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Abstract

The extraordinary situation due to COVID-19 pandemic has created an opportunity to examine the behavioural patterns of investors by way of the level of trading activities on the Australian Securities Exchange (ASX) around the releases of crucial information regarding the COVID-19 pandemic. This study aims to identify abnormal trading volume at ASX around eight selected significant announcements and measures of the COVID-19 pandemic in Australia. The study finds sufficient evidence to indicate that the COVID-19 announcements and calculations influence investor decisions on the ASX as the pandemic evolved.

Keywords: Investor reactions, COVID-19, Announcements, Australia, Australian Securities Exchange, ASX

JEL Classification: M40, G14, G41

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1. Introduction

Investor decisions based on information flow to the stock market have been studied in the accounting and finance literature. The foundations of financial reporting have been deeply linked to the decision-making activities of financial capital providers (IASB, 2018). More so, there has been an increase in demand for non-financial information such as corporate social responsibility (CSR), environmental, social and governance (ESG), and intellectual capital (IC) information by investors (Murray et al., 2006; Wahyuningrum et al., 2020; Zhang et al., 2018, 2020). Firms have been engaged in the disclosure of such non-financial information because of the perceived importance of such information to the buy or sell decisions of investors (Holland, 2003), and more especially with ethical investors increasing (Tschopp and Huefner, 2015). That notwithstanding, public information such as announcements of earnings, firm acquisitions, government regulations, and economic policies, have been found to have profound effects on the decisions of investors, culminating in the level of activity on the financial markets (Bae and Jo, 1999; Mitchell and Mulherin, 1994).

On the emergence of the recent COVID-19 pandemic, the stock market has experienced some significant fluctuations in the prices of stocks. It is reported at the beginning of the spread of the infection that stock prices were increased significantly before plummeting. For example, the DOW Jones, S&P 500 and Nasdaq composite index in the United States (US) reported significant hikes in value prior to COVID-19 situation (Imbert, 2020). Similarly, on the Australian Securities Exchange (ASX), stock prices generally appreciated in value and reached historically high levels (Janda and Chalmers, 2020).

However, as the pandemic spread and announcements of measures to contain the pandemic began, stock markets worldwide reported plummets in stock prices (BBC, 2020). The interesting question is whether the significant fluctuations in the stock market performances were reactions of the investors against the announcements or releases of information regarding the pandemic by the government and health institutions. This extraordinary situation due to the COVID-19 pandemic has led to an interesting and useful opportunity to examine this issue and gain valuable lessons from this situation.

Prior research in accounting and finance has examined the effect of information release by corporations and governments on the stock market (e.g. Bamber, 1986; Graham et al., 2003; Mitchell and Mulherin, 1994). These investor responses have mainly been measured by the level of abnormal returns or trading volumes, which is indicative of the value in the information content of the releases. The behaviour of investors in the stock market can be observed from their level of activities on the market. To this end, we use the level of trading volume as an indicator of investor reactions.

In this study, we seek to examine the behavioural patterns of investors by way of the level of trading activities on the stock market around the releases of information regarding the COVID-19 pandemic. Specifically, we seek to determine whether there is a significant abnormal volume of trading in firm stocks on the ASX relative to the release of information regarding the COVID-19 pandemic. We use the timeline for events and announcements on COVID-19 developments in Australia to identify the presence of abnormal trading volume activity, which is a measure of investor behaviour during the pandemic.

2. Information release and stock market activity

Scholars have been concerned about the movements in prices and stock market activity that cannot be explained by fundamental analysis (Tetlock, 2007). It is suggested that changes in investor beliefs have the tendency to cause price movements and high variation in trading volume on the stock market (De Long et al., 1990; Tetlock, 2007). However, changes in investor beliefs may be influenced by the release of new information, which, when interpreted by investors, can affect their decisions. Public information that is released unto the stock market could either be firm-specific corporate announcements or macroeconomic and government announcements. All these types of public information could be of relevance to investor decisions. For this reason, researchers have suggested that investor sentiments and actions on the stock market could be the result of information flow. Thus, empirical research on the relationship between information disclosures or announcements (news) and stock market prices and activity is well established in the finance and accounting literature (see Bamber, 1986; Beaver, 1968; Berry and Howe, 1994; Chae, 2005; Cutler et al., 1989; Ederington and Lee, 1993; Graham et al., 2003; Harvey and Huang, 1991; Holthausen and Verrecchia, 1990; Mitchell and Mulherin, 1994).

Examining the relationship between trading volume, annual earnings announcements and firm size, Bamber (1986) reported a significant positive correlation between trading volume and unexpected earnings. The author asserted that around the date of the unexpected earnings announcement, trade volume positively correlates with the absolute value of earnings surprise. In a similar study, Chae (2005) examined the dynamics of trading volume before scheduled and unscheduled corporate announcements. Using earnings announcements as a proxy for scheduled announcements, he found that trading volume decreased before scheduled earnings announcements. However, the reverse was the case for unscheduled announcements measured by acquisition, target, and Moody's bond rating announcements. Bae and Jo (1999) also analysed changes in price volatility and trading volume on the stock market as a result of rights offering announcements. They documented that while stock price volatility decreased in the period after the rights offering announcement, trade volume increased significantly.

Studies such as Tetlock (2007), Mitchell and Mulherin (1994), and Berry and Howe (1994) linked financial news releases to activity on the stock market. Tetlock (2007) analysed the influence of the content of a popular news column in the Wall Street Journal (WSJ) on stock market activity. He found that negative investor sentiments that were occasioned by the news content in the WSJ led to lower market prices and temporary high trading volume. Using the number of daily news releases by Dow Jones, encompassing both firm-specific and macroeconomic information, Mitchell and Mulherin (1994) examined the relationship between public information release and stock market activity. They suggested that sufficient evidence exists to support the notion that the number of news releases positively influenced the level of trading volume on the stock market. Similarly, Berry and Howe (1994) documented patterns in the flow of public information into the stock market and its effect on stock market activity. They measured public information as the number of news releases by Reuter's News Service that encompassed macroeconomic and firm-specific information. They found that public information arrival on the stock market was significantly related to trading volume.

Additionally, studies such as Ederington and Lee (1993), Harvey and Huang (1991), and Graham et al. (2003) used macroeconomic news and government announcements to analyse the relationship between news releases and stock market activity. Following the notion that market participants believe macroeconomic announcements influence the financial markets, Ederington and Lee (1993) selected 19 monthly scheduled macroeconomic announcements and explored their effect on the futures market for interest rate and foreign exchange. The authors

documented that there was sufficient evidence that the macroeconomic announcements significantly account for the volatility in these markets. Harvey and Huang (1991), in their study of volatility on foreign exchange futures market using data from the Chicago Mercantile Exchange and the London International Financial Futures Exchange, concluded that volatility in these markets was largely driven by macroeconomic announcements since the release of US macroeconomic news was found to coincide with high volatility in the futures market. Graham et al. (2003) selected 11 macroeconomic news releases in the US in their study of the relevance of such news to the valuation of stocks and found that five of the selected macroeconomic announcements had significant influences on the value of stocks in the US market.

Although prior research on the relations between public information announcements and the stock market focused on information that was of financial or economic nature, we contend that since the COVID-19 pandemic affects the economic outcomes of a country, the announcements surrounding the infections also have an impact on the investor behaviour on the stock markets. Moreover, it can be seen clearly from other activities that COVID-19 related announcements have affected human behaviour, such as in many cases of panic buying of groceries (e.g., Yuen et al., 2020) or abrupt change in the models of office meetings or university teaching (e.g., Djajadikerta et al., 2021). Thus, this study explores the impact of announcements and calculations of COVID-19 infections by the Australian Federal Government and its agencies on the ASX. Specifically, we examine the effect of these announcements and calculations on the trading volume of the largest firms on the ASX. We use the trade volume approach because of its critical role in the stock market (Chae, 2005). Moreover, trade volume is considered a good measure for the behaviour of the stock market relative to public information releases (Tetlock, 2007).

3. Data

Using market capitalisation as a basis, daily trading volume data for the top 100 firms on the ASX are selected from the Thomson Reuters Eikon Database. We exclude three firms that have consistent missing trading volume data for at least five trading days from the sample. Table 1 reports the distribution of industry sectors represented in the final sample. The 11 sectors based on ASX's Global Industry Classification Standard are all represented in the final sample.

Table 1. Sample Distribution by Sector

Number	Sector Name	Number of Firms	Percentage in Sample
1	Materials	19	19.59%
2	Financials	16	16.49%
3	Industrials	11	11.34%
4	Real Estate	9	9.28%
5	Energy	9	9.28%
6	Consumer Discretionary	8	8.25%
7	Information Technology	7	7.22%
8	Consumer Staples	5	5.15%
9	Health Care	5	5.15%
10	Utilities	4	4.12%
11	Communication Services	4	4.12%
	Total	97	100.00%

Trading volume data for the period between 4th September 2019 and 13th May 2020 for sample firms are obtained from Thomson Reuters Eikon Database. Non-trading days such as public holidays and weekends are eliminated from the data set. The final data set consists of trading volume data for 175 trading days.

We obtain the timeline of significant announcements and measures on the COVID-19 pandemic in Australia from BRI Ferrier Australia and ABC News Australia (Ting and Palmer, 2020; Woods, 2020). Eight significant dates between January and April 2020 are identified. The first case of COVID-19 infection in Australia was reported on 25th January 2020 with the first reported death on 1st March. The 100th case was reported on 10th March with a ban on international travel announced by the federal government on 17th March. The highest daily reported cases and highest casualties in a day were reported on 28th March and 7th April respectively. Significant drops in daily growth of cases were reported on 15th April and the intentions on easing of restrictions were announced by the federal government on 29th April 2020.

Of the 175 trading days in our sample, the timeline of significant announcements and measures on COVID-19 covers 85 trading days from 13th January to 13th May 2020. We use the 90 trading days volume trading data prior to 13th January for the estimation of normal levels of trading volume. All trading volume data are transformed into its natural log to reduce the effect of skewness on volume differences in our estimations (Chae, 2005; Jarrell and Poulsen, 1989).

4. Method

We follow Jarrell and Poulsen (1989) to identify abnormal trading volume around the eight selected significant timelines of the COVID-19 pandemic in Australia. We estimate normal trading volume for firms as the mean trading volume between 100 to 10 trading days before the announcement of the first case of COVID-19 in Australia. This 90-trading day period represents a period where there is no calculation of the pandemic in Australia (clean period), and thus trading volume is not expected to have been affected by calculations of the pandemic in Australia. This period relates to daily trade volume data from 4th September 2019 to 10th January 2020. Normal trading volume (*NTV*) is thus estimated with the 90-trading day daily volume data as follows;

$$NTV_i = \frac{1}{90} \sum_{-100}^{-10} \log(TV)_{it} \quad (1)$$

We compare the normal trading volume (*NTV*) estimated as the mean log of trade volume for the clean period to the actual daily trading volume from 10 days prior to 10 days past each identified significant COVID-19 announcement and calculation for each firm. The differences in daily trading volume for each firm is tested for significance by computing the *z*-statistics at 95% confidence level.

This is estimated as follows;

$$ANTV_{it} = TV_{it} - NTV_i \quad (2)$$

Where *ANTV_{it}* is positive or negative, *z*-statistics at 95% confidence interval (CI) is estimated as follows;

$$Z_{TV_{it}} = \frac{TV_{it} - NTV_t}{\sigma NTV_t} \quad (3)$$

Based on the firm z -statistics obtained for each trading day, we detect abnormal trading volume when the absolute z -statistics is greater than 1.96. We tabulate and report on the percentage of firms within the sample that experienced significant changes in trade volumes from 10 days prior to 10 days past the identified significant announcement and calculation of COVID-19 in Australia.

5. Results

Table 2 reports the percentage of firms within our sample that have significant z -statistics at 95% CI for daily trading volume from 13th January to 13th May 2020. This period constitutes a phase in the first wave of COVID-19 infections in Australia, where the Australian federal government made significant announcements and calculations on the pandemic. For the eight identified significant announcements and calculations identified in this period for the study, z -statistics for daily trade volumes are reported for 10 days prior to 10 days past each announcement (see columns 3 to 10 in Table 2). From Table 2, we find that abnormal trading volume is generally detected among sample firms within the period for all the eight identified significant announcements on COVID-19 in Australia.

Column 3 in Table 2 reports the statistics around the announcement of the first COVID-19 case in Australia on 25th January 2020. It is revealed that 10 days before and after this announcement, about 13% and 6% of firms in the sample experienced significant abnormal trading volumes. Between 5 days prior and past the first case, less than 10% of the sampled firms experienced abnormal daily trading volume. We observe that these statistics are not pronounced and therefore construe that this announcement does not affect the reactions of investors on the ASX.

Table 2. Percentage of Firms with Significant z-statistics for Daily Trading volume from 10 Days pre and post the Announcement Date

Trade Day	N	Percentage of firms with significant differences in trade volume at 95% confidence level							
		25-Jan	1-Mar	10-Mar	17-Mar	28-Mar	7-Apr	15-Apr	29-Apr
D-10	97	13.40%	13.40%	11.34%	25.77%	73.20%	58.76%	25.77%	21.65%
D-9	97	1.03%	5.15%	14.43%	16.49%	86.60%	50.52%	65.98%	31.96%
D-8	97	2.06%	14.43%	16.49%	13.40%	72.16%	44.33%	31.96%	18.56%
D-7	97	1.03%	9.28%	57.73%	13.40%	81.44%	55.67%	27.84%	10.31%
D-6	97	0.00%	7.22%	29.90%	47.42%	70.10%	25.77%	40.21%	11.34%
D-5	97	1.03%	9.28%	25.77%	70.10%	68.04%	65.98%	20.62%	15.46%
D-4	97	2.06%	11.34%	16.49%	55.67%	58.76%	31.96%	24.74%	9.28%
D-3	97	3.09%	14.43%	13.40%	72.16%	50.52%	27.84%	23.71%	9.28%
D-2	97	3.09%	16.49%	13.40%	84.54%	44.33%	40.21%	16.49%	5.15%
D-1	97	3.09%	57.73%	47.42%	73.20%	55.67%	20.62%	25.77%	15.46%
D 0	97	NA	NA	70.10%	86.60%	NA	24.74%	21.65%	9.28%
D 1	97	3.09%	29.90%	55.67%	72.16%	25.77%	23.71%	31.96%	43.30%
D 2	97	2.06%	25.77%	72.16%	81.44%	65.98%	16.49%	18.56%	17.53%
D 3	97	2.06%	16.49%	84.54%	70.10%	31.96%	25.77%	10.31%	11.34%
D 4	97	9.28%	13.40%	73.20%	68.04%	27.84%	21.65%	11.34%	7.22%
D 5	97	3.09%	13.40%	86.60%	58.76%	40.21%	31.96%	15.46%	7.22%
D 6	97	3.09%	47.42%	72.16%	50.52%	20.62%	18.56%	9.28%	12.37%
D 7	97	5.15%	70.10%	81.44%	44.33%	24.74%	10.31%	9.28%	7.22%
D 8	97	3.09%	55.67%	70.10%	55.67%	23.71%	11.34%	5.15%	6.19%
D 9	97	3.09%	72.16%	68.04%	25.77%	16.49%	15.46%	15.46%	9.28%
D 10	97	6.19%	84.54%	58.76%	65.98%	25.77%	9.28%	9.28%	16.49%

Note: NA is used in instances where the COVID 19 announcement day is not a trading day

In column 4, we report the effect of the first announced death of COVID-19 on the ASX. From 10 days to 6 days prior to this announcement, the percentage of sample firms that experienced abnormal daily trading volume ranges from 5% to 14%. However, it is revealed that from 5 days prior to the announcement, the percentage of firms consistently increased from 9% to 57.73% on 1 day prior to the announcement. It is further revealed that within 5 days after the announcement, the percentage of firms that experienced significant abnormal trading volume consistently reduced from 30% to 13%. These statistics are quite significant and indicate an effect of the announcement on investor reactions on the ASX.

We report the effect of announcing the 100th COVID-19 case on 10th March in Column 5. We find a substantial abnormal daily trading volume in our sample. We observe that 70% of sample firms experienced abnormal daily trading volume on the day of the announcement. Additionally, we observe that the level of abnormal daily trading volume within 5 days after the announcement is persistent as more than 50% of the sample firms continued to experience abnormal daily trading volume. Specifically, the level of significant abnormal daily trading volume within 5 days after the announcement ranged from 56% to 87%. These statistics are clearly a significant demonstration of the effect of this announcement on the reactions of investors.

On 17th March, where the Australian federal government banned all international travels, considerable levels of abnormal daily trading volume were reported in the sample firms. Column 6 reveals that on the day of this announcement, 87% of the sample firms experienced abnormal daily trading volume. Furthermore, an examination of the trading volume *z*-statistics within a 5-day pre and post window of the announcement reveals a pervasive pattern of abnormal daily trading volumes. It is observed that more than 55% of the sample firms experience abnormal daily trading volume within the 5-day pre and post announcement window. Thus, this announcement is considered to have influenced the reactions of investors on the ASX.

Column 7 reports the level of abnormal daily trading volume in the sample on 28th March, which represents the peak of daily reported cases in the first wave. It is observed that many of the sample firms experienced significant abnormal daily trading volume in the period of this announcement. In the 5-day window pre the announcement, the percentage of firms in the sample that experienced abnormal daily trading volume ranged from 44% to 68%, while in the 5-day window post the announcement, the percentage of firms ranged from 26% to 66%. These statistics establish that the announcement had a significant effect on the reactions of investors which is demonstrated in the level of the significant daily abnormal trading volume.

In column 8, we report on the effect of the announcement of the highest daily casualties from COVID-19 in Australia on the trading volume of the sampled firms. It is revealed that 25% of the sample firms experienced abnormal daily trading volume on the day of this announcement. Generally, a good number of firms experienced significant changes in the volume of shares traded around the period of this announcement. Specifically, in the 5-day window pre the announcement, more than 20% of sample firms experienced abnormal daily trading volume. Similarly, in the 5-day window post the announcement, the percentage of sample firms that experienced abnormal trading volume ranges from 16% to 32%.

Column 9 relates to the period where the reported daily growth in COVID-19 infections dropped significantly to below 1%. We continue to observe significant abnormal daily trading volume in the sample firms, although the level of such incidents is not as pronounced as in the earlier periods. On the day of this announcement, 22% of the sample firms exhibited abnormal

daily trading volume. This increased to 32% on the day after the announcement but reduced significantly to 19%, 10% and 11% on the second, third and fourth day, respectively.

The effect of the last significant announcement on investor reactions for our study period is presented in column 10. The federal government declared its intention on 29th April to begin the relaxation of restrictions on 11th May. We note that only 9% of the sample firms experienced abnormal daily trading volume on this day. However, a day after this announcement, we observed a spike in the number of sample firms that experienced abnormal daily trading volume. Specifically, 43% of the sample firms exhibited significant changes in their daily trading volume. This is significant given that a positive reaction of investors to this announcement was expected given the possible effect of relaxing restrictions on businesses. However, the levels of abnormal trading volume beyond this point consistently diminished from 18% on day 2 to 7% on day 5 post the announcement.

Overall, we find significant evidence of abnormal trading volume within our period of study. However, the evidence is more pronounced in the month of March. Notably, all the trading days close to the selected significant announcement dates in March demonstrate considerable levels of abnormal daily trading volume in our sample. Furthermore, we note that in April, where the levels of infections began to drop significantly, the evidence of abnormal daily trading volume began to subside relatively except for a spike in the number of firms in our sample that experienced abnormal daily trade volume a day following the declaration of intentions to relax restrictions in Australia.

6. Discussion

In this study, we establish that announcements and calculations on the COVID-19 pandemic by the Australian government have an impact on activity in the ASX. The tests from our data over the study period suggest that investor decisions on the ASX were influenced by the announcements and calculations as the pandemic evolved. We observe that the daily trading volumes within the period of our analysis appear to vary significantly. Using the trading volume data in the COVID free period as our benchmark, we establish that large firms on the ASX experienced significant abnormalities in their level of daily trading volume within the period of announcements regarding COVID-19. Generally, we observe that the level of abnormal trading volume is less significant in the early periods of the pandemic. However, with the growth in the daily spread of the virus, which necessitated a coherent reporting and containment strategy from the Commonwealth and State governments in Australia, the effect of the announcements and calculations also increased. We further observe significant declines in the levels of abnormal trading volume on the ASX in the latter periods of our analysis.

We find that, while there is evidence of abnormal daily trading volume throughout the entire period of the study, the evidence is significantly pronounced in the month of March. Abnormal trading volumes around the announcement and calculation dates in this month are significantly higher than the other periods included in the study, thus suggesting that the level of investor reactions within this period is very high. It is noted that in January and February, the contents of reports on the pandemic within Australia were not likely to generate negative sentiments about the virus among the population. At this stage, the spread of the virus had only been noted by the Australian authorities. It was not until 25th January that the first case was reported in the country. Furthermore, although the Australian government declared COVID-19 as a pandemic on 27th February with an emergency response plan activated, reports on the low number of cases in the country were not likely to have elicited negative sentiments.

However, with the first death reported on 1st March and the 100th case on 10th March, the outlook of the effect of the pandemic on the beliefs and sentiments of investors became pronounced. We note that within this period, the reports surrounding the pandemic became more negative. March could be described as the busiest month for the spread of the virus, with the highest number of daily cases reported on 28th March. Moreover, some of the strict measures adopted by the government to contain the spread of the pandemic were activated this month. These include the ban on international travel and enforcement of lockdown across the country. We, therefore, conclude that the information content of the announcements and calculations on the pandemic around this period carried more negative sentiments, which thus elicited more reactions from investors on the ASX, leading to the widespread abnormal daily trading volume in this period. This finding is similar to that of Tetlock (2007) that negative investor sentiments lead to temporary high trading volume.

We further observe that in April, although there is considerable evidence of the effect of COVID-19 announcements and calculations on the ASX, this is not as pronounced as that in March. We generally observe significant declines in the levels of daily abnormal trading volume among the largest firms on the ASX. This finding is attributable to the inclusion of positive sentiments in the announcements for this period. We note in April that media reports on the pandemic generally contained some positive news, such as recovery statistics in addition to the daily growth in infections. The Australian government began the inclusion of recovery statistics in its news releases from 6th April. Hence, this may have played a significant role in the beliefs and sentiments of investors. Moreover, the effect of the extreme measures implemented in the latter part of March had begun yielding results as the growth in daily infections began to decline to the point that on 10th April, recoveries were more than the current reported cases. However, we particularly note that a day after the announcement of the government's intention to begin the relaxation of restrictions, a significant spike in the percentage of firms with abnormal trading volume is observed. Thus, we conclude that indeed the government's announcements and calculations on the pandemic do influence the actions of investors on the ASX, culminating in significant abnormal trading volume experienced by the largest firms on the exchange.

These findings should inform the Australian government on the extent of its announcements and reporting of the pandemic on investor behaviour and activity in the stock market. Perhaps the content of such announcements should be balanced with some positive news since more negative news have a greater effect on the sentiments and reactions of investors. Stability in the stock market is preferred to volatility. Moreover, high volatility in trading volume can have an effect on the pricing process on the stock market (Chae, 2005).

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