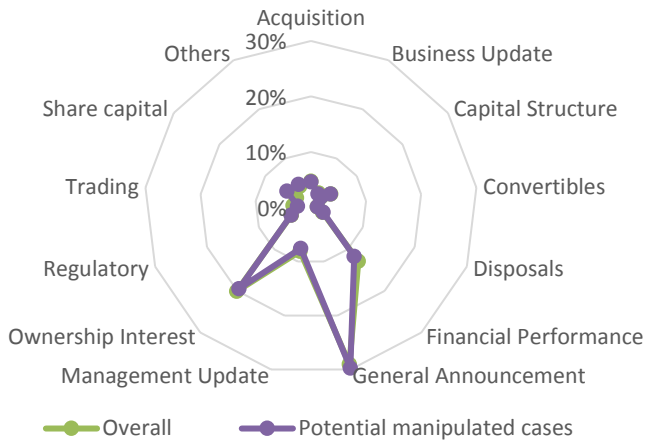
We run this analysis across our standard set of cumulative time horizons[25]. Of this, given that the broad pick-up in performance seems to occur around two

[24] *Absolute returns, Relative returns and Beta-adjusted returns*

days prior to announcement date, we consider cumulative two-day returns to be our primary case of analysis for observing the first two metrics – proportional returns and proportional standardised trade volumes. For the third metric, to measure the strength of price trend, we observe the proportion of days with a positive move netted against those days with a negative move. We run this observation over a five-day and a 10-day period.

Here, we also make a distinction between two sets of measures – Simple and Restricted. Under Simple measure, we look only at the first metric, prior period returns proportional to average comparable period returns. We define an alternate metric, Restricted measure, where all three metrics are considered and their values averaged.

Figure 11. Category representation across the potential manipulated set (Simple measure) and the overall universe



Source: *SGX, Bloomberg Finance LP*

Once we compute Simple and Restricted metrics across all announcements, we sort them by both the metric types and identify the top quartile of such announcements based on metric values. This in effect represents our potential manipulated universe as they have moved the strongest prior to announcements in relation to an average comparable period.

[25] *1-day, 2-days, 3-days, 5-days and 7-days*

No evidence corroboration among announcement (sub-)categories; Share Capital related announcements the only exception

Figure 11 shows the proportion of each announcement category in the overall universe as against the potential manipulated universe. We expected a higher representation of Ownership Interest, Regulatory and Trading announcements in the potential manipulated universe based on results from earlier analysis. However, the potential manipulated universe is remarkably consistent with the overall universe with hardly any visible deviation between representations of the two universes. We observe that Share Capital has a slightly higher representation in the potential manipulated universe (+2%) netted by a lower representation of Financial Performance (-1%) and Trading (-1%) related announcements.

The higher proportion of the Share Capital category is in line with our earlier analysis where the prior return of the category was found to be significantly higher than an average comparable period on a lower base of average returns. However, we do not see a higher representation from other categories in the same league such as Ownership Interest, Regulatory and Trading announcements. Given the reduced demand prior to financial result announcements owing to black-out periods, we expect a lower representation of Financial Performance announcements in the potential manipulated universe. The results are thus well justified.

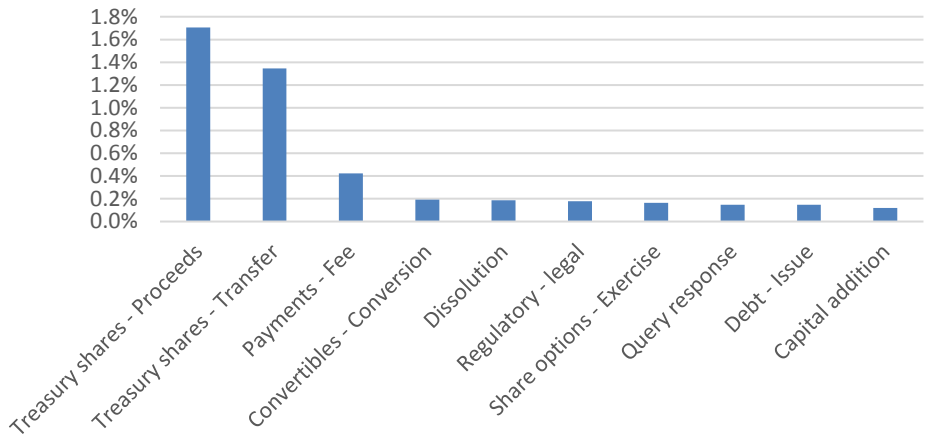
Overall, we thus see a very minimal variation between the two universes, leading us to believe that there is no concrete evidence to justify systematic manipulation in any of the categories.

Extending this to sub-categories, we observe that Treasury shares – Proceeds and Treasury shares - Transfer (both belonging to Share Capital category) have the highest level of excess representation, in line with expectations from the previous results. Although Transfers/Use of proceeds of treasury shares are

more customary and transactional in nature, they are typically done around a Share Buyback programme, leading to increased demand for the stock. This could possibly explain the strong prior performance of stocks prior to Treasury share- Usage announcements. Henceforth, we do not find evidence of any other sub-category having a greater representation in the potential manipulated universe.

Merger initiation (Acquisition category) and Impairment (Business update category) cases have a near equal representation in both the potential manipulated and overall universes. They essentially do not have a lower-than-expected representation in the potential manipulated universe, as was possibly hypothesised in the event of manipulation in these sub-categories of announcements. Overall, at a sub-category level, with the exception of the two Share Capital categories, we do not see any evidence of potential manipulation.

Figure 12. Excess contribution of sub-category of announcements in the potential manipulated universe vis-à-vis the overall universe

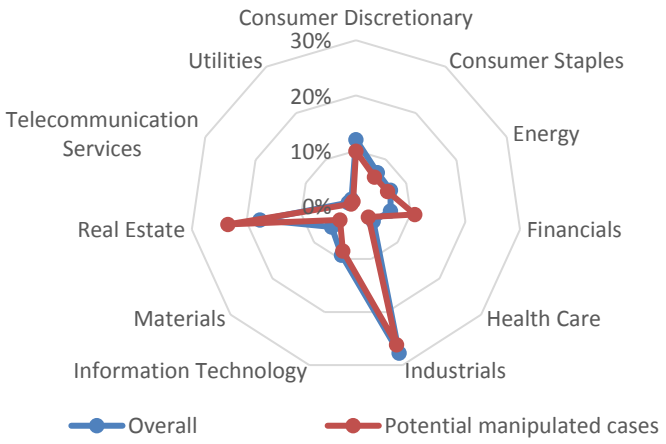


Source: *SGX, Bloomberg Finance LP*

Real Estate and Financials have a higher presence in the potential manipulated universe

We run through a similar analysis with sectors and sub-sectors. As expected, the representation of both universes is broadly in sync as per Figure 13.

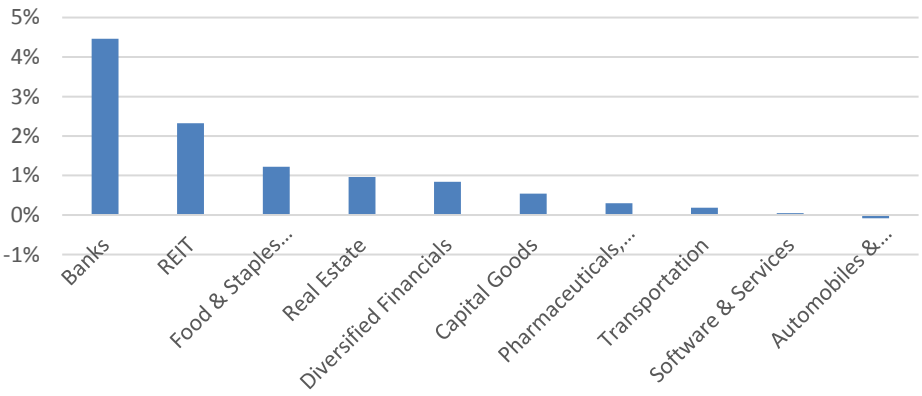
Figure 13. Sector representation across the potential manipulated set (Simple measure) and the overall universe



Source: *SGX, Bloomberg Finance LP*

However, Real Estate (+6%) and Financials (+4%) have a greater representation in the potential manipulated universe which is offset partially by most other sectors. This warrants further investigation.

Figure 14. Excess contribution of sub-sectors in the potential manipulated universe vis-à-vis the overall universe



Source: *SGX, Bloomberg Finance LP*

At a sub-sector level, we see that all sub-groups of Financials and Real Estate, barring Insurance, have among the highest excess representation in the potential manipulated universe, led by REITs. In fact, four of the top 5 excess contributors to the potential manipulated universe come from these two sectors. These findings[26] call for further investigation.

[26] *Replicating this analysis using the Restricted measure as well as running it across other variants of cumulative time horizons also provide a similar outcome and the results have not been presented here*

8. Analysis across Corporate Characteristics

We extend our study of potential manipulated universe to other stock characteristics beyond sector classification to evaluate if any of these cases provide more insights. In particular, we look to run through the validation study across the following groups: Market capitalization, Listing board and S-Chips representation.

We begin with a market-cap based analysis. The universe is split into seven broad market cap groups:

Table 11: Market Capitalisation categories

Name	Market Capitalisation range
Micro caps	<S$10 million
Small caps	S$10-S$50 million
Low mid-caps	S$50-S$100 million
Mid-caps	S$100million-S$1 billion
High mid-caps	S$1-S$5 billion
Large caps	S$5-S$10 billion
Mega caps	> S$10 billion

We compare the prior period performance of market cap groups against post period and average comparable periods. The comparison based on the two–day cumulative time frame is presented on Table 12

Table 12: Comparison of relative return around announcements by market capitalisation groups

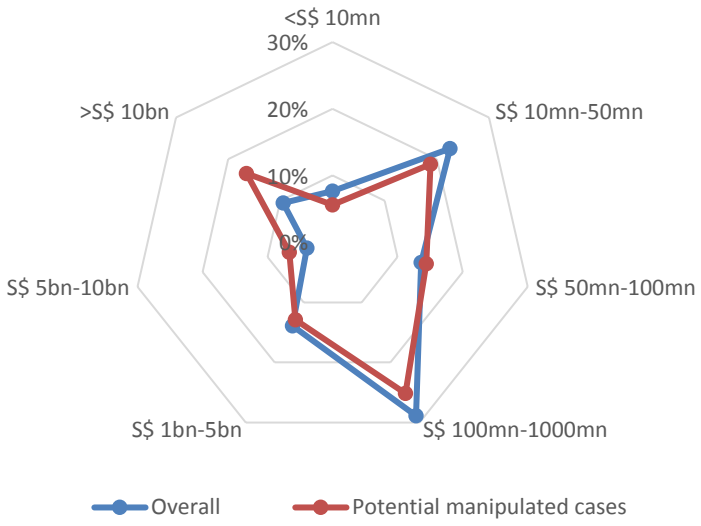
	Cumulative 2-day average relative returns (in %)		
Market-cap groups	**Prior-period**	**Post-period**	**Average period**
Micro caps	1.02	1.28	0.87
Small caps	0.92	0.88	0.28 *
Low mid-caps	0.79	0.77	0.32 *
Mid-caps	0.41	0.48	0.08 *
High mid-caps	0.10	0.13	0.03 *
Large caps	0.06	0.00	0.03
Mega caps	0.10	0.01 *	0.03 *

** significant at 5% level*

Across most market capitalisation groups, we observe the two-day prior period return to be significantly higher than the average return for a comparable period. Micro-caps and Large caps, although not emerging significant, also exhibit a pick-up in prior period returns versus an average comparable period. Apart from Large and Mega caps, we observe the returns staying elevated in the two-day period post the announcement.

Extending this analysis to the validation study, where we compare the representation across the overall and potential manipulated universes, we see that Large-caps and Mega caps, in particular, have a greater representation in the potential manipulated universe at the expense of small and mid-capitalisation categories as per Figure 15. This is counter-intuitive given that we would expect more manipulation among the smaller cap stocks. This again calls for a deeper dive.

Figure 15. Market capitalisation category representation across the potential manipulated set (Simple measure) and the overall universe



Source: *SGX, Bloomberg Finance LP*

Moving beyond market capitalisation, we look at categorisation of stocks by operational domicile – S-Chips and Non S-Chips.

Table 13: Comparison of relative return around announcements by operational domicile groups

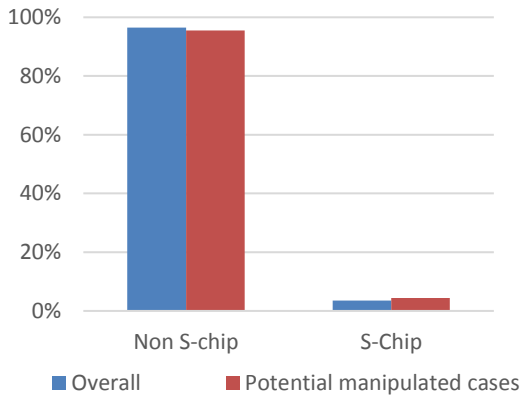
	Cumulative 2-day average relative returns (in %)			
Operational domicile groups	**Prior-period**	**Post-period**	**Average period**	
Non S-Chips	0.52	0.57	0.20	*
S-Chips	0.04	0.14	-0.05	

** significant at 5% level*

Interestingly, as per Table 13, only non-S-Chip stocks show significantly higher returns prior to announcement, while there is nothing much to distinguish the performance of S-Chips prior to announcement and during an average comparable period. This again is counter-intuitive. However, given that S-Chip names form quite a small set of the announcement universe (see Figure 16), it could be a case of a limited sample set here. In a comparison of representation

in overall universe versus potential manipulated cases, there is nothing much to distinguish between the two groups.

Figure 16. Operational domicile category representation across the potential manipulated set (Simple measure) and the overall universe



Source: *SGX, Bloomberg Finance LP*

We turn our attention next to the listing board of securities - Mainboard versus Catalist.

Table 14: Comparison of relative return around announcements by listing board groups

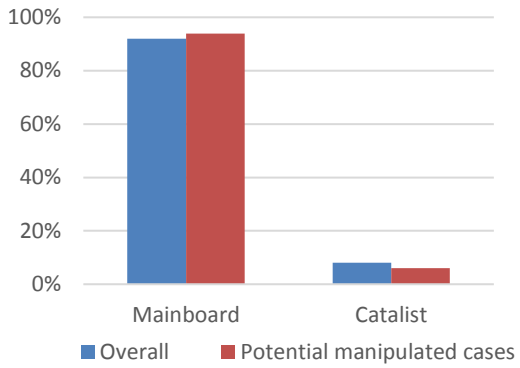
	Cumulative 2-day average relative returns (in %)		
Listing board groups	**Prior-period**	**Post-period**	**Average period**
Mainboard	-0.11	1.50	-0.02
Catalist	0.83	1.01	0.56

** significant at 5% level*

Both the listing board groups have a prior period performance not significantly different from an average comparable period as per Table 14, although Catalist-listed stocks seem to have, in general, a higher pre-announcement return. Interestingly, among Mainboard-listed stocks, we observe cumulative two-day prior period returns to be negative on an average but turning strongly positive post the announcement. We also do not see much of a distinction in

representation between the overall and the potential manipulated universe using validation analysis as per Figure 17.

Figure 17. Listing board category representation across the potential manipulated set (Simple measure) and the overall universe



Source: *SGX, Bloomberg Finance LP*

9. Robustness Check

We now evaluate if our findings from the previous validation study stay stable over a stressed environment. Specifically, we adopt the following two levels of stress test:

1. Running through validation study with standardised price performance[27] instead of actual price performance
2. Refining validation study with just the top decile of universe with the highest simple (and restricted) metric values

The first test helps to zero-in on specific stocks that have moved outside their usual trading range. In effect, those that have moved significantly higher in standardised terms. Such moves could more confidently be attributed to the announcements under consideration. The latter stress test is more a stringent measure of the potential manipulated universe, although we accept the probability of false positives could also be higher as we seek to put greater importance to outlier moves.

Figure 18 to 24 present the key exhibits from our validation study with standardised relative returns in place of actual relative returns in defining the Simple (and Restricted) measures. Under the more standardised setup, we observe Ownership Interest (+2%) to have the largest excess representation in the potential manipulated universe at the expense of Financial Results (-1%) related announcements. Share Capital that had the largest positive excess representation under actual relative returns appears to have disappeared once the returns are standardised. A higher presence of Ownership Interest is understandable given the pickup in demand and hence returns associated with a change in ownership. It is indeed the acceptable announcement effect and cannot be construed as manipulation. In effect, with a standardised measure

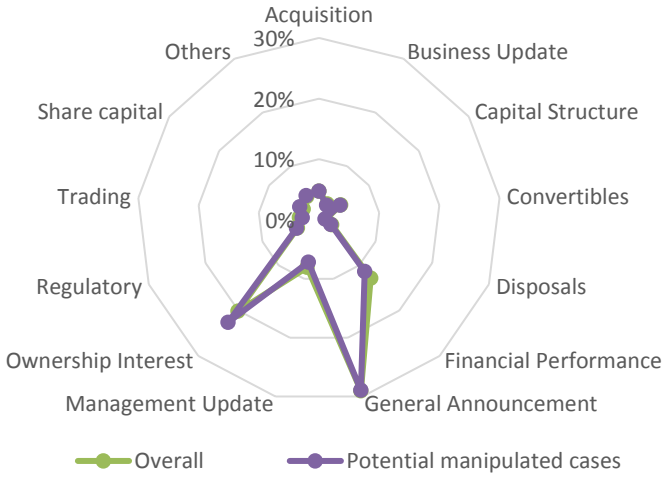
[27] *Under Simple metrics, instead of looking at prior period relative returns proportional to average relative returns, we now consider (prior period relative returns – Average relative returns)/standard deviation of relative returns*

even the limited evidence at the category level seems to have dissipated, lending confidence to our conclusion that systematic manipulation is absent at the category level. Sub-category level analysis also confirms this with Change of interest (+3%) being the only significant item of deviation from the overall universe. Treasury Shares – Transfer and Treasury Shares – Proceeds (both Share Capital category) carry only a marginally positive excess contribution in the potential manipulated universe under standardised setup.

At the sector level, Real Estate and Financials continue to have a stronger representation among the potential manipulated set compared to the overall universe, but the extent of excessive presence is far more curtailed. Sub-sector analysis also presents a similar finding.

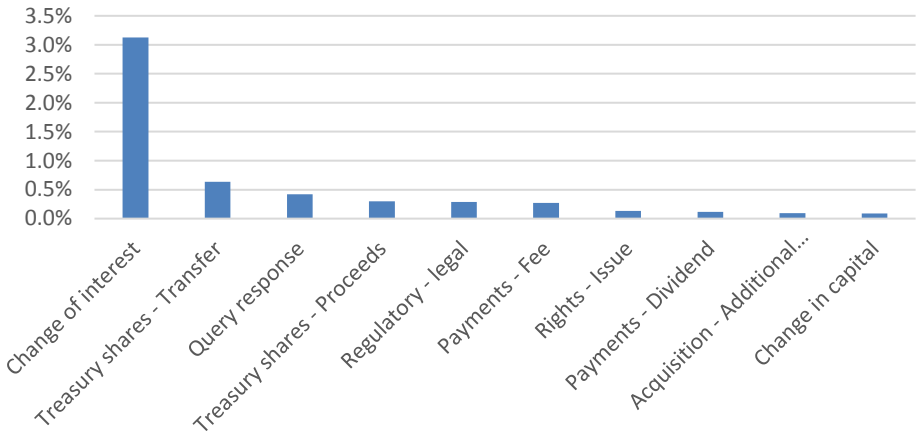
Among corporate characteristics - Market cap, Large cap and Mega cap stocks - continue to have a stronger presence in the potential manipulated universe, but their excess representation stands much reduced under standardised measures. There are no surprises with S-Chips and listing board characteristics, as all groups are equally represented in both the universes.

Figure 18. Category representation across the potential manipulated set (Simple measure) and the overall universe using standardised metrics



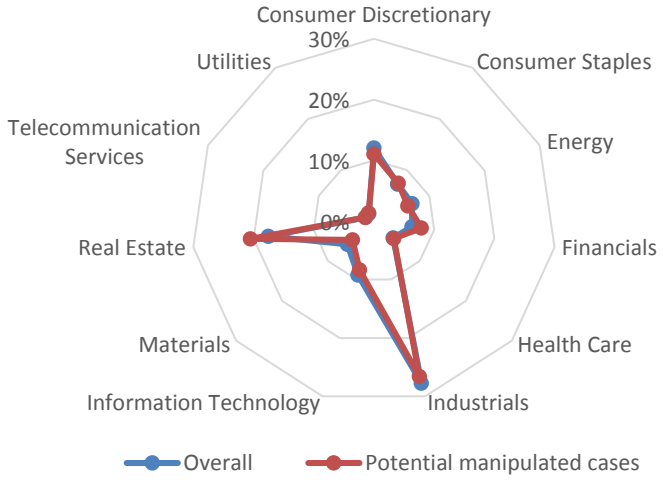
Source: *SGX, Bloomberg Finance LP*

Figure 19. Excess contribution of sub-category of announcements in the potential manipulated universe vis-à-vis the overall universe using standardised metrics



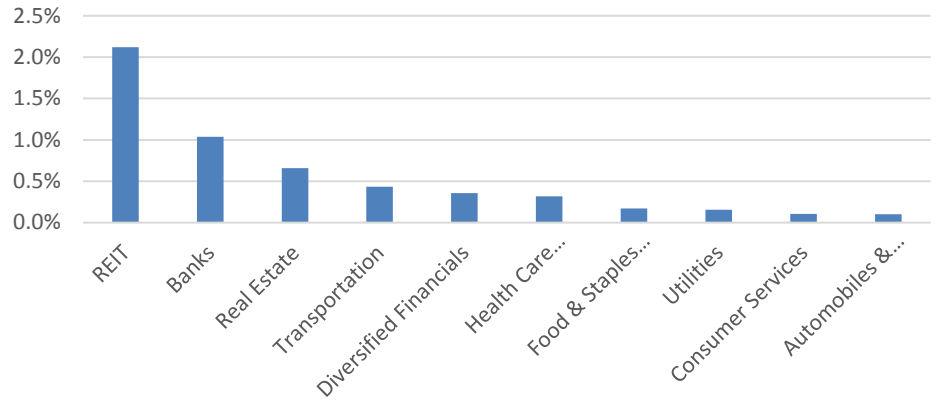
Source: *SGX, Bloomberg Finance LP*

Figure 20. Sector representation across the potential manipulated set (Simple measure) and the overall universe using standardised metrics



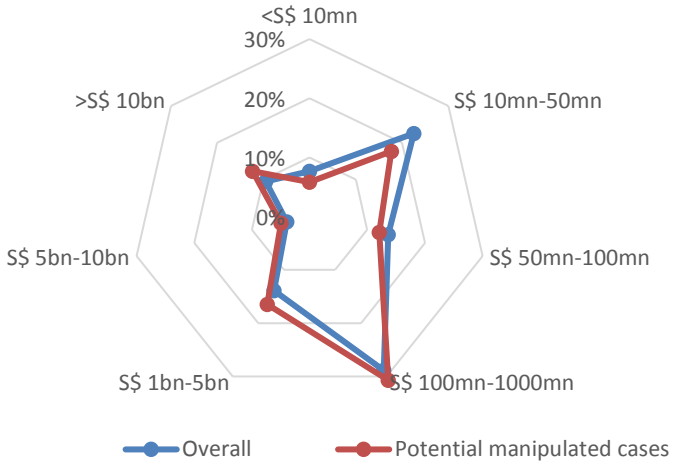
Source: *SGX, Bloomberg Finance LP*

Figure 21. Excess contribution of sub-sectors in the potential manipulated universe vis-à-vis the overall universe using standardised metrics



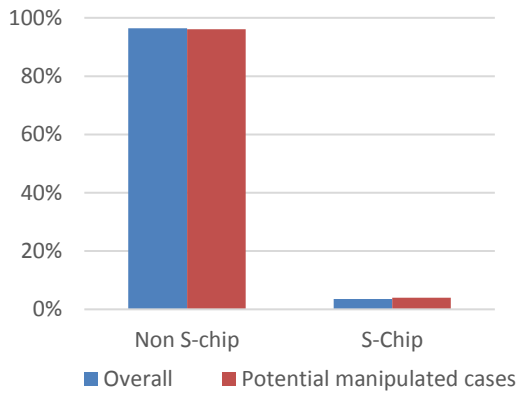
Source: *SGX, Bloomberg Finance LP*

Figure 22. Market cap category representation across the potential manipulated set (Simple measure) and the overall universe using standardised metrics



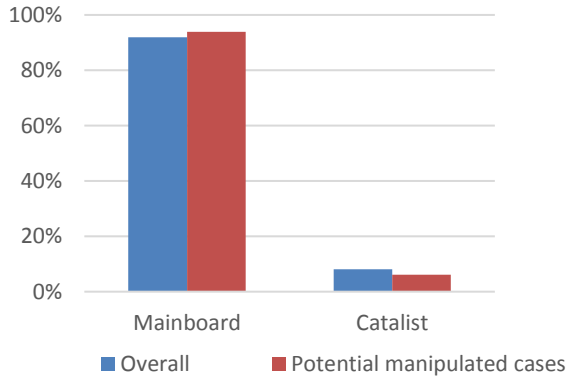
Source: *SGX, Bloomberg Finance LP*

Figure 23. Operational domicile representation across the potential manipulated set (Simple measure) and the overall universe using standardised metrics



Source: *SGX, Bloomberg Finance LP*

Figure 24. Listing board category representation across the potential manipulated set (Simple measure) and the overall universe using standardised metrics



Source: *SGX, Bloomberg Finance LP*

With the second robustness check (results on Figure 25 to 29), where we restrict our potential manipulated universe to announcements with the top decile of metric values, categories continue to remain fairly in line between the overall and potential manipulated universe. Among the sub-category of announcements, Acquisitions – New Business and Payments – Dividend groups tend to have a positive excess representation in the potential manipulated

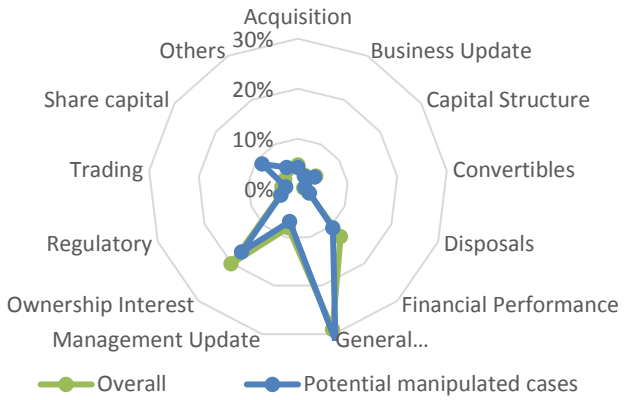
universe. However, given the smaller excess levels of limited sub-sectors in the potential manipulated universe, we can safely assume it to be an announcement specific issue and not be considered as a category or sub-category specific issue.

However, while extending the same analysis at the sector and the sub-sector level, we find that Financials (+12%) and Real Estate (+7%) have an even higher excess representation in the potential manipulated universe, offset other sectors. While the trend is fairly consistent with earlier versions of validation study, such a strong representation of these two sectors in the top decile space warrants additional analysis.

A very similar analysis is thrown up by the market capitalisation category comparison where Mega caps (+19%) corner a large proportion of excess representation in the potential manipulated universe at the expense of small and mid-cap groups.

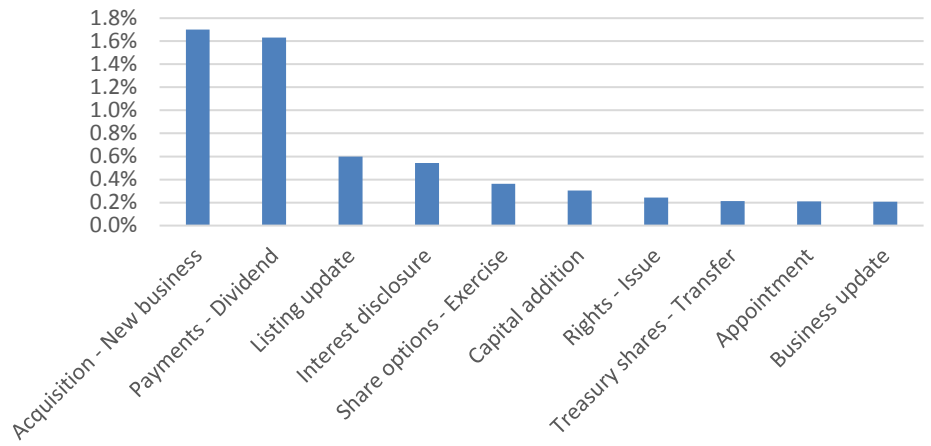
Groups belonging to operational domicile and listing board classification present a near equal representation across both the overall and potential manipulated universe with a stringent definition of potential manipulated cases, and hence have not been presented here.

Figure 25. Category representation across the potential manipulated set (Simple measure based on top decile values) and the overall universe



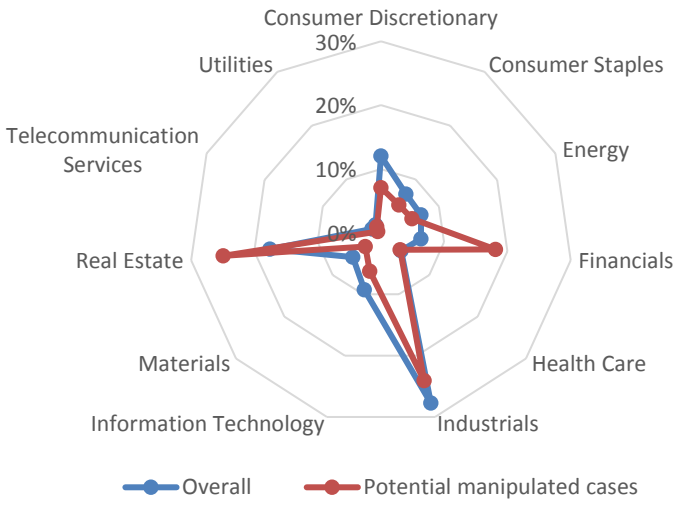
Source: *SGX, Bloomberg Finance LP*

Figure 26. Excess contribution of sub-category of announcements (simple measure based on top decile values) in the potential manipulated universe vis-à-vis the overall universe



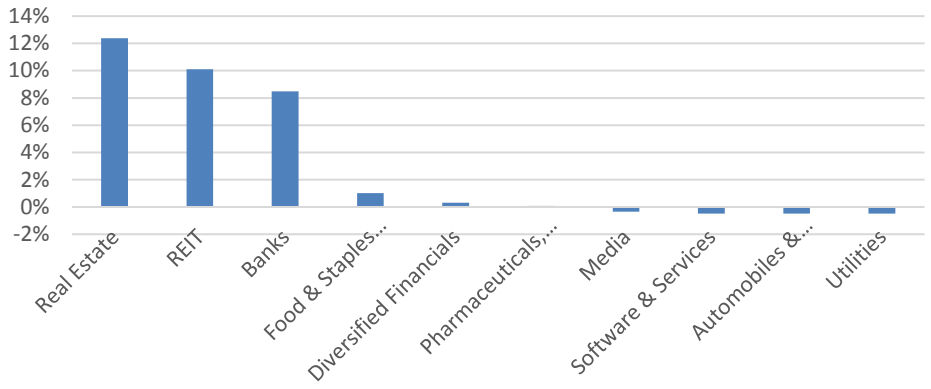
Source: *SGX, Bloomberg Finance LP*

Figure 27. Sector representation across the potential manipulated set (Simple measure based on top decile values) and the overall universe using standardised metrics



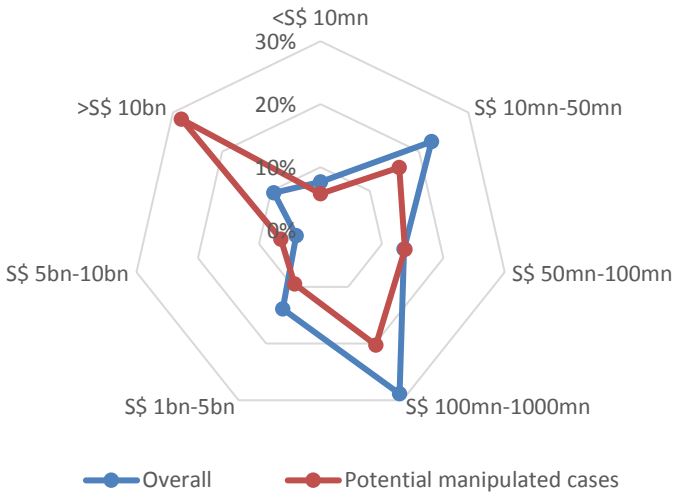
Source: *SGX, Bloomberg Finance LP*

Figure 28. Excess contribution of sub-sectors (Simple measure based on top decile values) in the potential manipulated universe vis-à-vis the overall universe using standardised metrics



Source: *SGX, Bloomberg Finance LP*

Figure 29. Market cap category representation across the potential manipulated set (Simple measure based on top decile values) and the overall universe using standardised metrics



Source: *SGX, Bloomberg Finance LP*

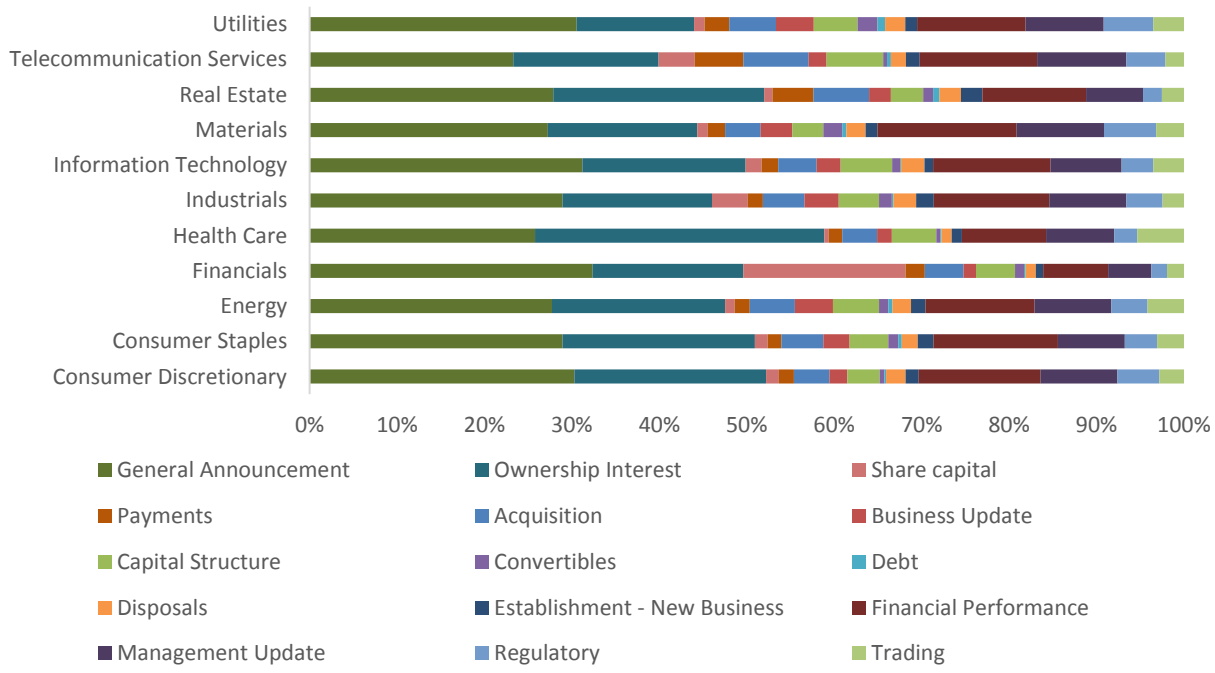
Upon completion of the robustness study, we are confident of the earlier conclusions. Across announcement categorisation, sector classification and

corporate characteristics, the trends have been fairly consistent under the stressed scenarios and have not thrown up any new surprises.

However, a higher representation of Financial and Real Estate stocks as well as securities from Large and Mega cap groups in the potential manipulated list remains the key concern and needs to be investigated.

For this, we begin by looking at the category distribution by sector as a matrix structure to understand how the various categories stack up in each sector. The figure below presents the view of the overall universe.

Figure 30. Announcement category distribution across various sectors in the overall universe



Source: *SGX*

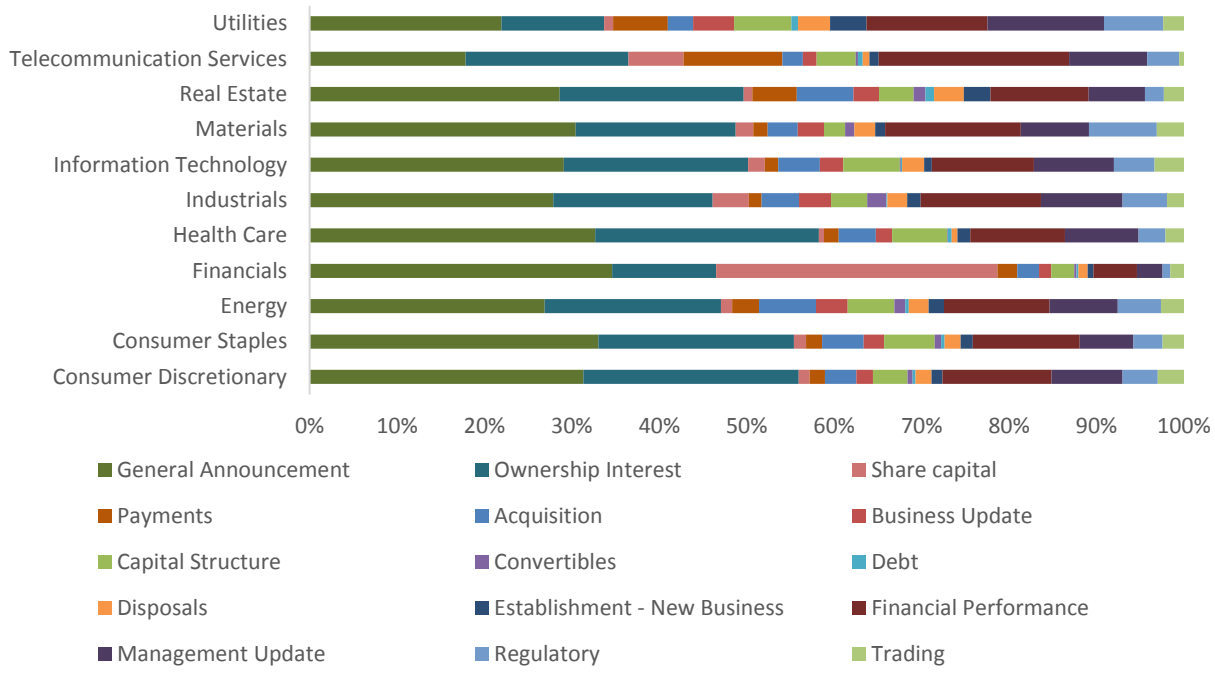
The analysis reveals interesting insights. We note the categories that are directly associated with influencing stock demand (hereafter referred as core categories, marking the first four categories here – General Announcement[28],

[28] *A significant share of General Announcements (approximately 25%) relates to daily share buyback notices involving activity of buybacks in the preceding days. This sub-*

Ownership Interest, Share Capital and Payments) and thereby contributing to a price rise, occupy over 50% of the total category mix across sectors. This possibly explains why the prior return is uniformly significantly positive across all sectors, as observed earlier. Interestingly, the only sector which did not produce statistically significant results was Utilities and here we can observe a less than 50% contribution from core categories.

Another interesting point to note is the contribution of core categories to Financials and Real Estate sectors. For Financials, Share Capital related announcements dominate and the proportion of Ownership Interest related announcements are significant for the Real Estate sector. In general, we observe the contribution of core categories to be among the highest for these two sectors.

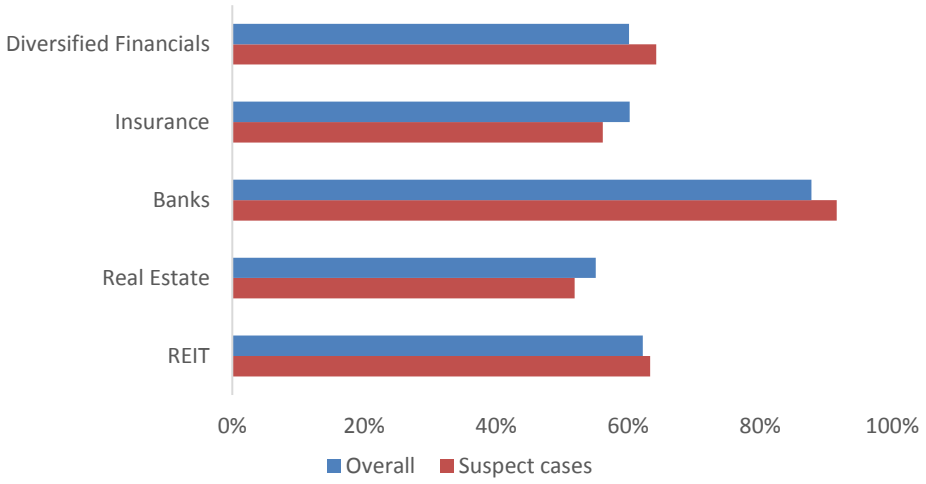
Figure 31. Announcement category distribution across various sectors in the potential manipulated universe



Source: *SGX*

Given this higher contribution and the tendency of core categories to naturally produce higher prior period demand-driven positive returns, we expect Financials and Real Estate to have more than proportional share in the potential manipulated universe, in the absence of other factors leading to manipulation. We have already seen this being established in the validation study. This is also commensurate with the category distribution in Figure 31, especially for Financials, where core categories account for nearly 80% of the total announcements for the sector in the potential manipulated universe.

Figure 32. Comparison of core category representation across sectors in announcements under overall and potential manipulated universe

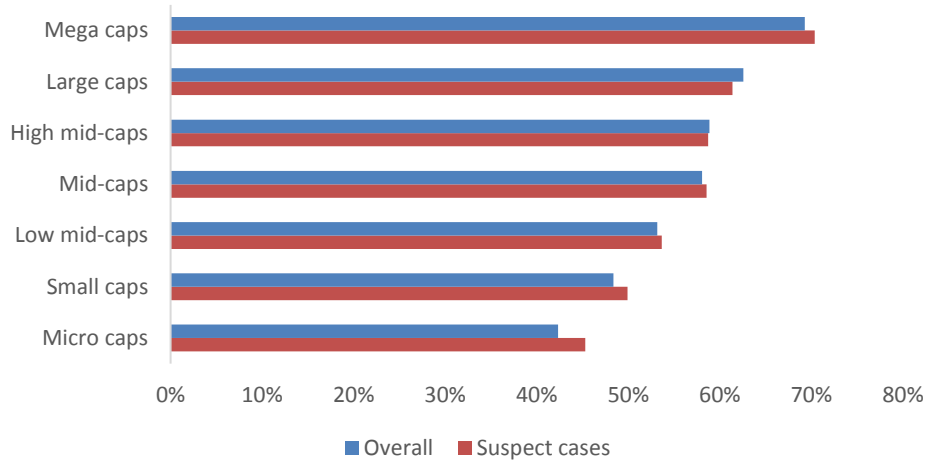


Source: *SGX*

More specifically, looking at the core category representation among sub-sectors as per Figure 32, we observe that Banks, REITs and Diversified Financials, in general, have a high proportion of announcements belonging to the core categories in the overall universe and an even higher proportion in the potential manipulated universe. Banks, in particular, have core categories accounting for over 90% of the representation in the potential manipulated universe. Although the excess representation of core categories in the potential manipulated universe versus the overall universe is quite limited in the case of REITs, given the share of the sub-sector in the total announcement space has

led to its stronger presence in the potential manipulated universe. In fact, even with a slight reduction in core category representation levels in the potential manipulated universe compared to the overall universe among non-REIT stocks, here again, the significant share of such stocks in total announcements, has led to a strong representation of the sub-sector in the potential manipulated universe. Replicating the analysis with market capitalisation groups also offer a similar finding.

Figure 33. Comparison of core category representation in announcements across market capitalisation groups under overall and potential manipulated universe



Source: *SGX, Bloomberg Finance LP*

Presence of core categories appears to be increasing as we move from smaller to bigger market capitalisation categories. The excess contribution of core categories to potential manipulated universe is also much higher among Mega caps, while it is in-line for Large caps. Higher volumes of announcements coming from Large and Mega caps, along with a higher presence of core categories of announcements among them, are likely to have led to a stronger-than-expected representation of these groups in the potential manipulated universe.

Henceforth, ***we derive reasonable comfort that any presence of manipulation in Singapore equities is attributable to company or announcement-specific factors and not systematically prevalent at the market level nor at any (sub-)category, (sub-)sector, market capitalisation group or any other specific corporate characteristic level.***

10. Conclusion

We present a brief summary of the study including the conclusion in the form of questions and answers. We believe this format will help address most of the queries that investors, regulators and other stakeholders may have on this study. It also serves to provide a quick overview of the entire analysis process.

1. What is the scope of manipulation covered in the study? Does it also cover potential insider trading related manipulation?

The scope of the study is to evaluate the presence of broad-based manipulation in stocks listed on SGX around company announcements. We do not explicitly segregate various types of manipulation. Thus, our scope is all-encompassing, assuming any form of manipulation, including insider trading.

2. How different is this study from the portfolio pumping manipulation research published earlier?

The previous study on portfolio pumping looked at a specific type of manipulation where investment managers artificially engineer an increase in prices of stocks in their portfolio to present a better representation of their performance than the real scenario. The study concentrated on reporting period-ends, typically quarter- and year-ends.

For this study, we have sought to identify possible various-type of manipulation around company announcements that could run at any point of time in a calendar year.

3. Is there any evidence of market manipulation in Singapore equities?

No, there isn't. Our study over a period of six years (January 2011 to December 2016) did not find satisfactory evidence to confirm the presence of broad-based manipulation around company announcements in equities listed on SGX.

While there were positive price and trade volume momentum prior to announcements, the moves were not found to be statistically significant to conclude a broader presence of manipulation in the market. In fact, the results stayed fairly stable when we delved deep into specific sub-segments (announcement categories, sectors and other corporate characteristics) and also when it was put through validation and stress tests.

This does not mean that there are no cases of manipulation, but any such instances, including abnormal movements in share prices and trading volume among certain groups, could be classed as standalone incidents or cases with plausible explanations – rather than part of a broader phenomenon.

4. Could you explain the research process?

We began with collation and cleaning of relevant stock and announcement data. Announcements were custom categorised to facilitate more granular analysis. Visual inspection of price and volume performance around announcements provided the needed input for working out a methodology and key parameters to be adopted for a more formal study.

Thereafter, we evaluated whether price returns and volume trends of stocks prior to announcements were significantly different from the post announcement period and an average comparable period by running hypothesis tests. We ran this across three forms of returns (absolute, relative and beta-adjusted) and for multiple cumulative periods, pre and post announcement (one-day, two-day, three-day, five-day and seven-day). Subsequently the analysis was extended for specific subsets of the universe, based on (sub-)category of announcements, (sub-)sectors, market capitalisation groups and other corporate characteristics.

We then corroborated our results with a validation study that first identified the potential manipulated cases and compared the composition of this universe

with the overall universe to identify instances of variation. Finally, a robustness check (stress test) was conducted under a couple of scenarios – in a standardised return environment and by adopting a stricter definition for identifying the potential manipulated cases – to confirm the stability of our findings.

5. Are there any specific pockets of announcements that are prone to manipulation?

There isn't. We ran through our analysis on a custom classification of 15 categories and 106 sub-categories of announcements. Among them, we found the two-day prior period return to be significantly higher than an average comparable period for Ownership Interest, Trading (Listing Updates) and Regulatory (Legal action and Responses to Non-Standard Queries) announcements. To a lesser extent, two-day prior period return edged higher against an average comparable period for Acquisition (New business), Share Capital (Share Consolidation and Use of Treasury Shares) and Payments (Dividend Declaration) related announcements.

However, when we performed a validation study, only Use (Transfer and Proceeds) of Treasury Shares had a reasonably larger share in the potential manipulated list versus the overall universe. This could be attributable to the pickup in demand due to a buyback programme typically accompanying such treasury share announcements and may not directly be tantamount to manipulation.

6. Is manipulation activity visible around specific sectors or sub-sectors of stocks?

The response is the same for sectors and sub-sectors – there isn't broad-based manipulation around company announcements. Interestingly, across all sectors and sub-sectors, we observed the two-day prior period return to be

significantly higher than the average comparable period. We believe that this could be due to over 50% representation of core categories (General Announcement covering Share Buyback updates, Ownership Interest, Use of Treasury Shares and Dividend Declaration) in the total announcement set. These sets of announcements typically drive prior period demand due to their very nature and hence may have raised a false alarm. Validation study only indicated Financials and Real Estate as outlier cases which again could be due to a greater representation of core categories in these sectors.

7. Do small and mid-caps show a higher propensity to be manipulated compared to large caps?

They do not. In fact, Large caps and Mega caps had a greater representation in the potential manipulated universe as opposed to the overall universe indicating a probable higher propensity of Large and Mega caps to be manipulated. We attribute this as well to the greater presence of core categories of announcements rather than any structural instance of broad-based manipulation.

8. Do S-Chip stocks show any visible signs of manipulation around announcements?

There is no indication of broad-based manipulation. The validation study did not offer any evidence of a higher-than-expected representation of S-Chips in the potential manipulated universe. Additionally, the trend remained stable across all our robustness checks including defining potential manipulation with a stricter definition.

9. Are Catalist-listed stocks in particular more likely to be manipulated compared to Mainboard listed ones?

The evidence does not point to the above. Listing boards do not seem to have a role in defining potential instances of market manipulation. The mix of

Mainboard and Catalist stocks was in-line across both the overall and the potential manipulated universe.

10. What are some limitations of the project?

The research studies potential manipulation around company announcements. However, there are many other forms of manipulation that do not involve company announcements. In other words, the study does not cover all forms of manipulation. Also, in exploring broad-based manipulation around announcements, we do not segregate various types of manipulation but rather assume it to be all-encompassing including among others, insider trading and front-running in securities.

We have restricted the return and volume data to T -10 days and T + 10 days. Hence, manipulation strategies that are elaborate and executed over a longer period may not be captured in our statistical analysis.

The study found no evidence of manipulation. However, enhanced research with specialised data, including details of individual trades and participant groups, is needed to firmly establish the absence of manipulation. Many a times, the presence of abnormal returns can be easily explained as increased interest in the stock and not due to manipulation. This needs to be cross-verified with further research.

11. Recommendation

The results from the study points to there being no statistically significant evidence to indicate the presence of manipulation:

I. At the broader market level

II. Within a particular category or sub-category of announcements

III. Within a sector or sub-sector

IV. Among other corporate characteristic groups based on market capitalisation, listing board and operational domicile (S-chip)

We conclude that any observed potential instance of manipulation around company announcements on SGX is a standalone event and not part of a broader phenomenon. Based on this, we proceed to make the following specific recommendations for various stakeholders.

For Policy Makers

We believe that the efforts of regulators in Singapore, including the Monetary Authority of Singapore (MAS) and SGX to prevent manipulation have contributed to this set of positive results. Current regulations, including market surveillance mechanisms are robust and effective in ensuring the integrity of the Singapore equity market. MAS also makes public the market misconduct cases and associated penalties which also serves as a deterrent in curbing market manipulation activities.

Notwithstanding the above, we offer the following recommendations to regulators as well as policymakers based on the findings from this study:

1. Expand the categorisation of corporate announcements: Increasing the sub-categories beyond the current level of 60 would allow more precise

analysis with regards to manipulation. This is because not all announcements have the potential to move prices of securities. For example, announcement of an acquisition is more likely to move the market, compared to conclusion of an acquisition, which is considered a formality and typically fully priced-in. The current practice is for both types of the above announcements to be filed under "Asset Acquisitions and Disposals". Moreover, through differentiation and being more specific in categorising announcements, monitoring will be simpler and more precise.

2. Increased monitoring: Even though there were instances of abnormal movement in share prices and trading volume around company announcements, there were plausible explanations and may not constitute manipulation. We note however that such instances were more widespread in certain announcement categories and certain sectors and hence we would recommend closer scrutiny on the following categories and sectors:

    a. Category of announcement

        i. Treasury shares - Transfer

        ii. Treasury shares - Use of Proceeds

        iii. Change of Ownership Interest

        iv. Ownership Interest Disclosure

        v. Dividend Declaration

        vi. Acquisition of New Business

    b. Sector

        i. Financials

        ii. Real Estate

3. Further research to gather more direct evidence: We recommend enhanced research with specialised data, including details of individual trades and participant groups, to go beyond the level of finding no evidence of manipulation to firmly establishing the absence of manipulation.

For Listed Companies

1. The Board of Directors, senior management, employees and related-external parties of listed companies must be aware when they are in possession of material non-public information and that they are obliged to maintain its confidentiality. Failure to do is a breach of fiduciary duty and can constitute a criminal offence.

2. Companies should establish robust internal policies and systems (for example, personal account dealing, training in material non-public information) to eliminate leakage or prevent illicit uses.

3. We have recommended that regulators keep a closer watch on potential manipulation cases involving:

    a. Category of announcement

        i. Treasury shares - Transfer

        ii. Treasury shares - Use of Proceeds

        iii. Change of Ownership Interest

        iv. Ownership Interest Disclosure

        v. Dividend Declaration

        vi. Acquisition of New Business

    b. Sector

        i. Financials

        ii. Real Estate

Similarly, listed companies due to make announcements in the above categories and falling under the above two sectors should exercise extra caution when they are in possession of material non-public information.

For Investors

1. Institutional investors entrusted to manage other people's money should behave as fiduciaries and should not engage in practices that distort prices or artificially inflate trading volume with the intent to mislead market participants. Senior management should set a culture of integrity with clear expectations on proper behaviour, recognising that this will ultimately drive value for their firm and for their clients.

2. Retail investors should be aware of their own risk tolerances and investment objectives when making investments and must do their own due diligence instead of following a herd mentality.

- **End** -