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## **An Empirical Study of COVID-19 Vaccine Announcement of Selected Companies by Using Event Study Methodology**

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**Abstract:**

**Purpose:** *How did health crises convert to a global financial problem? In this study we focus to examine the effect of COVID-19 vaccine announcement for Pfizer Company and the other companies.*

**Design/Methodology/Approach:** *This study finds the positive abnormal return and cumulative abnormal return impacts for the COVID-19 vaccine announcement for Pfizer Company. For our data sample this study used the daily-based data of Pfizer, AstraZeneca, Moderna and Biontech Johnson & Johnson .*

**Findings:** *This study focuses on the period from January 2019 to December 2020. This study used the event study methodology for the empirical analysis. This study examines the impact of covid-19 vaccine announcement for companies are positive abnormal return and statistical insignificant Cumulative abnormal return impacts for covid-19 vaccine announcement.*

**Practical implications:** *The impact of covid-19 vaccine announcement for companies were positive abnormal return and statistical insignificant Cumulative abnormal return impacts for covid-19 vaccine announcement based on both logarithmic return and discrete return methods. This result can be used for better execution of the vaccination programs.*

**Originality value:** *There is no similar study in the literature trying to examine the effect of COVID-19 vaccine among the pharmaceutical companies.*

**Keywords:** *COVID-19, COVID-19 Vaccine announcement, Event Study, Abnormal Return, Market Reaction.*

**JEL codes:**

**Paper Type:** *Research article.*

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## **1. Introduction**

In 2019, people were feeling anxiety about the impact of Brexit and China-US trade war on the world economy. On these basis IMF predicted moderated global growth of 3.4 percent. But suddenly COVID-19 changed the entire story unexpectedly. So here the question is that what is COVID-19 and how it changed the entire world? Basically COVID-19 is a disease, which caused by SARS-CoV-2. SARS-CoV-2 is a novel strain of coronavirus from the SARS species. It changed the entire world unexpectedly. The main question is that how COVID-19 effect the global financial markets? According to Ozili and Arun (2020) the global stock markets lost about US\$6 trillion just in one week from 24<sup>th</sup> of February to 28<sup>th</sup> of February due to the fear and uncertainty. According to Noel Randewich (2020) in the same week S&P 500 index lost over \$5 trillion in value and top ten largest companies of S&P 500 index faced a total loss of over \$1.4 trillion. In the following week some of these were recovered.

According to the International Air Transportation Association (IATA) the air travel industry will lose US\$113 billion due to COVID-19. The tourism industry affected by COVID-19 because the travel opportunities for tourists were decrease sharply and these tourists send billion annually. The cancellations for flights, cancelations for hotel bookings and cancelations for international and local events were increased which worth was \$200 billion. Mostly countries like Turkey, Pakistan, Iran, Italy, UK, France, USA, Canada and many more announced the policy for stay at home to fight this novel virus. They closed all the major factories and financial sectors. So this policy affects the economic activities very badly. According to (Financial Times, 2020) this policy rooted a seed for recession in developing countries.

During this anxiety period of COVID-19 when the entire world was in trouble a company announced the vaccine for the COVID-19. This company was Pfizer, which is a multinational company of medicines. This announcement was a very important for the entire world as well as for the financial sectors. So we can say it's a big event for medicine companies. In this study we focus on the COVID-19 vaccine announcement and we examine the effect on stock price. Finally the COVID-19 vaccine announcement is our event for the study.

Event study is an empirical analysis, which is used to estimate the effect of an event on stock returns. Event studies are primary methodology, which is used to estimate the effect that an event occurrence of an event has on the returns of firm's stock prices.

## **2. Literature Review**

The study by Fama, Fischer, Jensen, and Roll (1969) is the most significant piece of information on the dates of execution of stock splits. As they tested the abnormal behavior in the rates of return on shares when the stock was split. The residual

analysis technique was used in the financial analysis to obtain the results, as the study found that stock split is often preceded by abnormal high returns despite the fact that the markets were unable to obtain the information about the stock split. The increase in profits and their dividends leads to the ability of companies to implement the policy of dividing shares, and investors are looking for available information related to the division of shares, because it is a good thing to obtain profits.

Wu and Chang (1997) found an increase in abnormal returns during the stock splitting process. This increase continued for three days from the date of the announcement of the companies listed on the Hong Kong Stock Exchange during the period 1986-1992, which prompts the investors to verify the information related to the stock split.

Adaoglu and Lasfer (2008) studied the market's evaluation of the unusual form of bonus issuance, which is free stock distributions, as the study found an abnormal positive return on the day of announcing bonus issues, as it happens when dividends are distributed or when shares split and you move in developed markets and emerging markets.

Dasilas and Leventis (2011), studied the effect of the profit distribution announcement on the market reaction in the Athens Stock Exchange during the period 2000-2004, when the study created a reaction when the dividend was announced for the Athens market and the presence of an abnormal return, which supports the assumptions of dividend distribution and the predictions that result from it, and thus the market It has a similar reaction to the other markets.

Legenzova *et al.* (2017), found that a positive reaction to the average abnormal return when announcing the distribution of dividends for companies listed on the NASDAQ OMX Stock Exchange, but it was not statistically significant because the reaction was 3 or 7 days after the date of the announcement, which indicates that the market NASDAQ OMX suffers from poor market efficiency.

### **3. Objectives of the Study**

There are some objectives of the study, which are:

- To estimate the stock returns in terms of change in market value around COVID-19 Vaccine announcement days for companies.
- To study the effect of COVID-19 Vaccine announcement on the stock prices in terms of return due to change in market value of the companies.

### **4. Efficient Market Hypothesis**

A market where security prices fully response to all relevant information that is available about the value of the securities is called efficient capital market.

According to Mishra (2007) market efficiency is the explanations of the relationship between the share prices reaction in the capital market and information. There are different levels of efficiency, which are based on available information. These are weak, semi strong and strong.

*Hypothesis:*

$H_0$  = There is no positive effect for abnormal return and cumulative abnormal return to covid-19 vaccine announcement.

$H_1$  = There is positive effect for abnormal return and cumulative abnormal return to covid-19 vaccine announcement.

## 5. Data and Methodology

### 5.1 Data

For the empirical analysis we used the daily based date for the stock price from the January 11, 2019 to December 23, 2020. The source of date is Yahoo Finance. For the stock market index all companies are listed in NASDAQ. In this study we select the four companies, which are Pfizer, AstraZeneca, Moderna and Biontech, Johnson & Johnson.

Our main company for the analysis is Pfizer.

Company	Announcement date
Pfizer	November 9, 2020
AstraZeneca	November 23, 2020
Moderna	November 16, 2020
Biontech	November 9, 2020
Johnson & Johnson	March 1, 2021

### 5.2 Methodology

This study used the event-based methodology. Event study is an empirical analysis, which is used to estimate the effect of an event on stock returns. Event studies are primary methodology, which is used to estimate the effect that an event occurrence of an event has on the returns of firm's stock prices. Firstly we used adjusted stock price then we calculate the return for all companies and stocks market. For calculate the return we use two methods:

1- Logarithmic return

$$R_{it} = \ln \left( \frac{P_{it}}{P_{it-1}} \right)$$

2- Discrete returns

$$R_{it} = \frac{P_{it} + D_{it} - P_{it-1}}{P_{it-1}}$$

Where:

$R_{it}$  = Return of stock  $i$ .

$P_{it}$  = price of stock  $i$  at the end of period.

$P_{it-1}$  = price of stock  $i$  at the end of period for the previous year.

$D_{it}$  = Dividend paid of stock  $i$ .

After that we used Market model to find abnormal return for both methods logarithmic and discrete returns before we calculate abnormal return we found Alfa and Beta to calculate  $E(R_i)$  by using this formula. To calculate Abnormal return  $AR_{it}$  this study used this formula:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \quad E(R_i) = \alpha + \beta_i R_{mt} + \varepsilon_{it}$$

The Estimation period is from -250 to -10 for Pfizer and for companies -250 to -20 and event windows is  $t = -10$  to  $t=10$  for Pfizer and  $t=-20$  to  $t=20$  for all, event windows are important to know the behavior of stock price.

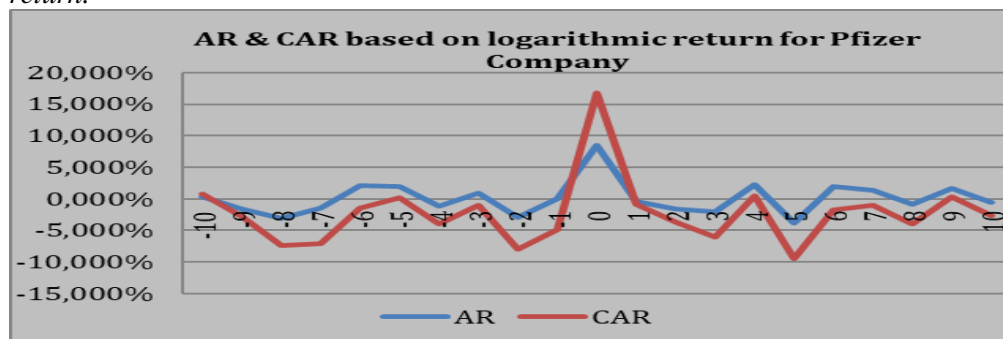
We calculated CAR by using these formulas:

$$\overline{CAR}_{t_1,t_2} = \sum_{t=t_1}^{t_2} \overline{AR}_t \quad \overline{CAR} = \sum_{t=t_1}^{t_2} \overline{AR}_t$$

## 6. Results and Discussion

This study examines the impact of the COVID-19 vaccine announcement on a corporation's stock price, and reaction for 2019-2020 by using event analysis methodology. The study used market models to calculate abnormal return by using both logarithmic returns and discrete returns. Part one is examines the impact of the covid-19 vaccine announcement on Pfizer company stock price:

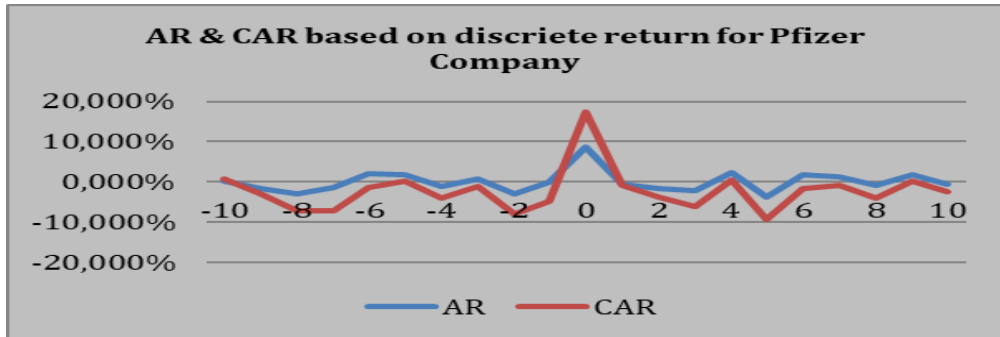
**Figure 1.** Abnormal return and Cumulative Abnormal return based on logarithmic return.



Source: Own study.

Figure 1 show abnormal return and cumulative abnormal return based on logarithmic return around the event period (pre-event, on event and post-event), abnormal return and cumulative abnormal return have an increase on days 0 after that there is decrease again, Where the increase is estimated at 8%, abnormal return has fluctuation effect after event day.

**Figure 2.** Abnormal return and Cumulative Abnormal return based on discrete return



Source: Own study.

Figure 2 show abnormal return and cumulative abnormal return based on discrete return around the event period (pre-event, on event and post-event), abnormal return and cumulative abnormal return have an increase on days 0 after that there is decrease again, Where the increase is estimated at 8.67%, abnormal return has fluctuation effect after event day.

**Table 1.** Show the abnormal returns and cumulative abnormal returns based on logarithmic return for Pfizer Company.

Period	Day <sub>t</sub>	AR	t-test log	p-value	Sign. Level
Pre-Event	-10	0.380%	0.24	0.813010529	
Pre-Event	-9	-1.620%	-1.01	0.313987838	
Pre-Event	-8	-3.073%	-1.91	0.056727431	10% LEVEL
Pre-Event	-7	-1.400%	-0.87	0.38402806	
Pre-Event	-6	2.128%	1.33	0.186138006	
Pre-Event	-5	1.902%	1.18	0.23715736	
Pre-Event	-4	-1.154%	-0.72	0.472757606	
Pre-Event	-3	0.881%	0.55	0.58354495	
Pre-Event	-2	-3.007%	-1.87	0.062238304	
Pre-Event	-1	0.070%	0.04	0.965058315	
On Event	0	8.404%	5.23	3.4992E-07	1% LEVEL
Post-Event	1	-0.440%	-0.27	0.784163422	
Post-Event	2	-1.606%	-1.00	0.318207581	
Post-Event	3	-2.039%	-1.27	0.205328483	
Post-Event	4	2.260%	1.41	0.160442869	
Post-Event	5	-3.815%	-2.38	0.018240799	5% LEVEL

Post-Event	6	1.933%	1.20	0.229716772
Post-Event	7	1.337%	0.83	0.405763791
Post-Event	8	-0.819%	-0.51	0.610251037
Post-Event	9	1.717%	1.07	0.285839905
Post-Event	10	-0.558%	-0.35	0.72867397

	Return (CAR)	t-test (CAR)	P-VALUE (CAR)
Event 0,1	7.9640%	5.23*	0.00
Pre-Event -10,-1	-4.8917%	-0.96	0.34
Post-Event 1,10	-2.0292%	-0.28	0.78

Source: Own study.

Table 1 show the abnormal returns and cumulative abnormal returns based on logarithmic return for Pfizer company, in event day ARs has statistical significant at 1% level so we can reject the null hypotheses and the stock price of Pfizer on average, as a result Pfizer reacted positively on the covid-19 vaccine announcement by 8.404%, and it will increase the shareholder wealth, while after 5 day there is negative impact on stock price and the reaction is statistical significant at 5% level.

Moreover, the cumulative abnormal return on event period (0,1) is statistical significant at 1% level and its 7.964% so Pfizer reacted positively on the covid-19 vaccine announcement, while the CAR for pre-event and post-event are not significant, Supports the sustainability of the impact of the announcement and supports the proper detection of the day of the announcement as well as the durability of the methods used to measure the reaction of the market. Our results are similar to previous studies like Adaoglu and Lasfer (2008).

**Table 2.** Show the abnormal returns and cumulative abnormal returns based on discrete return for Pfizer Company.

Period	Day <sub>t</sub>	AR	t-test dis	p-value	Sign. Level
Pre-Event	-10	0.374%	0.23	0.816410541	
Pre-Event	-9	-1.613%	-1.00	0.317655403	
Pre-Event	-8	-2.971%	-1.85	0.066237205	<b>10% LEVEL</b>
Pre-Event	-7	-1.407%	-0.87	0.383180337	
Pre-Event	-6	2.112%	1.31	0.1910231	
Pre-Event	-5	1.924%	1.19	0.233380797	
Pre-Event	-4	-1.165%	-0.72	0.470257103	
Pre-Event	-3	0.886%	0.55	0.582662053	
Pre-Event	-2	-3.015%	-1.87	0.062350101	
Pre-Event	-1	0.070%	0.04	0.965167143	
On Event	0	8.679%	5.39	1.66203E-07	<b>1% LEVEL</b>
Post-Event	1	-0.437%	-0.27	0.786342906	
Post-Event	2	-1.617%	-1.00	0.316429028	
Post-Event	3	-2.009%	-1.25	0.213414996	
Post-Event	4	2.297%	1.43	0.15508218	
Post-Event	5	-3.760%	-2.33	0.020366452	<b>5% LEVEL</b>
Post-Event	6	1.948%	1.21	0.227557815	
Post-Event	7	1.338%	0.83	0.406898128	

Post-Event	8	-0.821%	-0.51	0.61064781
Post-Event	9	1.726%	1.07	0.284751711
Post-Event	10	-0.556%	-0.35	0.72998273

	Return (CAR)	t-test (CAR)	P-VALUE (CAR)
Event 0,1	8.2416%	5.12*	0.00
Pre-Event -10,-1	-4.8043%	-0.94	0.35
Post-Event 1,10	-1.8906%	-0.26	0.80

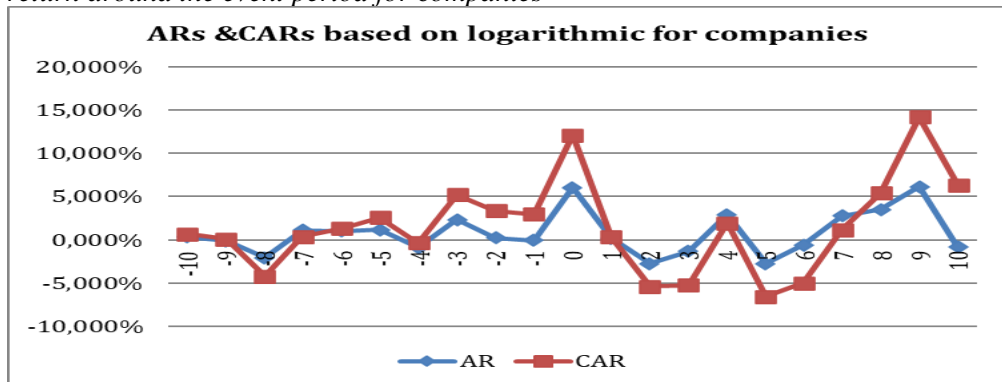
Source: Own study.

Table 2 show the abnormal returns and cumulative abnormal returns based on discrete return for Pfizer company, in event day ARs has statistical significant at 1% level and so we can reject the null hypotheses and the stock price of Pfizer on average, as a result Pfizer reacted positively on the covid-19 vaccine announcement by 8.679%, and it will increase the shareholder wealth, while after 6 day there is negative impact on stock price and the reaction is statistical significant at 5% level.

Moreover, the cumulative abnormal return on event period (0,1) is statistical significant at 1% level and its 8.2416% so Pfizer reacted positively on the covid-19 vaccine announcement, while the CAR for pre-event and post-event are not significant, Supports the sustainability of the impact of the announcement and supports the proper detection of the day of the announcement as well as the durability of the methods used to measure the reaction of the stock price.

Part two examines the impact of the covid-19 vaccine announcement on corporations stock price (AstraZeneca, Pfizer, Moderna and Biontech, Johnson & Johnson) Our results are similar to previous studies like Adaoglu and Lasfer (2008).

Figure 3. Abnormal return and cumulative abnormal return based on logarithmic return around the event period for companies

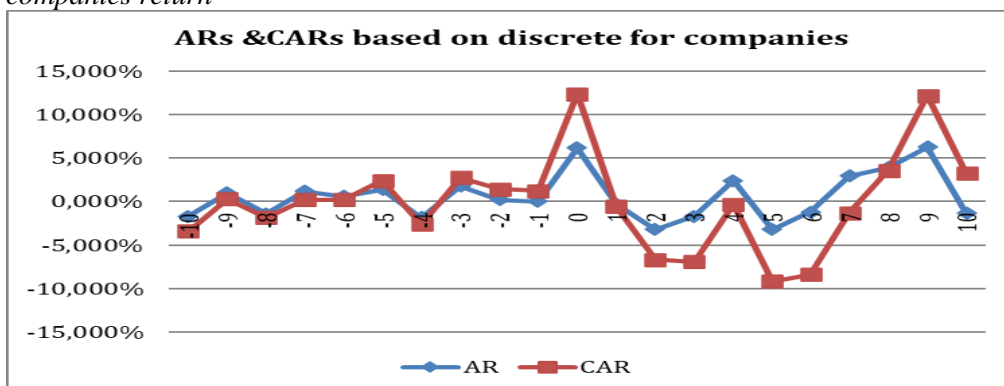


Source: Own study.



Figure 3 show abnormal return and cumulative abnormal return based on logarithmic return around the event period (pre-event, on event and post-event) for companies, abnormal return and cumulative abnormal return have an increase on days 0 after that there is fluctuation in the market reaction, Where the increase is estimated at 6.059%.

**Figure 4.** Abnormal return and cumulative abnormal return based on discrete for companies return



Source: Own study.

Figure 4 show abnormal return and cumulative abnormal return based on discrete return around the event period (pre-event, on event and post-event) for companies, abnormal return and cumulative abnormal return have an increase on days 0 after that there is decrease again, Where the increase is estimated at 6.185%, abnormal return has fluctuation effect after event day.

**Table 3.** The abnormal returns and cumulative abnormal returns based on logarithmic return companies

Period	Day <sub>t</sub>	Avg. AR	t-value	p-value	% count>0	sign. Level
Pre-Event	-10	0.3428%	0.16201	0.877641	60%	
Pre-Event	-9	-0.1204%	-0.05691	0.956822	40%	
Pre-Event	-8	-2.0579%	-0.97259	0.375424	40%	
Pre-Event	-7	1.0940%	0.517023	0.627189	60%	
Pre-Event	-6	1.0216%	0.482838	0.649609	80%	
Pre-Event	-5	1.1499%	0.543468	0.610151	60%	
Pre-Event	-4	-0.8862%	-0.41884	0.692719	20%	
Pre-Event	-3	2.3408%	1.106278	0.318971	100%	
Pre-Event	-2	0.2429%	0.114793	0.913076	40%	
Pre-Event	-1	-0.0810%	-0.03829	0.970938	60%	
<b>On Event</b>	<b>0</b>	<b>6.0589%</b>	<b>2.863525</b>	<b>0.035261</b>	<b>80%</b>	<b>5% level</b>
Post-Event	1	0.1731%	0.081824	0.937961	20%	
Post-Event	2	-2.7759%	-1.31192	0.246548	0%	
Post-Event	3	-1.3323%	-0.62968	0.556551	40%	

Post-Event	4	2.9320%	1.385688	0.224467	100%	
Post-Event	5	-2.7701%	-1.30917	0.247409	60%	
Post-Event	6	-0.6216%	-0.29377	0.780735	60%	
Post-Event	7	2.7835%	1.315494	0.245434	80%	
Post-Event	8	3.5157%	1.661561	0.157491	60%	
Post-Event	9	6.1471%	2.905197	0.033587	100%	5% level
Post-Event	10	-0.8578%	-0.4054	0.701946	60%	

	CAR Value	Length	t-value	p-value	Sign. level
<b>CAR (-10,-1)</b>	0.030464	10	0.455298	0.679826	
<b>CAR (-5,-1)</b>	0.027664	5	0.584692	0.599821	
<b>CAR (0,1)</b>	0.062321	2	2.082677	0.128673	
<b>CAR (0,5)</b>	0.022857	6	0.441015	0.68905	
<b>CAR (0,10)</b>	0.132526	11	1.888467	0.155389	
<b>CAR (2,5)</b>	-0.03946	4	-0.93254	0.419846	
<b>CAR (2,10)</b>	0.070205	9	1.105996	0.349452	

Source: Own study.

Table 3 show the abnormal returns and cumulative abnormal returns based on logarithmic return companies, for ARs period is (-10, +10) related to day 0 announcement day, the reaction of covid-19 vaccine announcement on average ARs is statistical significant positive effect at 5% level event day (day 0) by 6.0589%, 80% of the sample have positive abnormal return on day 0, after that market reaction start decrease for two days more on day 1, 100% of sample has negative abnormal return and in day 2, and sample has zero positive abnormal return, on day 9 there is significant and positive effect in the market and abnormal return is 6.1471% and the sample has 100% positive abnormal return. Cumulative abnormal return are not significant during the period (-10,-1), (-5,-1), (0,1), (0,1), (0,10), (2,5) and (2,10), so there is no effect of wealth covid-19 vaccine announcement in the market or there are some companies that have a positive effect on wealth while there is a negative effect for others. Our finding are similar to the pervious study Nadig (2015).

**Table 4.** The abnormal returns and cumulative abnormal returns based on logarithmic return companies

Period	Day <sub>t</sub>	Avg. AR	t-value	p-value	% count>0	Sign. Level
Pre-Event	-10	-1.703%	-0.78065	0.470335	40%	
Pre-Event	-9	0.996%	0.456797	0.666976	40%	
Pre-Event	-8	-1.406%	-0.64459	0.547599	60%	
Pre-Event	-7	1.170%	0.536464	0.614637	60%	
Pre-Event	-6	0.581%	0.266362	0.800596	80%	
Pre-Event	-5	1.395%	0.639536	0.550621	60%	
Pre-Event	-4	-1.837%	-0.84214	0.438123	0%	
Pre-Event	-3	1.774%	0.813506	0.452911	80%	
Pre-Event	-2	0.230%	0.105677	0.919947	40%	
Pre-Event	-1	0.028%	0.012881	0.990221	60%	

<b>On Event</b>	<b>0</b>	6.185%	2.835853	0.065871	80%	<b>5% level</b>
<b>Post-Event</b>	1	-0.287%	-0.13164	0.900405	20%	
<b>Post-Event</b>	2	-3.200%	-1.46738	0.202195	0%	
<b>Post-Event</b>	3	-1.710%	-0.78417	0.468443	20%	
<b>Post-Event</b>	4	2.427%	1.112733	0.316439	100%	
<b>Post-Event</b>	5	-3.200%	-1.46716	0.20225	40%	
<b>Post-Event</b>	6	-1.211%	-0.55537	0.602573	60%	
<b>Post-Event</b>	7	2.947%	1.351275	0.234528	80%	
<b>Post-Event</b>	8	3.916%	1.795789	0.132474	60%	
<b>Post-Event</b>	9	6.252%	2.86683	0.035125	100%	<b>5% level</b>
<b>Post-Event</b>	10	-1.338%	-0.61333	0.566484	60%	

	<b>CAR Value</b>	<b>Length</b>	<b>t-value</b>	<b>p-value</b>	<b>Sign. level</b>
<b>CAR (-10,-1)</b>	0.012297	10	0.178305	0.869844	
<b>CAR (-5,-1)</b>	0.015909	5	0.326225	0.765687	
<b>CAR (0,1)</b>	0.058977	2	1.91217	0.151802	
<b>CAR (0,5)</b>	0.002143	6	0.040107	0.970528	
<b>CAR (0,10)</b>	0.107812	11	1.490503	0.232876	
<b>CAR (2,5)</b>	-0.05683	4	-1.30299	0.28357	
<b>CAR (2,10)</b>	0.048836	9	0.746408	0.50959	

*Source: Own study.*

Table 4 show the abnormal returns and cumulative abnormal returns based on discrete return companies, for ARs period is (-10, +10) related to day 0 announcement day, the reaction of covid-19 vaccine announcement on average ARs is statistical significant positive effect at 5% level event day (day 0) by 6.185%, 80% of the sample have positive abnormal return on day 0, after that market reaction start decrease for two days more on day 1, 80% of sample has negative abnormal return and in day 2, no sample has zero positive abnormal return, on day 9 there is significant and positive effect in the market and abnormal return is 6.252% and the sample has 100% positive abnormal return. Cumulative abnormal return are not significant during the period (-10,-1), (-5,-1), (0,1), (0,1), (0,10), (2,5) and (2,10), so there is no effect of wealth covid-19 vaccine announcement in the market or there are some companies that have a positive effect on wealth while there is a negative effect for others.

## 7. Conclusion

The study investigate the impact of covid-19 vaccine announcement for Pfizer company alone and AstraZeneca, Pfizer, Moderna, Biontech and Johnson & Johnson together on stock price and market reaction, the number of companies were limited because just this companies that launch the covid-19 vaccine, the study found that there were positive abnormal return and Cumulative abnormal return impacts for covid-19 vaccine announcement on Pfizer company based on both logarithmic return and discrete return methods.

Furthermore, impact of covid-19 vaccine announcement for companies were positive abnormal return and statistical insignificant Cumulative abnormal return impacts for covid-19 vaccine announcement based on both logarithmic return and discrete return methods.

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