

Social Media and Financial Performance in Tehran Stock Market

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Abstract:

The function of social media and its awareness and information can play a significant role in the changes in stock prices and investors' decision making. Fluctuation is an important measure of financial performance that reflects uncertainty or risk. In view of this, the present study investigated and analyzed the social media and the fluctuations of the Tehran Stock Market during the period of April 2011 to August 2021 using auto-regression model. The results show that the instantaneous reaction functions of the stock returns of active companies in the Tehran stock market to the changes in the social media, the number of shares of the companies, the infected and the dead of covid-19 were positive until the third and fourth periods, and after the mentioned periods of shock entered into the explanatory variables did not have an effect on the fluctuation of the companies' returns. Also, the results of the analysis of variance showed the high effects of the number of shares of the companies in the changes of the efficiency of the companies and the effect of social media in explaining very slight changes in fluctuations have been observed.

1. Introduction

Social media were activated in the capital market in 2008, at the height of the crisis, with the emergence of the Stock Twits site. This site became a place for users to exchange opinions. Market managers and analysts tried to estimate the market based on behavioral finance principles, using data analysis and posts (tweets) sent in this social media, which also had success in this area. Following the growth of social networks, in October 2008, the stock market social media named Stock Tweet was launched. This network is exclusively for posts related to the stock market and has a separate infrastructure from Twitter. So that in this environment, people based on the stock market symbol of companies; they

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publish their opinions, analyzes and news. Currently, it has more than 230,000 active members who spend an average of 32 minutes a day on this site. This social media is compatible with the platform of other social media and users of other social media have access to its content. In the social media of the stock market, investors can publish their opinions, analyzes and news in real time and make them available to other analysts and investors. So that these social media have turned the one-way information space from the media into a two-way space. The role of social media in today's life is particularly important, these networks have influenced the stock market and financial markets, and the existence of mass movements and their effects can help investors in obtaining better information to predict market movements. In fact, information is considered an important strategic tool in decision-making, and without a doubt, the quality of decisions depends on the correctness, accuracy, and timeliness of the information used at the time of decision-making. In the financial markets, this matter is of particular importance because the basis for the decisions of the participants in the stock market is the information published by the stock exchanges, the issuers of stocks admitted to the stock exchange, financial intermediaries active in these markets, financial analysts and the press

Analysts and investors in the financial markets are constantly faced with a stream of new information and news in various fields, including macroeconomics, political news, information related to dividends, etc. This information can be in the form of various signs, symptoms, news and forecasts from inside or outside the company and be available to shareholders and cause reactions and cause changes in stock prices. Also, such news makes them update their expectations about the initial findings and make important financial decisions based on that. Therefore, social media and efficient information have been emphasized. Therefore, the study of the effect of information published by social media on the decision of investors in choosing stocks of different companies and the extent of this effect in different types of media is significant. Therefore, stock market reactions to announcements and news are different. In the financial market of Iran, the types of decisions made by investors are based on various factors. The aforementioned factors are also effective in stock price fluctuations because the behavior of investors ultimately leads to changes in stock price behavior.

Companies worry about fluctuations and uncertainty because it can make it difficult for companies to raise capital or finance, attract talent, or work with partners and distributors. Therefore, in general, managers as well as stock investors tend to minimize stock price fluctuations unless the price trend is rising. In fact, during periods of high fluctuations, an external event can increase traders' nervousness, which can lead to a sharp drop in price. Therefore, fluctuations in stock prices is particularly important, especially as it relates to marketing events such as product launches and consumer talk about brands. Therefore, the effect of information in cyberspace on stock fluctuations is of particular importance,

which should be investigated and paid attention to. This research seeks to answer the question that virtual space affects the stock fluctuations of companies active in the Tehran stock market in the period from April 2011 to August 2021 using the auto-regression model.

2. A review of research literature

A social media is a set of social connections in which people are connected to each other without intermediaries, and with this method, a significant number of people are connected to each other. Social media can have tasks such as exchanging news and carrying out dialogue. These networks take place in the context of communication intermediaries (Neubeck, Glasberg, 2004). Social media are suitable facilitators for people who have recently entered the capital market to obtain useful information in this way (Shepard, 2012). Collective behavior is caused by people's efforts to do the same behavior as others. When the people of a society behave in a certain way or do a certain work, it is intellectually and mentally very difficult for people to behave differently from the mass of people. In another definition, mass behavior is accepting high risk without sufficient information, which can be defined as the clear intention of investors to copy the behavior of other investors and follow them (Bikhchandani , Sharma, 2000).

Many researches have been done in this regard. In one of the surveys, it has been shown that many investors and stock traders use the information exchanged based on the existing communication between investors. In this context, the effect of internet conversations on stock prices can be mentioned (Hirschleifer, Hong Teoh, 2001).

George Day points out (Day, 2011) that many changes have occurred in the business landscape and managers must now pay attention to how customers perceive their company. In fact, UGC is one of the main ways consumers communicate with companies that can promote their products and services and subsequently gain value for their products using UGC. Content generated by the user can be interpreted as a reflection of the consumer's feelings (Bollen , Mao and Zeng , 2011). User-generated content is a reflection of consumer sentiments and can act as a leading indicator for companies' financial performance. Previous research has shown that online chat in blogs, comments, and forums affects sales (Chevalier & Mayzlin, 2006, Moe & Trusov, 2011). But these authors do not examine the effects of online chat on the stock market. We focus on stock market performance because it is very important to companies, is widely available at the discrete level, and reflects the collective expectations of millions of investors about a company's financial health (Srinivasan & Hanssens, 2009). Several papers in marketing have examined the effects of traditional marketing variables such as advertising, distribution channel, product innovation, etc. on

stock market returns (for a complete review see Srinivasan & Hanssens, 2009). As investors are constantly looking for any new information about a company, marketing researchers have found that online conversations, which are huge on a daily basis, actually affect stock prices. (Lou, 2009; Tirunillai & Tellis, 2012) Fluctuations are an important criterion that should be considered for the following reasons: first, in financial markets, the standard fluctuation is for uncertainty (Bloom, 2009). The stock market fluctuations have already been used as a representative for uncertainty at the company level (Bloom, Bond & Van Reenen 2007; Leahy & Whited 1996). For example, Bloom et al. (2007) has shown that fluctuations are significantly associated with a spectrum of alternative uncertainty indices, including real sales fluctuations and cross-sectional distribution forecasts. Therefore, measuring the fluctuations at the company's level provides a measure of uncertainty about the company's landscape. Second, fluctuations allow risk measurement for a company in the stock market. In general, the more fluctuations are more risky security. Investors may be cautious than securities whose prices can dramatically change in a short period of time and in general stock returns, the scope of potential values that may take a stock. The two contributions with different fluctuations may have the same returns. For example, stocks with less swing may have expected (average) 5% expected returns with an annual oscillation. This reflects the returns of almost 5% negative to positive 15% in most cases. The higher swing stock, with the same expected returns, 5%, but with an annual fluctuation of 20%, represents the return of almost 35% to positive 45% in most. Third, specifying the scope of probable results for each future event is usually easier than predicting the actual result of that event. You can use fluctuations to predict the most likely domain for a future event and the possibility of outputs. The first type analysis provides the ability to create effective programs, while the latter is the basis for proper planning. In fact, it is difficult to predict the actual stock return tomorrow, even in a given day a few weeks later, it is harder now. However, the stock returns will be inside. A range that matches fluctuations in the past few months. Fourth, fluctuations are usually uncertain compared with stock returns.

The crisis caused by the Covid 19 virus is a complex crisis, so the approach of complex systems to understand it (WAGNER 2020) seems to be important today using complex systems techniques for analyzing finance in various studies, as well as two general tools of complex systems included. The rules of power and complex networks are important for understanding the financial instability of the studied markets. And the general idea has been expanded by researchers in recent years: First, extremist events such as financial crises in the economy are frequent. This can be studied with the power laws, and secondly, several systems, independent of their financial, macroeconomic economy, are exposed to collective shocks. Are located (Pereira et al., 2020). The complexity of the possibility of analyzing financial markets may change, when financial markets

change to a specified threshold, the point that shocks can change the system path (SORNETTE, 2017), connecting different systems to each other, such as the environment, public health, industries and financial systems. It will lead to systematic risk increases and will be visible with the help of a complex network to some extent connecting these systems and networks to each other (Helbing, 2013).

Merikas et al. (2003) tried to identify factors affecting the behavior of real investors in the Greek capital market. Their research results show that the decision-making criteria for buying a share are a combination of economic criteria and psychological criteria. Raymond (2011) has been investigated as the impact of media coverage from the company's affairs agency and stock returns on the market Goa and Zahavi (2014) in a study with the aim of buying and selling suggestions based on a news text analysis system and price information of 72 companies from the S&P 500 index, between August 15, 2006 and August 31, 2007 and news published from Reuters 3000 and Extracting more than 51263 related news based on 5-minute decision making with sliding learning method. Lee et al. (2014) in another study, believing that economic and financial news are effective on stock price returns. Examining the volume of content and feelings of words is effective in predicting the pattern of price returns. Bick et al (2020) have investigated stock market fluctuations and Covid-19 at the level of different industries using a non-linear Markov switching approach. The results of the study show that the fluctuations of the stock market, while being influenced by economic indicators, was influenced by the news of Covid-19, and both positive and negative news of this crisis had an impact on the behavior of the stock market. The effects of the news regarding the Covid-19 on the total risk have been very significant, but the effect of this crisis on the systematic risk of different industries has been evaluated differently. Sipoi (2020) investigated the effect of Covid-19 on the stock market in six countries that were most affected by the spread of the virus and showed that the behavior of the stock market is affected by the news published about Covid-19. Li et al. (2020) investigated the fluctuations of the European stock market during the Covid-19 crisis by choosing three countries, France, Germany and England. The results showed that the stock market of England and France is predictable during this period. Aike and Hu (2020) by examining the American and European stock markets showed that market fluctuations can be considered as a predictor for stock market fluctuations. With the spread of the Covid-19 virus and its effects on the global economy, various researchers have empirically evaluated the effects of this The event was attracted to various financial markets and economic fluctuations. Diingen et al. (2020) have studied the effect of social media on the fluctuations of the American stock market using GARCH models.

3. Methodology

The current study is an applied research in terms of its purpose, and an analytical research in terms of its analysis method. In this study, the aim of the study is to investigate the effect of social media on the fluctuations of selected companies active in the Tehran stock market during April 2011 to August 2021 using the auto-regression model of the panel, and for calculations and estimation of the models, Excel and Eviews 12 software are used. Statistics and information required for research in a documentary and library method for listed companies from Codal, information related to the Covid-19 disease from the World Health Organization website and

The variable information of social media has been collected from the site (<http://www.google.com/trends>). The stock returns of companies are calculated as R_t stock return, P_t stock price at time t and P_{t-1} price.

$$R_t = \left(\frac{P_t - P_{t-1}}{P_{t-1}} \right) \quad (1)$$

Based on theoretical foundations and experimental studies conducted in this field by Dieijen et al. (2020), the experimental model of this research is defined as relation (2):

$$y_{i,t} = \beta_0 + \beta_1 x_{1,t} + \beta_2 x_{2,t} + \beta_3 x_{3,t} + \beta_4 x_{4,t} + e_i \quad (2)$$

$y_{i,t}$ the dependent variable of companies' productivity, β_0 width from the origin, β_1 is a social media variable which is the monthly number of searches The keyword of the company active in the stock market is calculated in the Google search engine, β_2 is the market share, the number of shares of each company at the end of the year, β_3 is the percentage of deaths as the ratio of deaths to the total number of patients, β_4 is the percentage of recoveries. It shows the total number of patients in the form of recoveries and e_i is the error term

The econometric method used in this study is vector autoregression of panel data, which is briefly reviewed below. One of the most famous and widely used multivariate models is the vector autoregression (VAR) model. In this model, the dependent variable is a vector of several time series, each of which is defined in terms of its breaks and the breaks of other model variables. A general VAR model with p intercept is as follows:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t \quad (3)$$

in which all the variables are endogenous and vector. Of course, things like fixed component and virtual variable can also be added to the model. The above model represents a VAR model for time series data. In recent studies, the VAR model was also used for panel data. The panel form of the VAR model is structurally similar to the conventional model for time series data; with the difference that a cross-sectional dimension is also added to the equations. Therefore, the VAR panel model assuming the presence of fixed effects will be as follows:

$$Y_{it} = A_1 Y_{i,t-1} + A_2 Y_{i,t-2} + \dots + A_p Y_{i,t-p} + X_{it} B + \mu_i + \varepsilon_{it} \quad (4)$$

where, Y_{it} is a vector ($1 \times k$) of dependent variable, X_{it} is a vector ($1 \times l$) of exogenous variables, μ_i is a vector ($1 \times k$) indicating fixed effects and ε_{it} is the error term of the model. Coefficients A_1, \dots, A_p , matrices with dimensions ($k \times k$) and matrix B with dimensions ($1 \times k$), There are model parameters that need to be estimated. This mode is also considered a dynamic panel model. Because the intervals of the dependent variable in the VAR mode are added to the right side of the regression equation.

4- Experimental results

In this section, the report of the experimental results of investigating the effect of social media on the monthly yield fluctuations of 84 selected companies in the Iranian stock market during April 2011 to August 2021 using the vector error correction model, response functions and variance analysis is discussed. At first, the optimal interval is determined according to the criteria for determining the optimal intervals; Considering that the studied time period is more than 100 observations per company; Therefore, determining the optimal interval is done with Akaike's criterion. The results of determining the intervals are reported in Table (1) for both equations. According to the results of the table, the optimal interval with Akaike's criterion is the third interval.

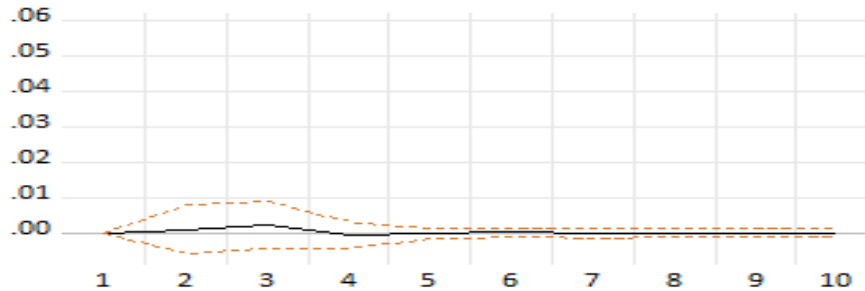
Table1.Results of Lag Optimization for Equation

Optimal lag	AIC
Third	-5.8185

Source: Research findings.

The report of the immediate response diagram of the market turbulence of the Tehran Stock Exchange to the shocks on the social media, company shares, the number of deaths and recoveries of the Covid-19 virus is discussed. Diagram (1) shows the reaction of the stock market fluctuations function to virtual space shocks. According to this diagram, the fluctuations function of the stock market has reacted positively to the changes in the social media until the third period. In the sense that for cyber space shocks, the efficiency fluctuations of companies increase, but after the third period, the impact of cyber space shocks on the efficiency fluctuations of companies has been constant and close to zero. In general, it can be acknowledged that the effect of social media shocks on the fluctuations of companies' efficiency is positive, in other words, with the increase of social media shocks, the fluctuations of the companies' efficiency increase.

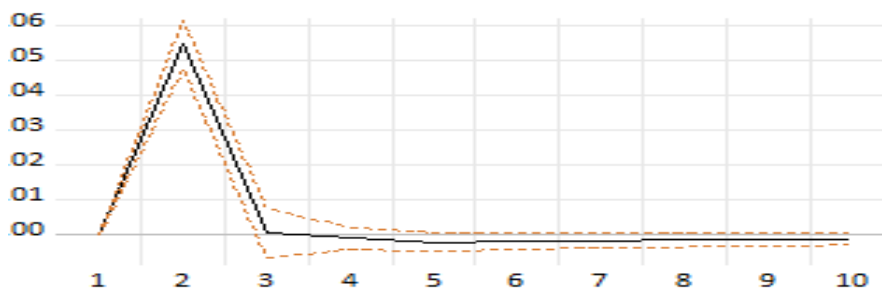
Diagram 1. Response of the stock market fluctuations to social media Shocks.



Source: Research findings.

Diagram (2) shows the reaction of the stock market fluctuations function to the shocks of the number of shares of companies. According to this graph, the fluctuations function of the stock market has had a positive reaction with a high slope to the changes in the number of shares of companies until the third period. In this sense, for the shocks on the number of shares of the companies, the fluctuations of the companies' returns increase, but after the third period, the impact of the shocks on the number of shares of the companies on the fluctuations of the returns of the companies has been constant and close to zero. In general, it can be acknowledged that the impact of shocks on the number of shares of companies is positive on the fluctuations of the companies' returns, in other words, with the increase of the shocks on the number of shares of the companies, the fluctuations of the companies' returns increase.

Diagram 2. Response of the stock market fluctuations to the number of shares of companies Shocks.

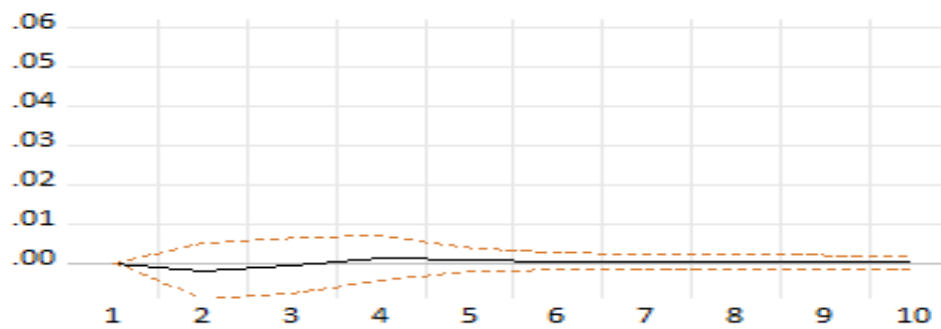


Source: Research findings.

Diagram(3) shows the reaction of the stock market fluctuations function to the shocks of those who have recovered from the Covid-19 virus. According to this diagram, the fluctuations function of the stock market has reacted positively to

the changes of those who have recovered from the Covid-19 virus until the fourth period. In the sense that for the shocks of the recoveries of the Covid-19 virus, the fluctuations of the companies' efficiency increase, but after the fourth period, the impact of the shocks of the recoveries of the Covid-19 virus on the fluctuations of the companies' efficiency has been constant and close to zero. In general, it can be acknowledged that the impact of the shocks of those who have recovered from the Covid-19 virus on the fluctuations in the efficiency of companies is positive.

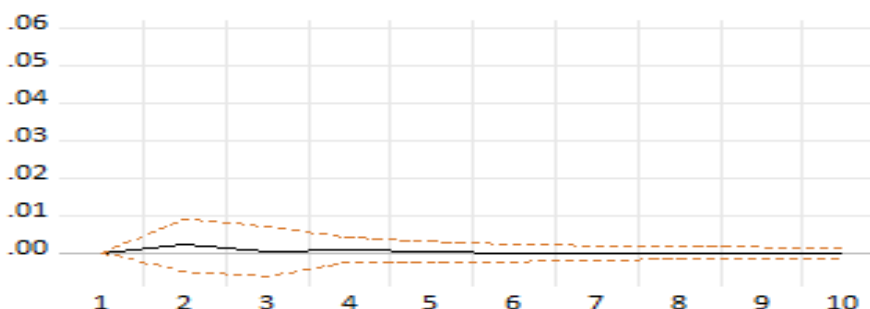
Diagram 3. Response of the stock market fluctuations to recoveries of the Covid-19 Shocks.



Source: Research findings.

Diagram(4) shows the reaction of the stock market volatility function to the shocks of the deaths of the Covid-19 virus. According to this graph, the volatility function of the stock market has reacted positively to the changes in the deaths of the Covid-19 virus until the third period. In the sense that for the shocks of the deaths of the Covid-19 virus, the fluctuations of the companies' productivity increase, but after the third period, the impact of the shocks of the deaths of the Covid-19 virus on the fluctuations of the companies' productivity has been constant and close to zero. In general, it can be acknowledged that the impact of the death shocks of the Covid-19 virus on the fluctuations of the companies' efficiency is positive, in other words, with the increase of the shocks of the deaths of the Covid-19 virus, the fluctuations of the companies' efficiency increase. Diagram (4): The reaction of stock market fluctuations to the shock of covid 19 deaths.

Diagram 4. Response of the stock market fluctuations to covid 19 deaths Shocks.



Source: Research findings.

In the following, the analysis of the variance analysis function of the companies' efficiency fluctuations will be discussed. Table (2) shows the analysis of the variance of the yield fluctuation function.

Table (2). Variance analysis of market fluctuations

Period	S.E.	β_1	β_2	β_3	β_4
1	0.354788	0.0000	0.0000	0.0000	0.0000
2	0.358976	0.000601	2.311152	0.003167	0.003321
3	0.358984	0.004574	2.311158	0.003265	0.003700
4	0.358993	0.004896	2.312344	0.003722	0.004955
5	0.359002	0.004953	2.316864	0.003756	0.005406
6	0.359008	0.004958	2.319979	0.003760	0.005567
7	0.359014	0.004975	2.322830	0.003764	0.005645
8	0.359018	0.004985	2.325233	0.003765	0.005701
9	0.359022	0.004991	2.327290	0.003765	0.005746
10	0.359026	0.005001	2.329042	0.003765	0.005781

Source: research findings.

By calculating the average changes of 4 variables in 10 periods, it can be acknowledged that the function of yield fluctuations is mostly caused by changes in the number of shares of companies, so that one unit change in yield fluctuations It is caused by 0.20 change in the number of shares of companies, 0.045 change in the number of deaths of Covid-19, 0.039 change in social media, and finally 0.032 change in the number of people who have recovered from Covid-19. Therefore, the fluctuations of the stock market returns has been most affected by the changes in the number of shares of companies and the least affected by the changes in the number of people who have recovered from Covid-19.

5- Conclusion

Considering the importance of the influence of information in cyberspace on stock fluctuations, in addition to the fact that predicting and managing fluctuations is of interest to both company managers and investors, this study examines whether fluctuations in user-generated content (UGC) can spillover to fluctuations in stock returns and vice versa. Considering this, the present study has investigated and analyzed the social media and the fluctuations of the shares of selected companies active in the Tehran Stock Exchange market during April 2013 to August 1400 using auto-regression model. According to the instantaneous reaction functions of stock yield fluctuations of companies active in the Tehran stock market to changes in cyber space, the number of shares of companies, patients and deaths of covid-19, it can be seen that the fluctuations of company yields compared to the shocks to explanatory variables up to the third and fourth periods were positive, and after the mentioned periods, the shocks to the explanatory variables had no effect on the fluctuations of the companies' returns. Similarly, the results of variance analysis show the high effects of the number of shares of companies in the changes in the returns of the companies, and the effects of the deaths of covid-19, social media and those who have recovered from covid-19 are in the next most influential ranks in the changes in the returns of the companies' shares.

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فضای مجازی و نوسانات بورس اوراق بهادار تهران

چکیده:

کارکرد فضای مجازی و آگاهی بخشی و اطلاع رسانی می‌تواند نقش بسزایی در تغییرات قیمت سهام و تصمیم‌گیری سرمایه‌گذاران ایفا نماید. نوسانات یک معیار مهم عملکرد مالی است که نشان دهنده عدم اطمینان یا ریسک است. با عنایت به همین امر، مطالعه حاضر به بررسی و تحلیل فضای مجازی و نوسانات بورس اوراق بهادار تهران طی دوره زمانی فروردین 1390 تا فروردین 1400 با استفاده از روش خودرگرسیون برداری پرداخته است. نتایج مطالعه نشان می‌دهد که تابع واکنش آنی بازده سهام شرکت‌های فعال در بورس تهران به تغییرات شبکه‌های اجتماعی، تعداد سهام شرکت‌ها، بهبود یافتگان و فوت‌شدگان کووید-۱۹ تا سومین دوره مثبت بوده است و پس از دوره چهارم متغیرهای توضیحی تأثیری بر نوسان بازده شرکت‌ها نداشته است.

همچنین نتایج تجزیه واریانس نشان می‌دهد که تأثیرات تعداد سهام شرکت‌ها در تغییرات بازده سهام شرکت‌ها بالا و تأثیر شبکه‌های اجتماعی در تبیین تغییرات بازدهی سهام شرکت‌ها بسیار جزئی بوده است.

کلمات کلیدی: رسانه‌های اجتماعی، نوسانات، عملکرد مالی، بازار سهام.