The Tehran Stock Exchange Reaction to Covid-19 Outbreak Announcement

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ABSTRACT

While prior research on the Covid-19 effects on stock markets focused on developed countries, this study aims to examine the impact of Covid-19 on Iran's emerging and developing market. The study sample comprised 245 companies listed on the Tehran Stock Exchange (TSE). This study uses panel-data regression models to evaluate the influence of the Covid-19 announcement on stock returns from February 12th to February 26th, 2020. The study results indicate that the announcement of the Coronavirus outbreak in Iran had not caused an abnormal return on the TSE. In examining the impact of this event on various industries, we have observed that other sectors did not show abnormal reactions through the news except for the three groups of banks, base metals, and pharmaceutical companies. Discussion and conclusion: the findings of this study suggest the poor market efficiency of TSE. Considering TSE is subject to macro-variables in the country, we have found that the metal industry in Iran converges with the global market of metals. Future research and implication: the investors should pay attention to international events affecting the metal industry, which brings new topics to focus on for future research. To investigate the long-term effect of this event on the capital market, future research is suggested to use models such as GARCH.

KEYWORDS: Financial Economics, Tehran Stock Exchange, Covid-19 Pandemic, Emerging Markets, Event Study, Panel Analysis, Iran

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Covid-19 пандемиясының Тегеран қор биржасына әсерін бағалау

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ТҮЙІН

Коронавирустық инфекция Covid-19 қор нарықтарына әсері туралы алдыңғы зерттеулер дамыған елдерге бағытталған болса, бұл зерттеу коронавирустық инфекция Covid-19 пандемиясының Иран қор биржасының дамып келе жатқан нарығына әсерін зерттеуге бағытталған. Зерттеу үлгісіне Тегеран қор биржасында (ТҚБ) тіркелген 245 компания кірді. Бұл зерттеу 2020 жылдың 12 және 26 ақпаны аралығындағы коронавирустық инфекция Covid-19 акцияларының өнімділігіне әсерін бағалау үшін панельдік деректер регрессия үлгілерін пайдаланады. Зерттеу нәтижелері Ирандағы коронавирус індеті туралы хабарландыру қор нарығында қалыптан тыс өсуді тудырмағанын көрсетті. Пандемияның әртүрлі салаларға әсерін талдай отырып, банктердің, металлургиялық компаниялардың және фармацевтикалық компаниялардың үш тобын қоспағанда, басқа секторлар жаңалықтарға ерекше реакция көрсетпегені атап өтілді. Талқылау және қорытынды: Бұл зерттеудің нәтижелері ТҚБ нарықтық тиімділігінің төмендігін көрсетеді. ТҚБ елдегі макро айнымалыларға тәуелді екенін ескере отырып, біз Иранның металл өнеркәсібі әлемдік металдар нарығымен жақындасып жатқанын анықтадық. Болашақ зерттеулер мен салдарлар: Инвесторлар болашақ зерттеулер үшін жаңа тақырыптар ашатын болат өнеркәсібіне әсер ететін халықаралық оқиғаларға назар аударуы керек. Короновирустың капитал нарығына ұзақ мерзімді әсерін одан әрі зерттеу үшін болашақ зерттеулер GARCH сияқты модельдерді пайдалануды ұсынады.

ТҮЙІН СӨЗДЕР: қаржы экономикасы, Тегеран қор биржасы, Covid-19 пандемиясы, дамушы нарықтар, оқиғаларды зерттеу, панельдік талдау, Иран

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Оценка влияния пандемии Covid-19 на Тегеранскую фондовую биржу

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АННОТАЦИЯ

В то время как предыдущие исследования о влиянии Covid-19 на фондовые рынки были сосредоточены на развитых странах, данное научное исследование направлено на исследование влияния пандемии Covid-19 на формирующийся рынок фондовой биржи Ирана. Выборка для исследования включала 245 компаний, котирующихся на Тегеранской фондовой бирже (ТФБ). В данном исследовании используются регрессионные модели панельных данных для оценки влияния Covid-19 на доходность акций в период с 12 по 26 февраля 2020. Результаты исследования показали, что объявление о вспышке коронавируса в Иране не вызвало аномального роста фондового рынка. Анализируя влияние пандемии на различные отрасли было отмечено, что другие секторы не проявили необычной реакции на новости, за исключением трех групп банков, металлургических компаний и фармацевтических компаний. Обсуждение и заключение: результаты этого исследования свидетельствуют о низкой рыночной эффективности ТФБ. Учитывая, что ТФБ зависит от макропеременных в стране, мы обнаружили, что металлургическая промышленность Ирана сближается с мировым рынком металлов. Будущие исследования и последствия: инвесторам следует обратить внимание на международные события, влияющие на металлургическую промышленность, что открывает новые темы для будущих исследований. Для дальнейшего исследования долгосрочного влияния короновируса на рынок капитала в будущих исследованиях предлагается использовать такие модели, как GARCH.

КЛЮЧЕВЫЕ СЛОВА: финансовая экономика, Тегеранская фондовая биржа, пандемия Covid-19, развивающиеся рынки, исследование событий, панельный анализ, Иран

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1. Introduction

On December 31st, 2019, the World Health Organization (WHO) identified the first case of COVID-19 in Wuhan, China. COVID-19 symptoms were hard to confirm and control during the early stages, which may occur within 2 to 14 days after exposure to or contact with the affected person based on Centers for Disease Control and Prevention (CDCP) research (Liu et al., 2020a). On March 11th, 2020, WHO officially declared the COVID-19 outbreak a "pandemic" and described it as the "worldwide spread of new disease" (Liu et al., 2020b; Briefing on COVID-19, 2020) by appraising the critical risk of spread and severity of COVID-19 outside China. All over the world have been announcing the number of cases and deaths since the inception of the pandemic.

The Coronavirus (COVID-19) has turned a health crisis into an economic crisis (Saneifar & Saeedi, 2020; Herwany et al., 2021). Kristalina Georgieva, managing director of the International Monetary Fund (IMF), describes it as "the world faced the worst economic crisis since the Great Depression of the 1930s, and we anticipate the worst economic fallout since the Great Depression". Its outbreak has led to solid adverse reactions from stock markets in various countries and price fluctuations in many macroeconomic variables. On the other hand, the propagation of the virus provides a basis for examining the effects of its outbreak on stock markets and economic variables, as well as the effectiveness and speed of information dissemination in times of crisis (Saneifar & Saeedi, 2020). Financial markets did not react due to incomplete information about the virus since the first case was identified until WHO officially declared the pandemic. However, investors' fears led to more stock market crashes after the virus outbreak in various countries. Financial markets, including; stocks, bonds, and commodities (including crude oil and gold), have been severely and widely affected by the economic unrest brought on by the COVID-19 pandemic (Hongsakulvasu & Liammukda, 2020; Alam et al., 2020). The WHO and public health officials deserve credit for performing the role of mediator to disclose the risk of an outbreak to the investors and form the investors' impressions of the disease (Liu et al., 2020a; Khanthavit, 2020; Smith, 2006). Investors' impressions influence the stock markets significantly.

On February 19th, 2020, Iran reported its first confirmed cases of infections in Qom. The total of cases in Iran was reported at 2.26 million until April 19th, 2021 (Iran Coronavirus Cases, n.d.). Like many other countries, Iran was impacted by the virus's poison (Blandenier et al., 2020). Iran›s capacity to react to the virus is considerably impaired by one-sided economic sanctions re-imposed after the US Administration withdrew from the nuclear deal in May 2018 and US sanctions imposed recently on March 18th, 2020 (Murphy et al., 2020). Also, Iran is culturally more vulnerable to herd-like actions and overreaction, so the effect of investor impression on the stock market is more obvious (Donadelli et al., 2017; Zouaoui et al., 2011).

TSE is an emerging or developing market that covers a small percentage of the country's financing system. Large enterprises are financed mainly through banks, not the Stock Market, while developed countries are stock-oriented. Iran Stock Market stockholding is mainly state-owned, and a small portion of approximately 20% of the capital in the Floating Stock is accessible to the public.

There is a correlation between economic development and the development degree of a country's Stock Market. We observed the increasing growth of the Iran Stock Market Index until March 2020, and the main reason for the growth was inflation and liquidity. We have detected Stock Market crashes in different countries after the outbreak of COVID-19. However, there were various speculations about TSE; some believed that COVID-19 positively affected the TSE. We periodically observe inflation and cross-rate growth; when the cross-rate increases, it causes the general price level rises, including physical assets and corporate stocks. As a result, we can detect the growth of the TSE Index (Safari, 2020). In March 2019, Tehran Stock Exchange Index started with 178659 units and ended up with 512900 units in March 2020. This year has been profitable and remarkable, with 187 percent aggressive growth for Iranian stakeholders (Ghasemieh, 2020). The price increase in the context of Coronavirus outbreaks was irregular since TSE was growing while other countries had Stock Market crashes. There was a similar experience in the economic crisis of 2008. 2008 the world's Stock Exchange Index decreased, while the TSE Index increased from 30000 to 80000 units. That is because no Iranian company involves in foreign stock exchanges, and no foreign company involves in the TSE (Safari, 2020). Tehran Stock Exchange is subject to macro-variables in the country. All the

cases mentioned above make investigating TSE exciting during the pandemic. Non-professional interventions in the Iranian economy, including the Stock Market, and herd-like and offhand people's actions have always been catastrophic. As we know, the Iranian government encouraged people to invest in this market for unjustified reasons. People entered the capital market recklessly, hoping for the government's benevolence and foresight and striving for higher and faster profits to maintain their purchasing power.

Existing literature focuses on illness-associated costs of medical or economic effects emerging from discomfort and death due to this disease (Liu et al., 2020b). However, stock markets are interlinked, and events like contagious disease outbreaks can strongly affect investment decisions and, as a result, stock market prices (Morales & Andreosso-O'Callaghan, 2012). Existing literature, however, focuses on developed and emerging markets such as the US, China, Germany, South Korea, and Italy. There is a lack of studies on stock returns in developing stock markets, including Iran. This paper is the first study to examine the impact of COVID-19 on stock performance in Iran, where it has not been long since people got interested in investing in stocks, and the majority of the public does not have expert knowledge of the stock market.

The purpose of our study is a) to focus on Iran's emerging and state-owned stock market (TSE) and examine the convergence of Iran's market with global markets (probability of closeness of results to developed countries) in order to open the way for future research, b) to see the market efficiency, and c) to draw the attention of management accounting and behavioral finance to this market for their future research. So, this paper contributes to the accounting and finance literature. First, existing literature focuses on developed countries with effective monitoring systems, and this is the first study to investigate the effect of an epidemic crisis on Iran's emerging and developing country with no robust monitoring system (both in the firms and capital market levels). Moreover, thus, this study adds to the extant literature.

Second, this study provides a better understanding of market efficiency in TSE. Stock market efficiency is commonly affected by different occurrences at different stages. In behavioral finance, it is generally accepted that occurrences causing massive panic: such as wars, economic, political, and financial crises,

and pandemics, often start on a breakdown of the efficient market hypothesis by leading asset prices to diverge from their fundamental values. Our result leads us to understand the efficiency of this event on TSE, and we can say that the forecast on the impact of this event on the capital market was in line with experts' expectations. That shows poor market efficiency, which leaves a wish list of topics for future research.

The remainder of this paper is organized as follows—section 2 reviews related literature and market reaction to new information. Section 3 provides the institutional background and then develops the research hypothesis. Section 4 presents the methodology, sample selection procedure, and market model. Section 5 reports the results of testing the hypothesis and the robustness test. Finally, section 6 concludes the paper.

2. Literature review
2.1 Market reaction to new information
A comprehensive set of previous studies has worked on event-included effects on the stock markets index—the majority of the first empirical papers to emerge observed the American market (Škrinjarić, 2019). Fama (1970) published an article describing the theory of capital markets, which eventually brought about a noticeable amount of literature published in the last decades. The central concept of the hypothesis is "a market is defined as efficient when current stock price fully reflects new information made available in financial markets". He also proposed that a price that "fully reflects" new information comes in three forms. Additionally, he proposes that a price that "fully reflects" new information comes in three forms. First, a financial market that is only reflected by its past prices or return histories refers to a weak form. Second, suppose the market also has taken other publicly available information (i.e., announcements within the market) into account. The current price tends to adjust immediately, which brings us to the semi-strong form. Last, market participants that possess monopolistic access to vital information that impacts price refers to the strong form.

Nevertheless, a vast and developing body of literature has challenged the market efficiency hypothesis. For instance, scholars in behavioral finance argue that academic finance needs supplements of other broader social science perspectives, such as psychology and sociology (Free & Free, 2010; Gilad et al., 1984; Mullainathan & Thaler, 2000). According to

Shiller (2003), for some scholars at least, the evidence of excess volatility seems to indicate that price fluctuations occur for no fundamental reason at all, that they occur due to various things such as "sunspots" or "animal spirits" or just mass psychology. Brown (2011) indicates that no fundamental mechanism leads prices to "fully reflect" new information and that the hypothesis does not serve as a benchmark for detecting, e.g., when a bubble is forming and when it might collapse. According to Malkiel (2003) and Leković (2020), Pricing models differ in standard and behavioral finance. Various researchers state that pricing is not always optimal, and the market has made several mistakes due to the market participants' irrationality. De Bondt and Thaler (1985) conclude that experimental psychology shows that people appear to "overreact" to dramatic and unpredictable incidents. However, Merrill (1966) focuses on American stock market reactions to incidents relevant to presidential illness or death. The Wall Street stock market immediately responded negatively to the news of the presidential illness or death. Nevertheless, the first day after the announcement passes, the stock market continued to increase and recover from the earlier decline. According to the author, a price reaction followed by an almost immediate correction could be a feature of the market's overreaction to events. The evidence scholars mentioned about the stock market that tends to overreact to certain events challenges Fama's theory of an efficient market.

2.2 World major events and stock market returns

2.2.1 The Impact of major political events

A broad set of previous studies has worked on the impact of political events on the financial markets of both developed and developing countries. The first to study the impact of political events was Niederhoffer (1971). According to this study, significant price changes strongly tend to display the same direction of change in the first- and second days following world events. There is a tendency to increase on days 2-5 following events. The market appears to be overreacting to bad news on certain occasions. The paper also states that the initial stage of a particular political crisis has the most significant impact on stock market prices, e.g., the democratic convention (1952).

Guidolin and Ferrera (2010) analyzed a sample of 101 internal and inter-state conflicts during 1974-2004 and how they, in turn, influenced stock markets in the US, Great Britain, France, and Japan. The result suggested that conflicts significantly impact the stock market return and that, in general, national stock markets appear to respond positively to the incidence of conflict. There have also been studies on political activities that are not linked to conflict or acts of violence; e.g., Brooks *et al.* (2005) studied the impact of the unification process of Germany during 1989-90 on the stock market returns. In this article, 31 countries were analyzed during the most critical dates surrounding the unification. Besides indicating that the occurrence caused an impact on stock market prices, the findings also indicate that the degree of impact on a country's stock market is related to the degree of economic exchange that a particular country had with Western and Eastern Germany. Both Belgium and France, great trading partners with Western Germany, recorded the most negative stock market returns during the period of the German reunification.

Moreover, subsequent research has been conducted on political and economic agreements' impact on stock market prices. For example, Moser and Rose (2014) examined the price reactions following RTA (Regional Trade Agreements) announcements, wherein 200 RTAs and 80 countries were analyzed over 20 years. The scholars discovered evidence that stock markets responded positively to the formation of RTAs, especially among countries that were major trading partners.

2.2.2. The impact of major economic events

Chen et al. (1986) examine the relationship between stock market prices and economic events. The paper discusses how systematic economic factors, such as changes in Industrial production or oil prices, impact stock market return and pricing, emphasizing the NYSE. According to the research outcome, markets are systematically exposed to economic news, and stock market pricing reflects this. Narayan and Narayan (2012) published a paper that examined the effects of major macroeconomic events in the United States on Asian stock markets from 2000 to 2010. The results differ; some countries' stock markets respond to certain macroeconomic events, while others do not. Regarding how the Asian stock market reacted to news about the US monetary policy, only the Philippines stock market responded positively. The scholars also indicated that economic depreciation in the United States following the outbreak of the

financial crisis in 2007/2008 had a significant negative impact on stock markets in all seven countries examined.

On the other hand, Pearce and Roley (1984) conclude that some economically relevant occurrences do not deliver significant returns on stock market prices. The impact of economic news announcements on the stock market was studied in this article, and the authors concluded that there is no evidence that economic news related to inflation or actual economic activity influences stock market prices.

2.2.3 The impact of natural disasters

From an index perspective, little is known about the impact of natural disasters on stock market returns. However, Wang and Kutan (2013) examined whether natural disasters have an unquantifiable impact on the insurance sector and stock market return, as well as the overall stock market return in Japan and the United States. The researchers found no wealth effects in the US and Japanese composite stock markets because the returns in these markets are unaffected by any of the natural disasters in their analysis. The eruption of the Icelandic volcano Eyjafjallajokull in 2010 is another example of significant event caused by natural causes. This is an example of how natural resource-related events tend to be firm-specific regarding abnormal returns, as Mazzocchi *et al.* (2010) concluded. The study also found that while the flight industry suffered economically from the incident, other sectors, such as car rental, benefited. However, there were no signs of consumer reactions at the country level.

2.2.4 The impact of illness outbreak (SARS and COVID-19)

Infectious disease does not take long to propagate across national boundaries in today's highly connected world. Siu and Wong (2004) analyzed the economic impact of Hong Kong's SARS outbreak, concluding that the most significant adverse effects were seen on the demand side, with local consumption and tourism and air travel-related services exports having a short-term impact. The economy was spared from supply disruptions because the manufacturing base in the Pearl River Delta remained unchanged, and most products were shipped to Hong Kong. Lee and McKibbin (2004) investigated the global economic impacts of the SARS epidemic using the G-Cubed model. They indicated that the impact of the SARS outbreak on human society all around the world is

profound, not only because the disease spreads quickly across countries through global travel but also because of financial integration and globalization. Any economic shock to one country spreads quickly to others. According to DeLisle (2003), the expense of the 2003 SARS epidemic was comparable to the Asian financial crisis, with losses of $3 trillion in GDP and $2 trillion in financial markets equity.

Using an event study method, Chen et al. (2007) studied the impacts of the SARS outbreak on the productivity of Taiwanese hotel stocks. They discovered that seven publicly traded hotel firms experienced enormous income and stock price drops during the SARS outbreak period. On and after the day of the SARS outbreak, Taiwanese hotel stocks reported substantial negative cumulative mean abnormal returns, showing that the SARS outbreak significantly affected hotel stock results.

According to Wang et al. (2013), infectious disease outbreaks significantly impact the performance of biotechnology stocks in Taiwan. Investors may be cynical regarding investment opportunities in a particular industry and sell off the market's stocks if an infectious disease epidemic occurs (Bai,2014; Baker et al.,2012). According to Iyke (2020), COVID-19 has a significant and long-term negative impact on the world economy as a public health occurrence of international concern.

COVID-19's effect on the aviation industry and employment was studied by Sobieralski (2020). Many stock prices in China's A-share market have plummeted to all-time lows, and the US stock market has taken four record-breaking nosedives. However, there is limited market-level literature on COVID-19's impact on stock prices in the available research, and COVID-19's economic level has industry limitations (Njindan Iyke, 2020; Reilly, 2020; Saadat et al., 2020). The impact of the pandemic on oil prices was studied by Qin et al. (2020). Ali et al. (2020) examined the effect of COVID-19 on various financial securities and compared China to other economies but ignored the market departure. Also, the impact of COVID-19 on crude oil and stock prices in the United States was examined by Liu et al. (2020a).

Given the limited number of event study analyses on the topic, there is a need for further research on the effects of the outbreak, especially on developing stock markets like Iran. In this context, we examined the various changes in the Tehran Stock Exchange index during the

pandemic to see how TSE responded to the pandemic.

3. Hypothesis development

The economic environment in which businesses operate influences them around the world. Any environmental change has an impact on the business entity in any way. The shaping of the market environment is heavily reliant on information. The market capitalization, or price at which the company's stock or equity is traded, is now used to determine its valuation. These trades drive stock market movements. The information in every form is the stock market's response stimulus (Dubey & Sarma, 2013). "Influence" may impact a stock market's performance (Ibrahim & Aziz, 2003). "Influence" is a causative factor that pressures people or events to get them to behave in a certain way (Seyhun, 2000).

As mentioned earlier, in both developed and developing countries, the Stock Market is essential to their financial structure. Therefore, any factor likely to affect investor behavior and, thus, the stock market index/return should be studied. With the onset worldwide outbreak of Covid-19, researchers began to analyze its impact on the stock market. So, according to the theoretical foundations and by reflecting on research and financial literature, we also decided to assess the effect of the prevalence of Covid-19 on TSE, which is the only symbol of Iran's Capital Market. As mentioned earlier, we observed the increasing growth of the Iran Stock Market Index until March 2020, and the main reason for the growth was inflation and liquidity. After the outbreak of COVID-19, we detected Stock Market Crash in different countries, but there were various speculations about the Tehran Stock Exchange. We believe that, because of all the positive results that happened earlier and people's optimism, COVID-19 has a positive effect on the TSE. The main question for us is whether the announcement of the first case of Covid-19 affected the TSE index positively or not. The following hypotheses have been developed to answer the question and achieve the research goal.

H1: The announcement of the first case of Covid-19 affected the TSE index positively.

4. Methodology
4.1 Research method

The study of events has a long history. Dolley's (1933) thesis was perhaps the first to be published. Ball and Brown (1968) and Fama *et al.* (1969), in seminal studies conducted in the late 1960s, developed a methodology that is the same as that used today (Mackinlay, 1997). According to the event study method, if an efficient market concept is valid, the impact of a particular event is represented in the change in stock prices, which helps to explain the effect on stock returns and response to information disclosure. As a result, the event study method is commonly used in scientific economics and finance research to determine the impact of specific events. For example, Thompson (1993) examined the effect of expected sectoral changes to the United States-Canada Free Trade Agreement on industry-level stock returns and concluded that trade liberalization had a favorable aggregate impact on the economy. Other research on the effect of unexpected diseases on the stock market has also used the event study method. For example, Loh (2006) studied the impact of SARS on the performance and risk profiles of a set of airline stocks listed on the stock markets, finding that airline stocks were more sensitive to news about SARS than the average non-aviation stocks. Wang *et al.* (2013) examined how infectious disease outbreaks impacted the performance of biotechnology stocks, finding that regulatory infectious diseases caused substantial irregular returns in Taiwan's biotechnology industry. Murteza and Ali (2015) studied the Impact of Major Political Events on the Stock Market Returns of Pakistan.

Based on existing literature, the event study method is chosen to evaluate the TSE index's abnormal returns (ARs) and cumulative abnormal returns (CARs) during the COVID-19 pandemic.

4.2 Sample Selection Procedure

First, companies listed in the TSE, which have been traded from February 12, 2020 (a week before announcing the first case of Covid-19 in Iran) to February 26, 2020 (a week after announcing the first case of Covid-19 in Iran) have been included in the sample. The initial sample is comprised of 529 firms. In the next step, companies that had a general meeting in the period mentioned above (86 firms), as well as companies that had a capital increase in the same period (63 firms) or companies that were closed

for at least four days for various reasons (135 firms) were excluded from the sample. Consequently, after adjusting for outliers, the total number in our sample includes 245 firms from different industries, as presented in Table 1.

Table 1 – Sample Selection Procedure

Selection Procedure	
Total number of listed firms in TSE in the period under review	529
Less: firms that had a general meeting during the research period	(86)
Less: firms that had a capital increase during the research period	(63)
Less: firms that were closed for more than four days during the research period	(135)
Total number of firms in the sample	245

Also, to perform the robustness tests, the selected samples were divided into two parts: small and large companies and companies with high trading and low trading volumes. The selected sample comprised 112 large and 133 small companies. Also, the sample sizes were 141 high-trading-volume companies and 104 low-trading-volume companies.

4.3 Market model

Our study is conducted in an event study format, considering the Covid-19 outbreak announcement in Iran as an event and the publication date of this announcement as the zero date. This event's investigation period is from February 12, 2020, to February 26, 2020. The purpose is to examine the abnormal returns on stocks over 14 days (7 days before the announcement and seven days after the announcement). In the standard event study method, abnormal return is the difference between the actual return at time t and the expected return at time t (Ghaemi *et al.,* 2011). When abnormal returns are significant, evidence can indicate a market reaction to a new event.

There are several ways to calculate abnormal returns. In this study, the abnormal cumulative efficiency model was constructed as follows. The abnormal return on i's stock is calculated using the following equation:

$$AR_{i.t} = R_{i.t} + E(R_{i.t}), \qquad (1)$$

In equation 1, $AR_{i.t}$ refers to the abnormal return on the stock i at time t, $R_{i.t}$ refers to the normal return on the stock i at time t, and $E(R_{i.t})$ refers to the expected return on the stock i at time t (Brown & Warner, 1985). The most important part of this equation is $E(R_{i.t})$, for which various methods have been proposed to calculate. A stock's expected return can be adjusted regardless of the market pattern, average, or market return. We calculate $E(R_{i.t})$ using equation (2) as follows:

$$E(R_{i.t}) = aj + \beta_{i.t}R_{m.t} + \epsilon_{i.t}, \qquad (2)$$

In equation 2, $R_{m.t}$ is the market return in period t. The parameters α and β are market parameters estimated based on the least squares error method. Only the average stock return in a particular period can be used when calculating the abnormal return. In this case, the value of β is zero. Then, abnormal returns for the event window were standardized, as shown below:

$$SAR_{i.t} = AR_{i.t}\sqrt{(var(AR_{i.t}))}, \qquad (3)$$

Where the variance of abnormal return is defined as follows:

$$VAR(AR_{i.t}) = St^2 \left[1 + \left(\frac{1}{T}\right) + \left\{(R_{m.t} + R_m)^2 / \sum (R_{m.t} + R_m)^2\right\}\right], \qquad (4)$$

In equation 4, S^2 is the Residual variance of market model estimation; R_m is the mean return of the market index during the estimation period; $R_{m.t}$ is the market returns on day t in the estimation period, and $\sum$ is the summation over the estimation period which is 14 days in this study.

For each company, the SAR (standard abnormal return) is calculated and divided by the square root of the days in the event window. Finally, Z statistics for n companies is calculated using the sum of standardized cumulative abnormal return (SCAR) divided by the number of companies (n), which is expressed as follows:

$$Z = \sum SCAR / \sqrt{N}, \qquad (5)$$

Our main hypothesis (H1) is tested by determining the extent to which the SCAR metric for the seven-day event window significantly differs from zero. If the effect, If the p-value of t statistics is significant at 5 percent, our main hypothesis is not rejected.

5. Results

5.1 Descriptive Statistics

Table 2 presents the mean and the standard deviation for CAR and SCAR variables. The mean cumulative abnormal returns (CAR) and the standardized cumulative abnormal returns (SCAR) are positive. The mean CAR for the sample size is 3.11 percent. Also, the mean SCAR is 11.17 percent.

Table 2 – Descriptive statistics for the 14-day event window (full sample)

Variable	Mean	Std. Dev.	Minimum	Maximum
CAR	0.0311	0.0218	-0.0234	0.4527
SCAR	0.1117	0.0677	-0.1324	1.1892

CAR = cumulative abnormal return

SCAR = standardized cumulative abnormal return

Table 3 shows the mean and standard deviation of CAR and SCAR based on companies' size and trading volumes. According to Aghaei *et al.* (2014), large companies have more market value than the mean market value for all companies. Also, high trading volume companies are companies whose trading volume is more than the mean trading volume for all companies.

As shown, the mean CAR for large companies is 2.95 percent, while this means for small companies is 3.65 percent. Also, the standard deviation of the CAR in large and small companies is 2.11 and 2.77 percent, respectively. For companies with high trading volumes, the mean and standard deviation of the CAR is 2.98 and 2.1 percent, while for low trading volume companies, these values are 3.11 and 1.85 percent, respectively. A T-test has been used to examine the difference between the mean of CAR and SCAR in large and small companies and high and low volumes. The results are presented in the next section.

Table 3 – Descriptive statistics for the 14-day event window (sample parts)

Category	N	Mean CAR	Std. Dev. CAR	Mean SCAR	Std. Dev. SCAR
Large	112	0.0295	0.0211	0.1065	0.0315
Small	133	0.0365	0.0277	0.1169	0.0519
High trading volume	141	0.0298	0.0210	0.0915	0.0689
Low trading volume	104	0.0311	0.0185	0.0875	0.0894

CAR = cumulative abnormal return

SCAR = standardized cumulative abnormal return

5.2 Data Normality

Before testing the primary hypothesis, the data normality should be considered. For this reason, the Kolmogorov Smirnov (KS) test was used. H0 is tested at a 5 percent level to check the data's normalization. If the KS statistic is more than 0.05, there will be no reason to reject H0 in this case. In other words, data distribution will be expected. The results of the KS test for CAR and SCAR variables are presented in Table 4. Due to the KS statistic's P-value being more than 5 percent, it can be said that data are expected at the 95 percent level.

Table 4 – The results of the KS test for CAR and SCAR variables

Variable	KS statistics	P value
CAR	0.793	0.555
SCAR	0.138	0.898

5.3 Testing the Hypothesis

Our main hypothesis state that "the announcement of the first case of Covid-19 in Iran affected the TSE index positively." To test this hypothesis, we apply the T-test. Table 5 summarizes the results of testing the main hypothesis.

Investigating the P-value of Levene's test shows that the precondition for the equality of variances is established for the T-test. Also, the P-value related to the T-test (0.074) indicates the extent to which the SCAR metric for the seven-day event window is not significantly different from zero. In other words, the announcement of the Covid-19 outbreak in Iran has not caused an abnormal return of stocks in the Tehran stock exchange and has not responded to investors.

Table 5 – The results for testing the primary hypothesis

Variable	Levene's test		T-test		High limit	Low limit
	F	p-value	T	p-value	Upper	Lower
SCAR	1.32	0.288	1.788	0.074	4.76	-0.225

Non-compliance of the Tehran stock exchange from other financial markets can be related to the specific conditions of Iran in the year of the announcement of the Covid-19 outbreak news and the powerful political and economic influences of the time interval. With the investment of new investors and prominent advertising to enter the Tehran stock exchange at the time of the announcement of the Coronavirus news, the impact of this news dropped sharply, except for several industries (pharmaceuticals, metals, and banks), other industries affected by liquidity and new investors. Other influential variables that reduced the effect of the outbreak on the TSE can be mentioned as follows: high inflation, alongside the excitement of investors, reduced bank deposits, government support from the stock exchange, the reduction of government oil revenues, government support from the capital market due to the budget deficit, and inevitably financing the capital market high liquidity (Sarraf *et al.*, 2020).

5.4 Robustness tests

To ensure the results and that the analysis was not affected by external and other factors, post hoc tests were also done. Previous studies by Hayes et al. (2000) suggest that the results of small and large companies in the stock market in post-event reviews can differ. In addition, there is evidence that trading volume is adequate for corporate returns. For example, Delshad (2019) stated that the growth of trading volumes had caused more normal and abnormal returns in the TSE. Islami Bidgoli and Shabagpour (2015) concluded a negative relationship between trading volume and stock returns. Johnson and So (2012) also considered trading volume influential on ROS. Mohseni and Jamshidi (2018) also showed

that the company's size effectively affects stock returns. Farhan and Sharif (2015) showed the impact of firm size on stock returns at the Karachi stock exchange. Also, considering that events can have different effects on various industries, the impact of the announcement of the Covid-19 outbreak on various industries has been investigated separately.

5.4.1 Analysis at the industry level

After examining the Tehran stock market reaction to the Covid-19 outbreak announcement, we further investigate this reaction among different industries. The total sample comprised 245 firms from 19 industries. Except for three industries, the P-values related to the T-test indicates the extent to which the SCAR metric for the event window is not significantly different from zero. In other words, the group of banks and financial credit institutions, the main metals, and the pharmaceutical industry had an abnormal return, and there was no abnormal return on the other industries. Indeed, the main metal industry heavily depends on the global price of metals. The abnormal return of this industry is justified. Also, the event under review is a medical event and brings many changes for pharmaceutical companies that give rise to investors' attention. As a result, it has caused abnormal returns in this industry.

5.4.2 Analysis of firm size and trading volume level

After examining the Tehran stock market reaction to the Covid-19 outbreak announcement at the industry level. This section investigates this reaction between small/ large and high/ low trading volume companies. The results are presented in Table 6.

Table 6 – Market reaction to size and trading volume of firms

Variable	SCAR	t statistic	p-value	Test of difference
Large firms	7.34	2.892	0.005	P value = 0.003
Small firms	14.68	6.891	0.000	
High trading volume firms	14.43	0.156	0.183	P value = 0.347
low trading volume firms	15.73	0.164	0.102	

As shown, the market reacted significantly to large and small firms, but the market reaction to small firms was significantly more than the reaction to small firms. Also, the results indicate that the market did not react significantly to high and low-trading volume firms. Therefore, there was no difference seen in high and low-volume trading firms.

6. Summary and Conclusion

This study aimed to investigate the stock market reaction to the announcement of the Covid-19 news in Iran, which is the first to focus on this emerging and developing market and brings new issues for researchers to pay attention to. While previous evidence suggests an effect of similar events on the capital market in different countries, there was no empirical evidence about the impact of the Covid-19 announcement on Iran's stock market. This study calculated standard cumulative abnormal returns (SCAR) in a 14-day event window (-7, +7 days) for companies listed on the Tehran stock exchange. All present companies in the capital market were initially included in the sample (N = 529). After reducing the sample for outliers, we reduced the sample size to 245 companies. The findings showed that the announcement of the coronavirus outbreak in Iran had not caused an abnormal return on the Tehran stock exchange.

Meanwhile, many studies have shown that the announcement of Covid-19 has affected many of the world's financial markets. Ozkan (2021) led that market efficiency in six developed countries, The United States, Spain, the UK, Italy, France, and Germany, was heavily damaged. Deviation from market efficiency in US stock markets and Britain during the prevalence of Covid-19 was more than in other stock markets. In a similar study, Hung *et al.* (2021) also found that the virus has heavily influenced the stock market in Vietnam, and all industries have had abnormal reactions. These changes have been seen in more financial companies. Hatmanu and Cautisanu (2021) showed that, despite the positive economic variables of the European market, the virus had a negative shock on the Romanian economy and its stock market. Bahrini *et al.* (2020) also examined the outbreak›s effect on the Gulf Council stock market. During the prevalence of Covid-19, the daily returns of the major stock market indicators in the Gulf Cooperation Council declined. At the same time, the stock market of these companies has also been buoyant for oil prices.

This reaction can be related to Iran's specific political and economic conditions. During the announcement of the disease in Iran, Iran's stock market was influenced by many economic and political variables of a growing market. The severity of the influence of these variables was to such an extent that, except for several industries (that usually pattern from global markets), the rest of their companies and shareholders would not pay specific attention to the economic-medical event. Factors such as the intense media and government advertising, and an excessive influx of newcomers who led to the arrival of severe liquidity to the stock market, caused demand for shares of different companies to be more than its supply in a multi-month period. As a result, the TSE showed significant growth in this area, so negative news, such as the announcement of the first Covid-19 case in Iran, did not affect the shareholders. According to our purpose, which was to examine the convergence of this market with the developed countries' market, due to the reasons mentioned above, we must say that no behavioral consistency was observed. And it is suggested that Behavioral Finance researchers pay attention to this market and its investors.

Also, reviewing and comparing the stock return of large and small companies showed that the returns of large companies with the announcement of the Coronavirus outbreak had been significantly reduced. In contrast, small companies have increased compared to the N period. With the contagion of the Coronavirus, like in other countries, the probability of an economic downturn in the leading industries is more than in small industries. Investors have shown more inclination to invest in small enterprises. In addition, the result showed no significant difference between the abnormal returns of the high and low-volume companies. concerning this review and our purpose, it should be mentioned that large and high-volume are more likely to experience a drop like other markets, and financial managers can have better predictions of the stock position in these companies. Also, it is recommended to draw attention to management accounting for companies with convergence to global markets (high-volume and large companies) and companies with divergence (low-volume and small companies).

Considering the effect of the Coronavirus pandemic event in most global markets and the inefficiency of this event on the TSE, we can say that the Tehran stock exchange is not an efficient market. For this reason, it is suggested that

investors be more careful in choosing stocks and trading time in this risky market by carefully studying and identifying the factors affecting the trend of the TSE. Also, considering that the findings showed that the medical industry has a predictable reaction to medical events, it is suggested that investors pay special attention to this finding in investing in these companies and include the resulting information in their calculations. In addition, the findings indicate that the metal industry in Iran has a good convergence with the global market of metals. It is suggested to pay attention to international events affecting this industry. For future research, researchers are recommended to study and identify the factors that cause the lack of convergence of the TSE with global markets at this event. Further, use hierarchical clustering methods to rank these factors. It is also suggested to compare the results of this study with the impact of other important events, especially critical medical events, and analyze the results. To investigate the long-term effect of this event, future research is suggested to use models such as GARCH.

In the end, market inefficiency was observed in the TSE, and since this market is an emerging market, this issue must be considered and investigated.

One limitation of this study includes the impossibility of using the information of some companies due to the time asymmetry with the fiscal year of many companies in the Tehran stock market. Furthermore, other factors may also affect stock prices despite attention to some control variables, such as raising capital. So, another limitation of this research is the lack of control of other influential variables in the TSE.

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