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The Relationship Between Exchange Traded Fund (ETF) and Market Fragility: Evidence from Iran`s Stock Market

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Abstract

The purpose of this study is to investigate the effectiveness of ETF funds on Iran's stock market. The index investigated in this research is the degree of fragility of the stock market in Iran. For this purpose, a model has been used at first, which shows how much the entry of an ETF market fund can affect the stability and fragility of the stock market. Then, in order to analyze the issue, a series of ETF funds in Iran has been selected. Using regression analysis, the results and analysis give a pattern that with the entry of ETF funds, the nonsystematic value has increased values. Therefore, we conclude that the entry of ETF funds into the market increases the fragility in the Iranian stock market.

Highlights

- ETF market fund can affect the stability and fragility of the stock market
- With the entry of ETF funds, the nonsystematic value has increased values
- Entry of ETF funds into the market increases the fragility in the Iranian stock market

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1. Introduction

Exchange traded funds are one of the new investment tools in the form of securities that are designed to follow a certain index or a basket of diverse assets (Lettau & Madhavan, 2018). In fact, this fund is a type of mutual investment fund that, like stocks, can be traded throughout the day. Investors can invest in a diverse portfolio of financial assets (shares and bonds, etc.) by buying shares of exchange-traded funds (ETF), which can be bought and sold during the day, just like the shares of stock exchange companies (Lettau & Madhavan, 2018).

The investment units of these funds are accepted in the stock market like ordinary shares and can be bought and sold through brokers during trading hours at prices that are determined during the day and not at the end of the day; Therefore, investors can use all common trading techniques in the stock market in the transactions of exchange-traded fund investment units (Krause & Ehsani & Lien).

Exchange-traded funds are one of the most popular financial instruments, the date of their introduction and their entry into the financial markets goes back to January 1993, in a way that first started in America with the introduction of SPDR Gastineau (2002) and since then in Global markets have enjoyed increasing growth so far.

At first, these funds were mainly interested in institutional investors, including active and passive fund managers and hedge funds. But in recent years, especially in America, it has also attracted the attention of retail investors (Glosten, 2019). In Iran, investment funds that can be traded on the stock exchange or over the counter as a new institution or financial instrument have been designed and its regulations have been formulated. Based on the approved regulations, it is currently possible to set up three types of investment funds tradable in shares, in fixed and mixed income securities. The first ETF fund in Iran, Hazman, was widely welcomed by investors with the anniversary of the establishment of the exchange, and now the number of funds that are being registered and subscribed is increasing (Rahmani et.al, 2021).

Although these funds are like normal investment funds, they are traded like a share in the capital market and its price is determined as a result of supply and demand. In other words, the main difference between the structure of ETFs and existing investment funds is creating liquidity by taking advantage of the potential of the stock market (Pham et.al, 2021). In ETFs, the liquidity guarantor element has been removed and a new element as a market maker provides the basis for the liquidity of ETF investment units in the stock or over-the-counter markets (Pham et.al, 2021).

These funds have a combination of the advantages of investment funds and stocks at the same time. Advantages such as the presence of specialized management, easy access, high liquidity and high-speed transactions are among the features of this new capital market tool. The high transparency compared to other mutual investment funds and the net publication of the daily value of the fund's assets in real time are other advantages of these funds (Hamm, 2010).

The time periods for calculating the net value of assets, issue price, cancellation and net statistical value of each investment unit are as follows: on trading days, it will be announced once every two minutes from the initial trading hour of the stock exchange until the end of daily trading and also at the end of that day. Also, the buying and selling fee in stock investment funds is about 1%. However, the said fee for buying and selling shares is about 1.6%. Users of online trading systems can also easily buy and sell the symbols of these funds through these systems (Bhattacharya & O'Hara, 2016).

Traded investment funds have a number of advantages, including the following (Zomorodian & Sohrabi, 2021):

1- The possibility of trading like a stock: one of the most important advantages of this type of fund is the possibility of trading like a stock during the day, which investors can buy and sell many times during the day and with all the common techniques in stock trading. Use for these types of funds as well.

2- The possibility of investing in a diversified portfolio: the purpose of forming a fund is to collect capital from investors and form a portfolio of assets and manage this portfolio. Using experienced and expert managers, these funds seek to create an optimal portfolio of assets in order to achieve the highest possible return by accepting the least risk. Investors can use the features of a diverse portfolio even with a small capital.

3- Fiscal efficiency: Based on the provisions of Note 1, Article 7 of the Law on the Development of New Financial Instruments and Institutions in order to facilitate the implementation of the general policies of Article 44 of the Constitution regarding the transfer of investment units of all types of tradable investment funds and their issuance and cancellation. Tax is not charged.

4- Reducing the per capita cost of each investor: the fund performs all related matters on behalf of the investors, such as the cost of employing expert staff, collecting and analyzing information, and selecting the optimal portfolio, as well as all executive matters, such as receiving dividends and securities coupons. Therefore, all related costs are divided between investors and the per capita cost of each investor is reduced.

5- More transparency: The NAV of each share for tradable funds is updated once every two minutes during trading hours and also at the end of the day, which is compared to mutual investment funds that only update their NAV once at the end of the day. They are more transparent. Also, the trading price of the shares of many investment companies is much less or more than their net asset value, but ETFs solve this problem and help investment companies to calculate the net asset value in the way of ETFs, which is more transparent.

6- The possibility of high liquidity and the participation of market makers: due to the possibility of buying and selling like shares, investors can sell their shares during the trading hours and finally, after 3 working days, the desired amount will be available. Whereas in mutual investment funds, according to the cancellation process, which requires a personal visit and completing the cancellation request, access to cash may take up to 7 days. It can also be stated

that with the participation of market makers, these types of bonds have less liquidity risk than ordinary shares. Market-makers are one of the pillars of this type of funds, which help a lot in removing the obstacles of trading nodes and long lines of buying and selling, which greatly increase liquidity.

7- They are cheaper than investment funds: Considering that the nominal value of each unit is set at 10,000 rials, it makes it possible to buy the shares of these funds with smaller amounts.

8- Suitable for both short-term and long-term investment: due to the fact that, like a stock, it has the ability to trade and have high liquidity during the day, as well as the flexibility of prices during the day and the possibility of using all common techniques in stock trading. It is also suitable for short-term investors. It should be mentioned that the purpose of forming such funds is to invest in an optimal combination of diverse assets to achieve the highest possible return and by accepting the least risk in the medium and long term. Therefore, the purchase of this type of bonds is recommended to investors with a long-term view. So, these types of funds have been widely accepted for retirement and long-term investment plans.

ETFS are a hybrid of two predecessors: mutual funds and investment trusts. Like mutual funds, ETFs are open-ended funds that can issue new shares at any time. Like mutual funds, but unlike mutual funds, ETFs can be traded throughout the day through the stock market, while mutual funds can be bought and sold at the end of the day based on net asset value (NAV).

ETFs provide access to a diversified portfolio at a lower cost compared to mutual funds. For example, the average expense ratio for each ETF per year is 0.25% and for mutual funds is 1% (Naraldi & Agnova, 2017).

The unique creation/redemption structure of ETFs ensures that ETF shares expand or contract based on investor demand. In the primary market, only legitimate actors who are large buyers and traders buy and sell large blocks of the ETF with its sponsor. In the secondary market, investors can buy and sell ETFs just like ordinary stocks. Since the price of ETF shares is determined through its supply and demand in the secondary market, its price is not always equal to NAV (Bhattacharya & O'Hara, 2016).

Based on this, legal activists try to ensure that intraday prices are approximately equal to the NAV of the ETF's underlying assets. For example, if demand for ETF shares is bullish, legal activists can buy a block of new ETF shares from the sponsor and sell them on the secondary market. Therefore, the mechanism of creation/redemption of ETF shares in the primary market shows the excess demand for ETF shares from investors. In other words, an increase in ETF holdings indicates an increase in the size of the ETF's portfolio (Glosten et al., 2019).

ETF fund managers are required to publish their fund's NAV. Investors in ETFs generally do not trade directly. Instead, their exchange is based on a relationship with legitimate actors or other liquidity providers. Investors can buy and sell ETF shares through a brokerage. This secondary market does not result

in the trading of underlying securities, which significantly reduces transaction costs.

Although shares of ETFs can be bought/redeemed at the end of each trading day, legal traders mostly take a profitable position on each day. For example, when an ETF unit is exchanged with a legal entity, then the legal entity may choose to exchange a basket of assets for the ETF and then either hold or sell it. The arbitrage buy/buyback mechanism works to help keep the price of an ETF close to its intrinsic value (Bhattacharya & O'Hara, 2016).

In the structure of an ETF fund, price deviations from the announced NAV do not necessarily mean the existence of arbitrage opportunities, especially for international funds and for funds whose components are difficult to value. As mentioned above, the ETF sponsor contracts with the market maker to calculate and publish the NAV based on past price data. Dealers also provide an intraday indicator value that is published periodically throughout the day.

This value is based on the most recent exchange values. So if, for example, the ETF includes Japanese stocks, the last price in Tokyo is used throughout the trading day in the United States, and a currency adjustment is also included for the currency units. For fixed income funds, the provider of intraday index values may not fully update the prices of non-exchange-traded assets.

2. A Review of the Related Literature

Today, Tehran Stock Exchange market has grown a lot in terms of volume, value of transactions and number of active companies; However, a review of the data and studies related to this market shows that the fluctuations and turbulence of the market are high and it has shown great sensitivity to shocks; This can confirm the fragility of the market. After the global financial crisis in 2008, investors and other financial market participants realized the existence of price gap factors including fragility in financial markets. Fragility occurs when there are many sharp and sudden changes in stock prices and companies are prone to negative shocks.

In other words, with the increase of investors' optimism, the balance of debt and risk changes, in other words, the items in the balance sheet are more sensitive to changes in interest rates, income, depreciation rates and other factors affecting liquidity, unusual fluctuations in them cause major financial problems. creates and the financial system of the company becomes extremely fragile. In this case, a situation arises in the financial system in which a small shock can have inappropriate effects on the state of stock price fluctuations (unusual fluctuations) and large financial problems such as the financial helplessness of companies, liquidity problems, financial stress, foreign borrowing without any adequate coverage. Creditors' pessimism towards debt repayment and acceleration of capital outflow.

The greater the fragility of the stock, not only by itself, but also by the effect of shocks entering the market and multiplying and strengthening it through increasing risk (increasing the probability of expected loss) and uncertainty

(decreasing confidence in the probability of loss) in the market, causing a downward trend. In terms of the rate of share price growth and the downward trend in the economy. Even the increasing progress of fragility and its destructive effects resulting from globalization have attracted the attention of many economists and researchers, which is of particular importance to eliminate its bottlenecks. Due to uncertainties and variables that are effective in changing the market index on a particular day; It is a very controversial work. Stock price changes are an important and effective source of information for them in evaluating the state of the business unit (Battacharya and others, 2016); Therefore, the most important issue for investors is the possibility of predicting price changes, because stock prices, as a very important issue in the literature of GDP, are the leading variable for predicting the fluctuations of macro variables, especially business cycles. Identifying fragility leads to the reduction of financial instability. The financial system performs its economic tasks, including the efficient allocation of resources, risk distribution, and settlement of payments, and is able to deal with shocks, crises, and structural changes.

Lack of fragility prevents high-risk investment actions (a type of investment in which a person takes a lot of risk to get a small return) and financial crisis, which is defined as a sudden and rapid change in all or most of the financial indicators. It can be prevented.

On the other hand, stock price convergence is considered a relatively new field in financial and economic research and has a close relationship with economic development and stability of financial markets. Stock price convergence occurs when a company reacts to systematic and nonsystematic risk, it will also happen in its subsidiaries; Because factors such as systematic and nonsystematic risks have a positive convergence with the industry in question as well as the subsidiaries of each group. Also, the amount of time it takes to reach the convergence of the stock price is called the convergence speed of the stock price. The speed of stock price convergence shows the degree of stock price mobility and the alignment of stock price movement in the company and its subsidiaries (BenDavid et al., 2018). Ignoring the speed of stock price convergence reduces the ability of investors, analysts and economic activists to predict stock prices.

The increase in the phenomenon of stock price forecast reduction makes them pessimistic about investing in Bahadur Stock Exchange. Because due to the nature of irregularity and great instability of stock behavior, investing in this market is associated with high risk and causes their decisions to be disturbed. The incorrect decisions of investors, analysts and economic activists cause price deviation (between the stock market price and the intrinsic price of the stock) and create uncertainty about the future cash flow of companies; In order to minimize these risks, factors that predict the movement of stock prices in the future with high accuracy need to be identified.

Increasing focus on the speed of stock price convergence will reduce or eliminate capital restrictions, harmonize legal and accounting frameworks for

financial reporting, and encourage investors to invest in companies. If the insight and understanding of investors in stock price analysis increases, it will prevent momentary stagnation, price growth in the form of bubbles and untimely reactions in transactions, and will not only strengthen transparency in transactions, but also lead the market towards efficiency. Now the question arises, what is the relationship between price, price prediction and information efficiency? If there is enough information in the market and this information quickly affects prices, such a market is called efficient. In such a market, the price of securities is close to its intrinsic value.

An efficient market should be sensitive to new information. If new information becomes public, prices will change accordingly. One of the types of efficiency in the stock market is known as "informational efficiency". This efficiency means that stock prices in the stock market should be determined based on the "best" information available (Battacharya et al., 2016). Generally, in order to predict future stock prices, the market provides a series of information to the stock market actors and agents, and a series is obtained by the market agents themselves.

In order for the stock market to be efficient in terms of resource allocation, it must be efficient in terms of information, because rational decisions in that market are made based on the reaction or response of market decision makers to "prices". Therefore, the health of production, distribution and consumption of market information are inextricably linked with the correctness of market prices and form the efficiency of the market. The effectiveness of information is one of the most important elements of an efficient market, and it means the speed of the market's reaction and response to information. If the market is efficient in terms of information, the prices in that market adjust quickly and on time to the new information. In such a way that the market operators can't get a sustainable extra profit by using that information and the stickiness of the market prices.

The degree of informational efficiency of the stock market depends on the strength and speed of its adjustments. If the current stock price is only a reflection of the past information, the weak type of efficiency dominates the market, and if the information base of the market operators is all information available to the public, the profit of the operators' expectations is low, and the quality of the analysis of information and forecasts shapes the market in terms of It is called semi-strong information efficiency.

Finally, a market is strong in terms of the efficiency of information that prices respond quickly even to information that is not available to the public and does not allow rent-seeking to form. However, the efficient stock market assumes that stock market investors use their information in the "best" stock pricing model. The best here means that their chosen model is determined by the market conditions. Therefore, the financial market of the country should prepare the environment for choosing the best model so that the behavior of the market and the individual become rational and the market plays its main role in other fields and the national economy.

If we use various types of information as a basis for classification, the markets are divided into three categories:

1- Markets with weak efficiency (information about the past)

Because in this type of market, everyone knows the price trend in the past, it is not possible to use the information or the past trend of the stock price to choose a stock with a very high rate of return in the future, because everyone has the same information.

2- Markets with semi-strong efficiency (all public information)

The semi-strong form of the efficient market hypothesis states that the company's stock price reflects all publicly available information about the company's prospects. Publicly available information includes annual reports and investment advisor data. In such markets, not only the information about the past prices does not create any advantage in the choice of investment (poor efficiency), but also the knowledge of all public information does not create an advantage in the choice of investment.

If a company has a high rate of return, buying and selling its shares will increase the stock price. Only if new information is provided, the stock price will change significantly. According to this hypothesis, all information available to the market is immediately reflected in the current stock price. The evidence strongly supports semi-strong efficiency, but some studies reject this form of market efficiency, for example, we can mention the effect of small companies and companies with low P/E ratio, some of which are described at the end of the article. will be

3- Markets with strong efficiency (all information including private and public)

If prices reflect all public, private and confidential information about the stock, the market is highly efficient. In this case, the investor cannot benefit from the information that is available only to a certain group. According to this hypothesis, if people have specific information, they buy and sell the company's shares, and this causes the price to be adjusted according to this specific information. In highly efficient markets, no one person can profit from having special information or information that is not available to others and only a certain group has it because the company's stock price fully reflects that information.

Empirical observations show that strong form efficiency is not established in most markets. Evidence suggests that company managers have sufficient access to relevant information before it is released to the public, which enables them to make trading profits based on the information.

What causes the formation and change of the expectations of capital market investors is the information that is somehow related to this market. This information can include any information that is published from different sources and in a way that creates changes in the capital market. Each investor, according to the type of expectations he forms for himself based on this information, determines his expected rate of return and based on this, offers his suggested prices to complete transactions.

It is obvious that the fluctuation of this information and, more importantly, their non-transparency, will cause expectations not to be properly formed and will ultimately lead to the formation of false and unrealistic prices in the market. Capital market investors, based on expected returns (expectations) and their level of riskiness, enter into a transaction where both the buyer and the seller expect to make a profit before making the transaction. Undoubtedly, in such a market, the type of information that caused the formation of expectations was important, and in general, the existence of heterogeneous information will cause the formation of transactions quickly.

In such conditions, transactions are formed in such a way that after the transaction, the expectations before the transaction will be very different from the reality that happens after the transaction, because the same heterogeneity of information has caused the transaction process to become opaque and A kind of expression of information rent will be created. Such a market will only work for the benefit of investors who depend on specific information sources in the unequal equation of information and will enter the win-loss game of investment based on this information. Such a market is only exclusive and is for a special few, which not only does not cause economic prosperity and development of the country, but it will result in the unfair distribution of wealth and its accumulation in the hands of a special few.

In an ETF-based structure, price deviations from the declared net asset value do not necessarily mean the existence of arbitrage opportunities, which is more pronounced for international funds as well as funds that are not able to be valued due to the small number of exchanges. As noted, the ETF sponsor contracts with market data vendors to calculate and publish the net asset value based on historical prices. Dealers also publish the daily index value at certain intervals throughout the day. This amount is usually determined based on recent exchanges. For fixed income funds, the daily index value provider may not necessarily fully update the prices of non-exchange-traded securities. According to this pricing mechanism of ETF funds, now the question is, what is the relationship between these funds and the fragility of the market? And secondly, what is the effect of the information communication of these funds?

ETFs have a unique and innovative design that allows them to change the information efficiency of the market and introduce fragility into the market through herd behavior. In particular, as these funds feed more macro-level information into the market, individual asset prices may be constantly skewed and changed. In fact, these funds can exacerbate herding behavior and drive asset prices away from their fundamental value.

Accordingly, a fundamental problem for market regulators is the mechanism of expansion of instability in the market, which originates from non-fundamental shocks. In the absence of ETF funds, the market maker's learning process is mainly focused on the exchange flow in the market, but with the presence of ETF funds, the market maker also learns from the information obtained from the price of the ETF, which means that both the exchange flow in the market and the ETF

information Prices are effective. Therefore, this can cause more volatility, just as fluctuations in ETFs can affect market prices, even if this information is unrelated to a particular asset. If this happens, then we can say that the price of the ETF causes the price of the assets to change, and not that the price of the assets causes a change in the price of the ETF.

In addition, ETFs can generate sustained deviations from fundamentals at the asset level, while at this level we can see increased price efficiency. In this regard, it can be said that assets with high beta and high weight in the ETF portfolio are exposed to most of these deviations.

Considering the above-mentioned cases, it can be said that considering that ETF funds lead to more market fragility, this case should be one of the policymakers' concerns. In this regard, things like limiting the ETF to having certain assets and reducing its size are proposed. Based on this, improving the quality of the fund's underlying asset information can be effective because it can reduce information differences between markets. Therefore, information transparency and information communication can be effective in this direction.

Fragility and instability in the stock market are among the key components considered by the market maker in the securities market, and this index is influenced by economic variables and financial instruments that are formed over time and in different ways. ETF funds are one of the new financial tools for investors that we have witnessed in the last decade in the Iranian capital market. Although ETFs in their original format are a combination of market-traded and exchange-traded assets, but in terms of the level of liquidity, risk and volatility as well as the creation of a new level of information about the assets, they are different from the previously traded stocks in the market, and this distinction makes us expect that the level of market volatility will change when ETF funds enter the market. And because this level of volatility is directly related to the entry of new financial instruments (ETFs), as a result of the entry of these financial instruments, we will witness an increase in market fragility and an increase in its volatility index.

On the other hand, due to the fluctuation, fragility and increase in instability mentioned above, as well as the trend of ETF price changes over time, we are witnessing the entry of another new source of information in the market, which is the fund's price fluctuations, and therefore, this information is expected to be in line with the smoothing of market fluctuations should be provided to the market maker. Therefore, investigating the information connection between ETF funds and the market mechanism is one of the most important things that are investigated regarding the entry of these funds into the market.

In the field of the relationship between market fragility and tradable funds, a wide range of studies have been conducted inside and outside the country, and in this section, while referring to some of them, the difference between the present study and them is examined. While ETF studies have analyzed different concepts and aspects, one major part of these studies considered the structure of ETFs and their differences with other funds; for example, Wu et al. (2021) compared the

performance of ETFs and traditional funds in China: the results of this study show that ETF funds have relatively better performance than other funds. Also, more tests showed that during the crisis, the effects of the ETF fund are greater than other funds.

Since ETF funds have side effects on market, some studies devoted to test the relationship among macro variables and ETFs; according to this line of research, Sakaria et al. (2020) in their study examine the relationship between exchange-traded funds and currency volatility in Turkey. Empirical findings show that exchange rate fluctuations have an asymmetric effect. The asymmetric effect is positive and significant in all models, which indicates that a positive flow shock causes higher exchange rate volatility. The most important finding is that high inflows to ETFs increase the current and future exchange rate volatility, but resource outflows have a significant negative effect on the intermittent exchange rate volatility.

Volatility analysis, which is one of goals of current paper, is another important research title of ETFs. Some researchers believe that ETFs have direct and meaningful effect on market volatilities; for example, Corbett et al. (2014) in their study have investigated the relationship between ETF funds and volatility in the commodity market. In their study, the authors have mentioned the basis of the research on the basis that ETF funds in relation to the asset markets are the causes of the commodity market and its fluctuations can affect the price fluctuation in the commodity market. The results of this research show that the higher the market share of ETF funds, the more volatility we will see in the basis of the EGARCH model. Also, smaller commodity markets will see more liquidity flow, which shows the advantage of investing in ETFs.

Among domestic studies, we find that a major part of researches devoted to the structure and trading of ETFs; for example, Rahmani Asal et al., (2021) in an article titled Portfolio formation of tradable funds with the combined approach of clustering and aggregation of the discriminating advantages of portfolio formation of tradable funds have been investigated. The results of the research indicate that the combined framework used is appropriate and the yield index with a weight of 0.153 has the greatest role and the Trainer ratio index with a weight of 0.039 has the least role in the investment portfolio. Also, according to the results obtained from the accuracy of the classification and testing of the test samples, it was found that the accuracy of the model is 100%, and finally, three tradable funds Arman Ati Kotsar, fixed income tradable Kian and stable Parand Sepehr. which are placed in the first cluster according to k-mean clustering and have the most usefulness based on the method of aggregating the discriminating advantages, were selected to form a portfolio.

Another paper devoted to structural analysis ETFs is Zamardian et al. (2018), examine the rating of exchangeable investment funds based on the value-creating approach and approach. Value at risk has been paid. In order to investigate this goal, a statistical sample including ETF funds that operated in the capital market from September 2013 to September 2016 was considered. The results of the

investigation show the appropriate ability of value-at-risk models based on the GARCH-EVT approach to assess the risk of these funds. Similar to Zamardian et al. (2018), Bahadran et al. (2017) in their study entitled Mispricing, Arbitrage Continuity and Tradable Fund Returns in Iran have investigated mispricing, arbitrage continuation and tradable fund returns in Iran.

The purpose of this research is to investigate the existence of arbitrage opportunities, to identify the impact of these opportunities on the returns of investment units, and also to investigate the durability and sustainability of these opportunities, hence tradable funds whose information is in Availability was selected as a sample and their information was collected daily from October 2012 to March 2015. The results of the research indicate the impact of arbitrage opportunities on the expected return. The presence of negative arbitrage has a positive effect on expected returns, and positive arbitrage has a negative effect.

As a summary of the mentioned studies, it is necessary to point out that the investigation of the role and impact of exchange-traded funds (ETF) on the performance of the capital market and its related indicators is one of the most important issues in the financial field. Various applied fields have also been used in various domestic and foreign studies, some of which have been mentioned in this chapter. However, the point that is prominent and important in these studies is the relationship between the entry of ETF funds and financial indicators and variables before and after their entry into the market.

One of the important results of these studies is the relationship between risk and fluctuations that arise as a result of ETF funds entering the market. Often, due to the fact that these funds are a combination of different assets, therefore, the arbitrage between its price and related assets, and also because of the information gap that these funds have with respect to asset shares, can be considered as the source of market volatility. Another important result of these studies is the relationship between the liquidity spillover effects of ETF and its underlying assets, in the sense that the risk of liquidity contagion between these two markets is high. Also, this hypothesis has been confirmed that the more percentage of a company's shares are kept by ETF, then the cost of wrong choice of buying the company's shares will be higher. In addition to this micro-relationship, macro-economic variables are also affected by this phenomenon, among them is the exchange rate; Empirical findings show that exchange rate fluctuations have an asymmetric effect. The asymmetric effect is positive in the sense that a positive flow shock causes higher exchange rate volatility.

The difference between this study and other domestic studies is that in this study we quantify a measure of the relationship between fragility in the Iranian stock market as a result of the entry of ETF funds; in other words, we investigate the market fragility before and after ETFs entering market. This static analysis enables us to tell whether introducing ETFs have direct effects on market volatilities or not. The criterion introduced in the model section makes it possible to make specific and accurate conclusions about the effects of ETF funds.

3. The Study Model

This study is organized based on modeling the structure of a market with continuous transactions. In order to model this feature, the study of Kiel (1985) has been used, in which transactions are formed in several related markets, which include ETFs and related assets. The basic model is a market structure without ETF, and then the effect of ETF entry is examined. The modeling of the study is based on the modeling of behaviors and trends, based on which each part is modeled based on the structure and characteristics. The models made for each section are as follows:

1- Specification of the model for the value of an asset

2- Modeling market participants and their information

3- Description of the objective function for the trader in order to derive the demand equation for the asset

4- Determining behavioral equations of asset pricing

5- Determining some systematic and nonsystematic shocks

In this study, a quantitative model is used to model the presence of ETF funds and related asset markets. The base model of the study is a market structure without an ETF fund, and then we examine the incremental effect of introducing an ETF fund. The structure of this model is as follows:

1- Explanation of the liquidity value of a specific asset: based on the current market value of the asset and its price in the market

2- Explanation of the liquidity value of an ETF fund: based on the daily price of the assets in it, the share of each asset and finally the weighted sum of the liquidity value of each asset

3- Expressing the goal of traders in buying a specific asset and determining the mathematical form of their goal: defining the subordinate form of the goal function of traders in the market based on the behavioral foundations of the mentioned unit

4- Expressing the goal of traders in buying an ETF fund and determining the mathematical form of their goal: defining the dependent form of the goal function of traders in the market based on the behavioral principles of the mentioned unit for each asset and then summing it up for the assets in the ETF fund

5- Derivation of the price of each asset and ETF fund in long-term balance: based on mathematical relationships based on the designed financial structure, which is mentioned in detail in each section of the study.

6- Extracting the price of each asset and ETF fund in consecutive periods: Based on the relationships defined in part (5), in addition to the long-term balance, the mentioned index is also extracted in other time periods.

7- Quantitative investigation of the number of nonsystematic shocks in the absence of ETF funds: through the statistics of statistics, including moments of variables and indices based on these moments.

8- Quantitative investigation of the number of nonsystematic shocks in the presence of ETF funds: through the statistics of the science of statistics, including the torques of the variables and the indices built on the basis of these torques.

9- Calculation of indicators related to the fragility and instability of investment funds, as well as the efficiency of information related to them: this is calculated based on the defined index related to this variable.

10- Using the statistical inference approach in examining the indicators extracted from step (9) in order to test the hypothesis related to examining the research hypotheses.

This study is organized based on modeling the structure of a market with continuous transactions. In order to model this feature, the study of Kiel (1985) has been used, in which transactions are formed in several related markets, which include ETFs and related assets. The basic model is a market structure without ETF, and then the effect of ETF entry is examined. The modeling of the study is based on the modeling of behaviors and trends, based on which each part is modeled based on the structure and characteristics. The models made for each section are as follows:

1- Specification of the model for the value of an asset

2- Modeling market participants and their information

3- Description of the objective function for the trader in order to derive the demand equation for the asset

4- Determining behavioral equations of asset pricing

5- Determining some systematic and nonsystematic shocks

In order to check these cases, it is assumed that there are N asset markets and an ETF fund is included in this structure. An ETF, denoted e, tracks a weighted average of N assets. The initial values of the i-th securities (i=1,...,N), Pi,0, are known to the public. The cash value of the asset, vi, is determined as follows:

$$P_{i,0} + b_i\gamma + \epsilon_i, \quad i = 1, \dots, N \tag{1}$$

In this regard, γ and ϵ_i are random variables with normal distribution and independent of each other, whose mean is equal to zero. The shocks to asset value can be divided into two systematic (γ) and nonsystematic (ϵ_i) parts, where b_i is the loading factor of the relevant factor. For simplicity, it is assumed that var(ϵ_i)=var(ϵ_j)=var(ϵ) in the sense that the variance of nonsystematic components is equal.

$$\sum_{i=1}^{N} w_i P_{i,0} + \sum_{i=1}^{N} w_i b_i \gamma + \sum_{i=1}^{N} w_i \epsilon_i \tag{2}$$

where w_i is the weight of the i-th asset.

3.1. Market participants and their level of information

All market traders are assumed to be risk neutral. Every asset market has a set of customers who are actually part of the market participants who were engaged in asset exchange before the introduction of ETFs. It is assumed that this category of customers is specialized and not eager to exchange ETFs.

Insurance companies, for example, rarely hold ETF assets. For a number of reasons, this lack of enthusiasm is justified. O'Hara et al. (2016) point out that in corporate bond markets, exchange relationships and networks make a significant difference to the exchange component of market participants. Often, long-term

market participants earn a return on the market they are active in, something they can't get in an ETF. Additionally, traders who specialize in a particular market have less of an informational advantage and face more competition when trading an ETF portfolio.

The asset market in this structure is similar to the Kiel (1985) auction model, with a specific market maker. Each market's customers consist of an informed trader who trades liquidity. The trader receives a signal about the systematic and nonsystematic risk affecting the market. As with the standard structure of this class of models, liquidity exchanges are assumed to have an exogenous reason for being exchanged. In the market for asset i, traders place a general order level of z_i~N(0,var(z_i)). Into this structure then enters the ETF fund, which brings its own clients: a legal activist, an informed trader and liquidity traders. The legal operator is responsible for maintaining prices in the ETF fund and is able to trade in the asset in question. Other people involved in the ETF are not involved in the said asset market, which is due to the mentioned frictions. The ETF trader receives N+1 signals: one signal about the systematic factor and N signals about the N nonsystematic factor. In the ETF market, the liquidity order is z_e~N(0,var(z_e)).

The goal of a trader in the market is to select activity i as follows:

$$x_i = argmax_{x_i'} E(x_i'(\epsilon_i + b_i\gamma - P_{i,1}|\epsilon_i, \gamma) \quad (3)$$

Similarly, the ETF trader's objective (if an ETF is introduced to the market) is to choose the order size x_e such that:

$$x_e = argmax_{x_e'} E\left(x_e'\left(\sum_{j=1}^{N} w_j\left(\epsilon_j + b_j\gamma\right) - P_{e,1}\right)|\epsilon_i, \gamma\right) \quad (4)$$

The total order in the ETF market is q_e=x_e+z_e. Also, in the i-th market, the total order is q_i=x_i+z_i.

In the long-run equilibrium, the price set by the legal operator in the ETF market in period 1 is as follows:

$$P_{e,1} = \lambda_e q_e \quad (5)$$

Also, the price set by the market maker in the i-M market in period 1 is as follows:

$$P_{i,1} = \lambda_i q_i \quad (6)$$

The ETF trader's order size is equal to:

$$x_e = \sum_{j=1}^{N} v_{ej}\epsilon_j + \theta_e\gamma \quad (7)$$

And for a trader in the i-th market, the order level is as follows:

$$x_i = v_i\epsilon_i + \theta_i\gamma \quad (8)$$

that in these relationships:

$$v_{ej} = \frac{w_j}{2\lambda_e}\ ,\ \theta_e = \frac{\sum_{j=1}^{N} w_j b_j}{2\lambda_e} \quad (9)$$

$$v_i = \frac{1}{2\lambda_i}\ ,\ \theta_i = \frac{b_i}{2\lambda_i} \quad (10)$$

$$\lambda_e = \sqrt{\frac{(\sum_{j=1}^{N} w_j^2)var(\epsilon)+(\sum_{j=1}^{N} b_j w_j)^2 var(\gamma)}{4var(z_e)}} \quad (11)$$

$$\lambda_i = \sqrt{\frac{var(\epsilon)+b_i^2 var(\gamma)}{4var(z)}} \quad (12)$$

After the first period, market makers see price changes in other markets and this provides them with additional information to update prices. Since there is a one-to-one mapping between price and order level, market makers can make inferences about order levels in other markets in the first period according to their price changes. It should be noted that without an ETF, there is a degree of intra-market learning in the model, which uses a price factor-based representation. This is because market makers try to obtain more information about systematic risk by using other asset prices.

But an ETF provides a different source of information. ETF prices contain not only systematic risk information but also nonsystematic risk information about the respective asset markets. Therefore, the effects of learning in the economic system are strengthened by the existence of the ETF fund. Accordingly, in the long-run equilibrium with the existence of an ETF fund in the market, the second period price of the i-th asset is as follows:

$$P_{i,2} = \left(\frac{q_i K_i v_i}{var(z)+var(\gamma)\theta_i^2} + \frac{q_e K_i v_{ei}}{var(z_e)+var(\gamma)\theta_e^2+\sum_{j\neq i} var(\epsilon)v_{ej}^2}\right) +$$

$$b_i\left(\sum_j \frac{q_j K_{\gamma e}\theta_j}{var(z)+var(\gamma)\theta_i^2} + \frac{q_e K_{\gamma e}\theta_e}{var(z_e)+\sum_j var(\epsilon)v_{ej}^2}\right) \quad (13)$$

And the price of the second period of the ETF fund is equal to:

$$P_{e,2} = \left(\sum_i \frac{q_i K_i v_i w_i}{var(z)+var(\gamma)\theta_i^2} + \sum_i \frac{q_e K_i v_{ei} w_i}{var(z_e)+var(\gamma)\theta_e^2+\sum_{j\neq i} var(\epsilon)v_{ej}^2}\right)\sum_j w_j b_j \left(\sum_i \frac{q_i K_{\gamma e}\theta_i}{var(z)+var(\epsilon)v_i^2} + \frac{q_e K_{\gamma e}\theta_e}{var(z_e)+\sum_j var(\epsilon)v_{ej}^2}\right) \quad (14)$$

that in these relationships:

$$K_i = \left(\frac{1}{var(\epsilon)} + \frac{v_i^2}{var(z)+var(\gamma)\theta_i^2} + \frac{v_{ei}^2}{var(z_e)+var(\gamma)\theta_e^2+\sum_{j\neq i} var(\epsilon)v_{ej}^2}\right)^{-1} \quad (15)$$

$$K_{\gamma e} = \left(\frac{1}{var(\gamma)} + \sum_j \frac{\theta_j^2}{var(z)+var(\epsilon)v_j^2} + \frac{\theta_e^2}{var(z_e)+\sum_j var(\epsilon)v_{ej}^2}\right)^{-1} \quad (16)$$

Accordingly, in the long-run equilibrium with N assets and no ETF, the second period price of the i-th asset is as follows:

$$\tilde{P}_{i,2} = \left(\frac{q_i v_i var(\epsilon)}{var(z)+var(\gamma)\theta_i^2+v_i^2 var(\epsilon)}\right) + b_i\left(\sum_j \frac{q_j K_{\gamma a}\theta_j}{var(z)+var(\epsilon)v_j^2}\right) \quad (17)$$

In this regard:

$$K_{\gamma a} = \left(\frac{1}{var(\gamma)} + \sum_j \frac{\theta_j^2}{var(z)+var(\epsilon)v_j^2}\right)^{-1} \quad (18)$$

A defining feature of the transmission of information through ETF order flow is that it results in the associated markets becoming more interconnected. In fact, there is some kind of connection when using a factor-price representation for the

security price. The expansion $\tilde{P}$_(i,2) of the asset price of the second period in the market without ETF in relation (17) includes the order flow for q_1,...,q_n. But more orders only affect the posterior systematic risk factor, which includes the component of the bracket after b_i in relation (17), because the market maker in asset i knows that asset j does not contain information related to the nonsystematic risk factor of asset i.

With the addition of ETFs, the situation is different. Now, with P_(i,2), the asset price in the second period in the market that has an ETF, the order flow in other markets not only affects the posterior systematic risk, but also affects the nonsystematic risk. In relation (13), the component in the first bracket represents the nonsystematic risk factor of the updated price, while the component in the bracket after b_i represents the systematic risk factor. It is clear that the additional effect on the nonsystematic component of P_(i,2) occurs due to the ETF order size (q_e).

This is because the relevant market maker cannot fully distinguish the various components of the ETF's price movements. In fact, q_e is affected by all N nonsystematic risk factors. This means that the nonsystematic risk factor P_(i,2) is a weighted sum of all nonsystematic risk factors in the market. Even for the systematic risk factor P_(i,2), ETF order flow (q_e) amplifies any distortion by q_1,…,q_N.

Now, in the context of fragility and volatility, it can be said that with the existence of an ETF fund in the market, a shock δ_j to the nonsystematic component of asset j leads to an increasing effect to the extent of:

$$\delta_j \frac{v_{ej} v_{ei} K_i}{var(z_e)+var(\gamma)\theta_e^2+\sum_{j\neq i} var(\epsilon) v_{ej}^2} \quad (19)$$

In the nonsystematic risk factor, the price of the i-th asset becomes P_(i,2). This shock also leads to an increasing effect of:

$$\delta_j b_i \left(\frac{v_{ej} K_{\gamma e} \theta_e}{var(z_e)+var(\epsilon) v_{ej}^2} + (K_{\gamma e} - K_{\gamma a}) \frac{v_j \theta_j}{var(z_e)+var(\epsilon) v_{ej}^2}\right. \quad (20)$$

In the systematic risk factor, the price of the i-th asset becomes P_(i,2). The aforementioned relationships provide an accurate expression of market fragility that results from the market maker's inability to distinguish the various components of ETF price changes. The shock is a completely new nonsystematic component, and in the absence of an ETF, the nonsystematic component of the updated price remains unchanged. With the ETF fund, we see the transfer of δ_j to P_(i,2) through two channels: q_j, the order flow in the j-th asset market and q_e, the ETF order size. The overall effect is equal to the weighted average of the effects of these two channels. Whether the incremental effect on the systematic risk factor is negative or positive then depends on how this weighted average compares with the effect through q_j. Based on the equation (19), it can be pointed out that the increasing effect of an uncorrelated shock on the nonsystematic shock of the price of an asset is greater if it has a greater weight in the ETF fund. Therefore, if an ETF trader has more information about an asset that has a higher weighting in the ETF, then he will mainly trade based on that signal because it

gives him a relatively greater informational advantage. As a result, the relevant market makers in those markets will learn more about ETF price adjustments and thus be more exposed to uncorrelated shocks.

Therefore, ETF markets will have both a cost and an advantage to the respective asset markets. Cost includes unrelated information mixed with related information, which in this case affects prices. Its advantage includes access to more information. The informativeness of prices is measured by changes in the variance of the market maker's value distribution for an asset after one round of trading. In a modeling structure such as Keel's model, the posterior variance is half of the prior variance, and therefore, making an exchange reveals the traders' information in each period. Accordingly, the information in the ETF reduces the variance in the related market makers.The analytical structure of the present study is based on the risk neutrality of market participants, the existence of asymmetric information, and the learning relationship between ETF funds and its related securities.

Table 1. Model variable definition

Symbol	definition	Symbol	definition	Symbol	definition
$P_{i,0}$	initial values of price	ϵ_i	random variable	γ	Systematic shock
b_i	loading factor of the relevant factor	$P_{e,1}$	ETF market in period 1	x_i	activity i
x_e	order size	q_e	total order in the ETF market	$P_{i,2}$	second period price of the i-th asset

4. Empirical Results

According to the statistics and information available at the time of writing this research, the number of active ETF funds in the Iranian market is equal to 47 funds, of which 25 are fixed income bond ETF funds, 21 are stock ETF funds, and 4 are ETF funds. Mixed, there are 2 funds of land and building ETF type and 1 fund of fund-in-fund ETF type. According to the purpose of the study on the relationship between the entry of ETF funds and market returns, in this research we will only focus on ETF stock funds, which are 21 in number. The time period used is in the form of daily information and in the period from 30-Jan 2022 till 28-Dec 2022.

Based on this, the amount of information used is equal to 218 samples. In order to calculate the price of each of the assets under the ETF fund and their share in the portfolio, it is necessary to use the balance sheet of the financial year of the fund, which can be done by referring to the website of the Iranian Foreign Exchange, the website address of the specific fund, and then referring to that address. Fund information has been obtained. Then, by referring to the assets

under the ETF fund, the information of each asset is specified and the required data is extracted based on that. Based on the available information, the funds contain the assets of 20 different companies, and with the identification of the information of these 20 companies, their prices and their fluctuations in the mentioned period of time were extracted by referring to the system of the stock exchange organization, and based on that, the equations were checked.

The estimation procedure is as follow: first, we estimated equation (1) for each 20 assets by three different approaches: OLS estimation, VAR estimation and Bayesian VAR estimation, where due to uncorrelated relation among variables, the OLS and VAR estimation reaches a similar result and because of lack of information regarding prior probability distribution functions, Bayesian estimation was not justified. After estimating parameters of eq (1) for each asset, we can use the solution of optimization of (3) and (4) to compute parameters needed for systematic and nonsystematic measures, where reported in the table (2).

As can be seen from Table (2), the effect of an uncorrelated shock on the nonsystematic price shock is greater for assets that have more weight in the ETF fund; Because the ETF trader trades on the information signal of the asset with a higher weight because it has a relatively greater informational advantage for him. As a result, relevant market makers in those markets will learn more about ETF price adjustments and thus be more exposed to uncorrelated shocks, which means more nonsystematic shocks.

Table 2. Statistics of assets underlying ETF`s

Asset statistics							
Estimated systematic risk	Estimated nonsystematic risk	K_i	λ_i	v_i	w_j	v_{ej}	Asset
0.1	0.7	233	170.5	0.3	1.4	0.5	1
0.0	2.4	9184	581.7	0.1	3.9	1.5	2
0.0	2.5	96475	1730.3	0.0	4.6	1.8	3
0.2	0.1	95	232.7	0.2	0.4	0.2	4
0.0	1.5	1581	525.9	0.1	0.8	0.3	5
0.0	2.2	1147	182.1	0.3	6.1	2.4	6
0.0	2.3	196252	1649.4	0.0	11.2	4.3	7
0.0	0.0	17	78.8	0.6	0.4	0.1	8
0.0	1.0	133	63.9	0.8	4.7	1.8	9
0.0	2.2	1090	140.0	0.4	8.3	3.2	10
0.0	2.5	44032	1237.0	0.0	4.1	1.6	11
0.0	2.5	138431	3094.8	0.0	2.0	0.8	12
0.2	1.0	164	151.0	0.3	3.7	1.4	13
0.0	1.5	205	66.1	0.8	6.9	2.6	14
0.0	2.5	13313	789.9	0.1	3.0	1.2	15
0.3	0.1	22	101.1	0.5	2.4	0.9	16

0.0	2.3	518798	2894.4	0.0	9.7	3.7	17
0.0	2.4	3800	308.5	0.2	6.0	2.3	18
0.0	2.5	119725	1770.7	0.0	5.5	2.1	19
0.0	2.4	275605	2658.8	0.0	5.7	2.2	20

Source: *Author computations*

As reported in table (2), we computed systematic and non – systematic risk for stock included in sample ETF. These indices reveals that how ETF could impact on market fragility. Based on the results of table (2), with the exception of asset number (8) whose estimated nonsystematic risk is equal to zero, the value for other assets is far from zero, and this indicates the impact of seemingly uncorrelated shocks of ETF assets on each other, and therefore it can be stated that with the introduction of ETF funds, the nonsystematic risk of assets has increased and this increase means an increase in fragility in the market.

In other words, when terms of ETFs were traded in market, the information behind each asset has changed and therefore the efficiency of market due to presence of ETF could alter and this may lead to a variation in prices of assets behind ETF which means more volatility. In fact, the non – systematic risk means the variations of a specific asset and when it get a meaningful value, it means that by altering the environment, the volatility of asset was changed.

As depicted in fig (1), the relation between a shock to market price and nonsystematic risk is straightforward, by the way it means that introducing ETF may lead to more volatility in assets price which redirect means a high degree of market fragility.

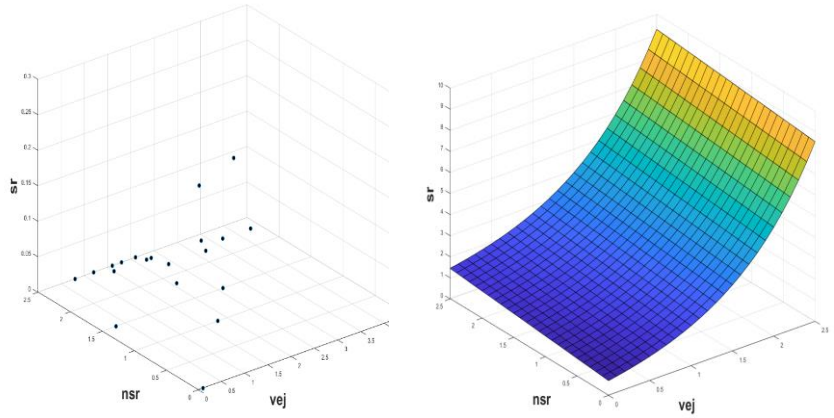

Figure 1. Trend relation among a shock to market price (vej), nonsystematic risk (nsr) and systematic risk (sr) in the underlying assets of ETF.

Source: *research computations*

5. Concluding Remarks

Examining a selected set of ETF funds and their underlying assets shows that the entry of the said funds into the Iranian stock market has increased the market's fragility. In other words, due to the action and reaction between assets, the number of shocks caused the creation of nonsystematic risk and its increase, and therefore, as a result, it shows the increase of fragility in the market.

Therefore, based on the existing literature, ETF funds in Iran have been able to change the information efficiency of the market and increase the fragility in the market through collective behavior. Specifically, these funds have allowed more information to enter the stock market at the macroeconomic level, and accordingly individual asset prices have changed more modestly. Therefore, it can be concluded that in the Iranian market, these funds can intensify the collective behavior and make the asset prices away from their base value.

According to the obtained results, a fundamental problem for market legislators in Iran is the effect of instability in the market, which originates from non-basic and non-systematic shocks. By defining ETF funds, the flow of exchange in the Iranian stock market will cause more volatility, and the fluctuations mentioned in ETF can have a significant effect on market prices. If this happens, then we can say that the price of the ETF causes the price of the assets to change, and not that the price of the assets causes a change in the price of the ETF.

Considering the above-mentioned cases, it can be said that given that ETF funds in Iran lead to greater market fragility, therefore the policymaker should pay serious attention to this matter. Among these things, we can refer to creating ETF restrictions to include certain assets and reducing its size. Based on this, improving the information exchange flow of fund's basic assets can be an effective step in this regard with information transparency.

Therefore, a worrying problem for the legislator in the ETF market is the spread of instability in such markets, which is caused by the transmission of nonsystematic shocks. In the absence of ETFs, market makers' learning is more focused on their market order flow. With an ETF, the market maker also extracts information from the price of the ETF, which means that its own and the ETF's market information affects prices. This can lead to volatility affecting fundamental market prices as a disruption.

The fact that ETFs can lead to volatility in asset prices can outweigh their benefits. When asset prices diverge from fundamental values, markets cease to function and their vital role in the efficient allocation of capital is compromised. Just as importantly, market behavior can cause undesirable characteristics such as excessive volatility and excessive movement, which in turn can lead to general market volatility.

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