



The Impact of the Covid-19 Outbreak on the Stock Value of Food Companies: Case Study of the Tehran Stock Exchange-Iran

S.M. Mojaverian^{1*}, F. Eshghi², S. Ahangari³

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Abstract

In addition to imposing a negative impact on public health, Covid-19 has made the world face a huge financial-economic crisis. The worldwide spread of the coronavirus has also affected the volume of transactions and the value of stocks. Since the food market is more affected under crisis conditions, this relationship has been investigated in the stock exchange in the present study. In order to investigate the effect of Covid-19 patients on the stock index value of food industry companies as well as the relationship between risk and stock index value, the official daily data of the Ministry of Health and Medical Education and the Financial Information Processing Center of Iran were collected from March 3, 2021 when the first report was announced, to June 2, 2021. Mean Conditional heteroscedasticity variance regression models were used in the current study. The statistical model specification tests showed that, first, the assumption of heteroscedasticity was rejected and the need to use heteroscedasticity models was proved. Secondly, the asymmetry assumption was accepted. Model estimation results showed a relationship between the numbers of Covid-19 patients with the stock value of the food industry that was an increase in the number of infected people causes a decrease in the stock value of the food industry. Therefore, like other economic sectors, the capital market was affected by the Covid-19 crisis, and increasing exchange rate as a competing market had a negative effect on the stock price index. Considering the relationship between risk and stock value of food industries, as expected, there was also an inverse and significant relationship between risk and stock value of food industry companies. In other words, an increase in risk leads to a decrease in the stock price of food industries.

JEL Classification: G17, G41

Keywords: Coronavirus, Conditional heteroscedasticity model, Iran, Stock market

Introduction

According to official statistics, the first Covid-19 related deaths in Iran were recorded in March 2020 (Ministry of Health and Medical Education, 2020). On the other hand, the main problem is not only the number of patients, but also the huge global economic

disruption. The lack of unified action to control the virus spread has led global stock markets into a panic. On March 9, 2020, the Morgan Stanley Capital International (MSCI) index, which monitors the average stock price of 1,647 largest companies in the world's stock exchanges, decreased by 8.9% during seven working days (a black week), which was the biggest drop since October 2008 until that time (Morales and Callaghan, 2020). In fact, investors' excitement significantly affects the stock market (Anusakumar *et al.*, 2017).

1, 2 and 3- Associate Professor, Assistant Professor and Ph.D. Student of Department of Agricultural Economics, Faculty of Agricultural Engineering, Sari Agricultural Sciences and Natural Resources University, Iran, respectively.

(* - Corresponding Author Email: mnojaverian@yahoo.com)

Coronavirus imposes different impacts on the financial markets of each country because the spread of the disease, the severity and the death rate on different sectors are ambiguous factors (Selmi and Bouoiyour, 2020). Covid-19 destroyed at least five thousand billion dollars of stock market value in one week (black week) and its rapid spread to other countries led to the fear of stock market investors (Saneifar and Saeedi, 2020).

Angel Gurría, as secretary-general of the Organization of Economic Co-operation and Development (OECD), believes that the economic impact of the recent epidemic has been greater than the global crisis of 2008: "Even if we do not witness a global recession, some global economies will either have no growth or their growth will be negative (Hutt, 2020). Kenneth Rogoff, one of the prominent global economic counsellors such as the International Monetary Fund (IMF), claimed that the size of the global economy will decrease continuously. Iran, like other countries, has been affected by the coronavirus (Jafari *et al.*, 2020, Taherinia and Hasanvand, 2020). In fact, the global coronavirus pandemic and its subsequent negative impacts on the global markets have led the investors to think that the Iranian stock market, like the stock market of other countries such as America, China, etc., is severely affected by this virus and the economy conditions and the affected companies (decrease in production, sales, exports, etc.), and this concern will cause the stock market to fall sharply; however, the stock market was affected by other important issues (Soheili *et al.*, 2020). The world community will experience a different lifestyle and food basket after Covid-19. In the meantime, it is expected that the role of food will find a significant place. Therefore, necessary mechanisms should be established to keep up with these changes in crop production and supply and transactions of this products in the stock market (Abedi and Farhani, 2020).

Recent studies on the impact of the coronavirus on the volume of stock market transactions, showed a fall in the stock prices.

In an article that investigated the reaction of stock prices to the coronavirus, researchers came to the conclusion that despite the presence of this virus, investors are worried about the debt and liquidity of companies and a financial crisis is created (Ramelli and Wagner, 2020). Another study titled "Analysis of the impact of the coronavirus on the stock market and potential investment strategies", also showed that most markets react negatively to such events in the short term (Yan *et al.*, 2020).

It was shown in an article that Covid-19 caused a sharp drop in the price of oil and in turn a sharp drop in stocks (Sharif *et al.*, 2020). The effect of Covid-19 on the fall of stock prices, which resulted in the fall of stock prices in global markets was also investigated in another study (Wang *et al.*, 2020). The impact of the coronavirus was investigated on the Indian economy, and it was concluded that the coronavirus has greatly affected various economic sectors and caused a sharp decline in the value of the stock market (Selmi and Bouoiyour, 2020). The reaction of the stock market of the United States and Europe at the onset of the Covid-19 pandemic was investigated, and it was confirmed that the stock market reacts negatively to the announcement of death in a country (Heyden, 2020). Considering the effect of the coronavirus on stock prices, it was shown why the stock markets have fallen sharply, and it was finally concluded that the financial stimulus news will strengthen the market and long-term growth (Gormsen and Koijen, 2020).

There have also been studies on the impact of the coronavirus on the financial markets. The fact that the death rate affects the volatility index of financial markets was investigated (Albulescu, 2020). It was concluded that there is a positive and significant relationship between Covid-19 cases and financial markets (Sansa, 2020). The global stock market network at the onset of the Covid-19 crisis was investigated and an increasing connection was observed between stock markets during the Covid-19 crisis

(Aslam *et al.*, 2020). The effect of Covid-19 on the stock market was investigated in six countries that suffered greatest impact due to this virus and it was concluded that the stock market behavior is affected by the Covid-19 news (Cepoi, 2020). The European stock market fluctuations during the Covid-19 crisis was investigated in France, Germany and England. The results showed that the stock market of England and France is predictable during this period (Li *et al.*, 2020).

The Covid-19 pandemic has impacts on the global economy and health to the extent that most businesses are completely closed due to government restrictions, the food sector must remain active throughout the supply chain in order to feed the nation. It is very important to maintain the health and safety of workers while maintaining a high level of food safety and consumer trust under such a challenging period. Considering the increasing uncertainty, up-to-date and reliable information is more important than ever for both regulatory bodies and this sector. Therefore, the impact of the Covid-19 on the volume of transactions and stock value of food companies is investigated in the present research.

Materials and Methods

A conditional heteroscedasticity model was used in the present study in order to take into account random heteroscedasticity fluctuations. Considering that the variability is demonstrated through the variance, the variance instability in the regression equation can be called uncertainty. It is necessary to use regression models of the mean conditional variance under such a situation (Menjazzb and Nosrati, 2018). If Y_t is the studied variable and all the classical assumptions including that the conditional variance remains constant, The conditional mean and variance of Y_t compared to X_t is:

$$E(Y_t|X_t) = \beta_0 + \beta_1 X_t \quad \text{Var}(Y_t|X_t) = \sigma^2 \quad (1)$$

In most of the real data, especially the highly fluctuating variables, this classical assumption is violated and the above conditional variance is heterogeneous, in other words:

$$\text{Var}(Y_t|X_t) = \sigma_t^2 \quad (2)$$

The conditional mean $[E(Y|X)]$ is calculated when the data of X vector is available, but there is no information about the nature of σ_t^2 . The fluctuating models suggest that the disturbance variance in each period depends on the information of the disturbance components of the past periods, that is:

$$\sigma_t^2 = \text{Var}(U_t|U_{t-1}, U_{t-2}, \dots) = E(U_t^2|U_{t-1}, U_{t-2}, \dots) \quad (3)$$

According to Equation 3, σ_t^2 can be calculated, if the value of past errors is known. The number of lagged disturbances that affects the conditional variance at period t can be optimized using lag statistics such as Schwarz Bayesian Information Criterion (SIC), Akaike Information Criterion (AIC) or Hannan-Quinn information criterion (HQ). For example, in the case of one lag, the model determines the Autoregressive Conditional heteroscedasticity (ARCH(1)) model. Consequently, in general cases, ARCH(q) is used as follows:

$$\sigma_t^2 = \alpha_0 + \alpha_1 U_{t-1}^2 + \alpha_2 U_{t-2}^2 + \dots + \alpha_q U_{t-q}^2 \quad (4)$$

The modified ARCH method was generalized (Balerso, 1986) to solve the problems of non-negativity of coefficients and became GARCH, which has a process similar to ARMA models. In this generalized model, sentences with a lag from the dependent variable were added. As an example, the GARCH(p, q) model is as follows:

$$\sigma_t^2 = \alpha_0 + \alpha_1 U_{t-1}^2 + \alpha_2 U_{t-2}^2 + \dots + \alpha_q U_{t-q}^2 + \gamma_1 \sigma_{t-1}^2 + \gamma_2 \sigma_{t-2}^2 + \dots + \gamma_p \sigma_{t-p}^2 \quad (5)$$

In this study, based on heteroscedasticity tests, GJR was used to show the presence and absence of symmetry of the effect of previous information for the conditional variance fluctuation, and finally, risk (fluctuations) was added to the main model as a new explanatory variable. Therefore, the method of the present study includes the following steps:

1. Calculation of the residual stock index
2. Testing the presence of conditional heteroscedasticity using F and chi-square statistics

3. Testing asymmetry in the conditional variance with GJR estimation and investigating the significance of the coefficient of failure as a dummy variable

4. Determining the final model of changes and estimating coefficients, calculating new residuals (identical)

5. Adding conditional variance as an explanatory variable (risk) to the main model of stock value.

The main model used includes risk (in step 5), the simultaneous free exchange rate (dollar to rial) as a competing market, the simultaneous index of the total stock price as the general trend of stock value in the stock market, and the number of Covid-19 patients as the target variable:

$$Food_t = \beta_0 + \beta_1 Risk_t + \beta_2 Total_{t-1} + \beta_3 Suffering_t + \beta_4 Dollar_t + \varepsilon_t \quad (6)$$

In Model 6; Food variable is the stock value index of food industry companies, Risk is the unexplained stock fluctuations as a risk, Total is the total stock index value in the last day, sufferers is the number of patients and Dollar is the daily price of the dollar (in Rials) in the open market as a competing market for investors. The non-simultaneity of the total price index is due to the elimination of simultaneity bias and the elimination of simultaneous equations.

In this research, the daily information of the deceased and infected Covid-19 patients was used from the website of the Ministry of Health of the Islamic Republic of Iran. Also, the information on the food index and the total index was extracted from the website of the Tehran Stock Exchange Technology

Management Company - Iran's Financial Information Processing Center. The exchange rate as the most important competing market was collected from the gold, coin and currency information network. The studied time period included February 22, 2020 when the official announcement of the outbreak of the disease was made in Iran until June 2, 2021 on a daily basis (working days, five days a week).

Results and Discussion

The statistics of Covid-19 patients are shown based on official and daily statistics in Figure 1. According to this figure, this disease has different prevalence rates in various days and has different peaks. The last two big peaks dated back to the middle of November 2019 and the end of May 2019. The creation of a peak, its speed and size, especially the wavelength, is highly dependent on the crisis management and, of course, the cooperation of people to comply with health guidelines (Morales and Callaghan, 2020). Iran's economic problems have historical roots, and sanctions are the most important barriers to curb them. However, one cannot ignore the coherence of management and decision-making fluctuations.

According to the method section, the first step is extracting the residuals and testing the heteroscedasticity is based on both F and χ^2 , the assumption of conditional heteroscedasticity is rejected (p-value of >99%), and therefore, there is a need for variability models.

Table 1- Calculation of residual stock index of food industry companies

Variable	Coefficient	P-value
F-statistic	11808	0.000
T.R2	248	0.000
Equation testing		
Variable	Coefficient	Std. Error
In ¹	2817229	2382096
RESID ² (-1)	0.961**	0.0088
R ² =0.98	F=11808**	Adjusted R ² =0.98

Source: Research findings

1- Intercept

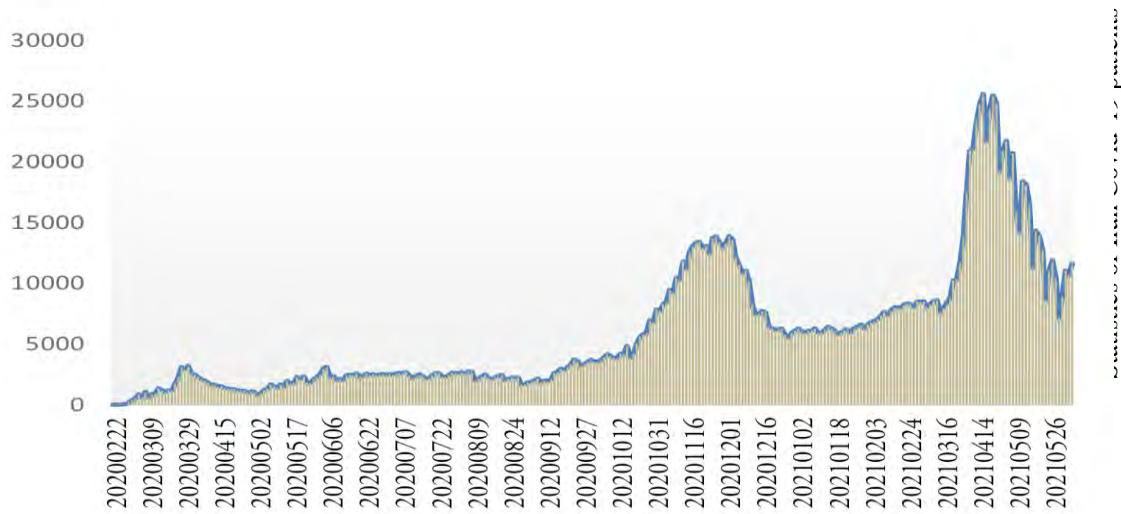


Figure 1- Statistics of Iran Covid-19 patients from the onset of the pandemic on February 21, 2020 to June 2, 2021

Figure 2 shows the disturbance components' value over time, which indicates heteroscedasticity. According to the figure, this variable has a strong upward trend in the early stages of the study, according to every pandemic phenomenon, therefore, the average is changing. Changes stop, but the fluctuations

continue at different intensities after about 75 observations. This figure shows that it is possible to achieve a static condition by detrending in the initial part of the observations (the first 75 observations), but the variance heterogeneity prevents the static regression relationship.

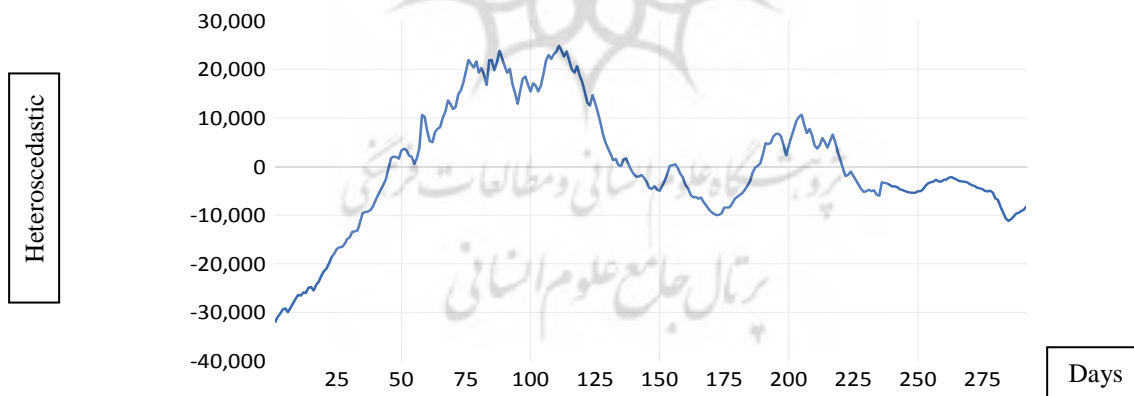


Figure 2- Heteroscedastic disturbance

Since the stock value index shows different reactions to its drivers (in this study, the exchange rate, the general trend of the stock market, and the exchange rate) during fluctuations, in other words, it has different adhesion as a result of different regimes, according to the third steps mentioned in the research method, GJR hypothesis testing was carried out. Table 2 shows the estimation result. According to the results, the dummy coefficient of failure of the variance equation

is not significant and, therefore, the symmetry hypothesis cannot be rejected. The choice of order 1 and 1 for GJR was made based on the optimal lag statistics.

After removing variance failure as the dummy variable, the model was re-fitted in the variance equation without this variable. All the coefficients in the main model and the variance equation are significant (P-value < 0.01) (Table 3).

To improve the model, the calculated variance equation fluctuations were added as risk to the main model. Since the conditional variance is obtained from the residuals of the main equation that is the unpredictable part of the stock value fluctuations of the food industry after deducting the effects of the entered variables, it can show the risk of the above-mentioned market. According to the

results of this model, which are the final results of the study, as expected, risk has an inverse and significant relationship with stock value (P-value= 6%). In other words, the increase in risk leads to a decrease in the stock price of the food industry, which is contrary to the results of studies (Mojtahedi *et al.*, 2020, Ghadiri Moghadam and Rafie, 2010).

Table 2- Asymmetry testing in conditional variance

Variable	Coefficient	Std. Error
In	39997	633
T(-1)	0.03**	0.0003
FER ¹	-0.089**	0.002
SN	-0.114	0.01
Variance equation		
In	125609	85245
RESID ² (-1)	0.991**	0.255
DA ²	0.408	0.281
Garch(-1)	0.176**	0.056
R ² =0.69	$\bar{R}^2=0.69$	RSS=1.36×10 ¹⁰

Source: Research findings

Table 3- GARCH estimation results (1,1)

Variable	Coefficient	Std. Error
In	40853**	600.07
T(-1)	0.0296**	0.0003
FER	-0.088**	0.003
SN	-0.059**	0.015
Variance equation		
In	265384	156784
RESID ² (-1)	1.065**	0.199
Garch(-1)	0.199**	0.081
R ² =0.7	$\bar{R}^2=0.69$	RSS=1.35×10 ¹⁰

Source: Research findings

Table 4- Estimation results after entering risk

Variable	Coefficient	Std. Error
In	38425**	972
SQRT ³	-0.135*	0.062
T(-1)	0.28**	0.0004
FER	-0.073**	0.003
SN	-0.022	0.013
Variance equation		
In	62207	68148
RESID ² (-1)	0.756**	0.19
GARCH(-1)	0.389**	0.073
R ² =0.7	Adjusted R ² =0.69	RSS=1.34×10 ¹⁰

Source: Research findings in appendix 4

1- Free Exchanges Rate

2- Dummy Asymmetry

3- Risk Variable from Heteroscedasticity

The indices of the total stock market and food industry are in harmony, and there is a positive and completely significant relationship between the two after using the lagging indicator for the total index of the stock market. From a statistical point of view, it can be stated that the previous day's price index of the entire stock market can be a good predictor for the food industry index. This coordination can indicate the great effects of the Iranian capital market environment, and government interventions, socio-economic crises are important parts of this environment. Study (Rahnamay and Mohseni, 2018) confirms such a result for the Iranian stock market. In addition to the stock market, there are competing markets to attract investors in Iran, such as the gold, housing, cars markets, etc. But one of the most important competing markets is the dollar. In the present study, the dollar market was used as a competing market, due to the quick reaction and high liquidity of this market.

Table 4 shows an inverse and significant relationship between these two markets in such a way that every hundred toman increase in dollar the stock price is reduced by 73 rials. The most important part of the results is related to the effect of patients on stock value. The

results show a significant and negative relationship between these two variables ($P < 0.90$). For every 100 patients, the food industry index decreases by 2.2 units, which is similar to results of studies (Albulescu, 2020, Heyden, 2020).

Conclusion

The global spread of the Covid-19 affected the volume of transactions. Like other countries, Iran also has unexperienced adverse economic changes and crises following this pandemic. The findings of the present study showed a relationship between the number of Covid-19 patients and the food industry stock value, and it decreases the price of the above index. Shows a gradual decrease in the negative impact of the Covid-19 pandemic on emerging stock markets. According to the results of the present study, it is suggested that the impact of Covid-19 on the index of other important markets, such as cryptocurrencies, precious metals, etc., should be investigated in future studies. In order to investigate the impact of Covid-19 on the stock market, other variables that represent this pandemic should be used.

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مقاله پژوهشی

جلد ۳۶ شماره ۴، زمستان ۱۴۰۱، ص. ۳۶۱-۳۵۳

تاثیر شیوع بیماری کرونا بر ارزش سهام شرکت‌های مواد غذایی در بورس تهران

سیدمجتبی مجاوریان^۱ - فواد عشقی^۲ - صدیقه آهنگری^۳

تاریخ دریافت: ۱۴۰۰/۰۴/۰۴

تاریخ پذیرش: ۱۴۰۰/۱۱/۰۲

چکیده

ویروس کرونا (کووید-۱۹) علاوه بر تاثیر منفی بر بهداشت و سلامت افراد، جهان را با یک بحران مالی - اقتصادی عظیم روبه‌رو ساخته است. شیوع ویروس کرونا در سراسر جهان، میزان معاملات و ارزش سهام را نیز تحت تاثیر قرار داده است. از آنجا که در شرایط بحران بازار مواد غذایی تاثیر بیشتری می‌گیرد، در این مطالعه به بررسی این رابطه در بورس اوراق بهادار پرداخته شده است. به منظور بررسی اثر مبتلایان ویروس کرونا بر ارزش شاخص سهام شرکت‌های صنایع غذایی و همچنین ارتباط میان ریسک و ارزش شاخص سهام از داده‌های روزانه رسمی وزارت بهداشت و مرکز پردازش اطلاعات مالی ایران از سوم اسفند که اولین گزارش اعلام گردید تا ۱۲ خرداد ۱۴۰۰ گردآوری گردید. روش مورد استفاده در این مطالعه مدل‌های رگرسیونی میانگین واریانس ناهمسان شرطی است. آزمون‌های تصریح الگو نشان داد اولاً فرضیه عدم ناهمسانی واریانس رد شده و لزوم استفاده از الگوهایی با واریانس ناهمسان ثابت گردید. ثانیاً فرضیه عدم تقارن پذیرفته گردید. یافته‌های پس از برآورد مدل نشان داد میان تعداد مبتلایان به ویروس کرونا و ارزش سهام صنایع مواد غذایی ارتباط وجود داشته و افزایش تعداد مبتلایان سبب کاهش شاخص مذکور می‌شود. به این ترتیب همانند سایر بخش‌های اقتصاد، بازار سرمایه متاثر از بحران همه‌گیری کرونا گردید افزایش قیمت دلار بعنوان بازار رقیب تاثیر منفی بر شاخص قیمت سهام نشان داد. همچنین با توجه به بررسی ارتباط میان ریسک و ارزش سهام صنایع غذایی، ریسک مطابق انتظار رابطه معکوس و معنی‌دار با ارزش سهام شرکت‌های صنایع غذایی داشته و به عبارت دیگر افزایش ریسک منجر به کاهش قیمت سهام صنایع غذایی می‌شود.

طبقه‌بندی: JEL: G17, G41

واژه‌های کلیدی: الگوی ناهمسانی واریانس شرطی، ایران، بورس سهام، کرونا و ویروس