

The Impact of Big Data Techniques on Predicting Stock Prices: Evidence from Jordan

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Abstract. The purpose of this study is to demonstrate the impact of big data analytics techniques on predicting stock prices in industrial companies listed on the Amman Stock Exchange (ASE) from the perspective of employees in Jordanian financial intermediation firms. To achieve the goal of this research, two approaches were used. The first approach is an analytical descriptive approach that collects primary data through a survey that measures the elements of the independent variable related to big data analytics techniques (Volume, Velocity, Variety, and Veracity). A second approach is an applied approach that measures the dependent variable of stock price prediction using financial statements from industrial companies listed on the ASE from 2015 to 2021. Multiple regression tests were used to test the hypotheses and extract the results, which demonstrated that big data technologies play an important role in providing appropriate and reliable information to predict the prices of stock exchange traded shares. The variable "veracity" ranked first in the power of influence in predicting share prices, while the variable "volume" ranked last. These findings suggest that ASE dealers prioritize the credibility of data received from companies over the rest of the information resulting from big data analyses to predict stock prices traded on the stock exchange.

Keywords: Big Data, Stock Price Forecasting, Industrial Companies

1. Introduction

There is a great controversy in the accounting and finance literature about the ability of financial analysis processes and the indicators issued by companies whose shares are traded in the financial markets to help investors explain the financial conditions of these companies and then predict the prices of traded shares. As the stock exchange reflects the performance of shares and all available and free information through the interaction between financial analysis processes with their indicators and investment decision-makers (Marie, et. al, 2019). Some of the study results confirmed the relationship between the financial analysis processes that dismantle the financial statements content and make them clearer and more useful to assist future prediction and decisions making regarding the value of shares traded in the stock exchange, while some other studies confirmed the opposite (Alshehadeh, et al.,2022b).

Information has a predictive ability when it is able to influence the user's decision by helping him confirm or correct the prior expectations of decision makers, and for the information to be useful, it must be characterized by impartiality in its evaluation of the material and non-material elements appearing in the financial reports (Enow & Brijlal, 2016). The existence of bias in the presentation of information, even if it serves the interests of a certain category of information users, may harm the interests of other categories of users of financial reports. The information published in the financial reports must show the facts with no regard to the behavioral effects that this information may cause, and it must also be verifiable and does not serve one category of users at the expense of another. This embodies the “Veracity” of the published information (Al-Shahadah et al., 2023).

In light of the efficient financial market, the information will be quickly analyzed to reach all investors (buyers and sellers) at the same time. This will not be properly achieved except through the use of big data analytics techniques, which will result in an immediate change in the market value of the share to reflect its true value without giving any investor the advantage of a head start that would allow him to achieve an extraordinary revenue (Abnormal Return) at the expense of others, and then achieve information parity for all market dealers (Almumani, 2014).

The use of data has increased dramatically by all parties interested in the economics of companies, as big data analyses have the ability to explain the characteristics of that data and remove ambiguity in it, as big data technologies can support companies in assessing their financial positions through multiple methods and techniques of evaluation, (Alshehadeh et al., 2022a). Which necessitates those interested to identify data sources and convert them into sets of important, safe, influential and accurate data, which increases their usefulness and reliability by users and reduces the risks of asymmetry for parties interested in corporate economics. Consequently, this enables the produced data in forecasting stock prices listed in the capital markets (Salijeni et al., 2019), (Alshebli, 2022).

Big data analyses help in discovering and identifying the most important data for the parties that deal in the capital markets, including shareholders, investors, and lenders, and also in directing their future decisions, and increasing the capabilities of these dealers in determining revenue flows, and indicating areas of efficiency in operations and customer services. They can also assist to identify risk areas and areas of risk management for companies listed in the market, and thus in predicting the share prices of those companies (Zabihollah & Wang, 2017). The flow of big data has become one of the biggest challenges facing contemporary companies because of the difficulty of processing, storing, managing, and benefiting from it to meet the needs of beneficiaries. There are many challenges and obstacles hinder the use or the expanded use of big data (Raguseo, 2018). Big data technique is one of the most important modern technological tools used to access a wide range of data, information, applications, and tools invested to achieve and improve the cognitive capabilities of decision-makers, and to reduce information discrepancy among all users (Yudowati&Alamsyah, 2018). Which may contribute to obtaining the appropriate and reliable information needed to make a rational investment decision. As it is expected this will contribute positively to reducing cases of asymmetry in information

which is considered one of the risks they may face when making decisions regarding shares traded in the stock exchange. (Sandrielem & Fernando, 2017). **Hence, this study will answer the following main question:**

Does the use of big data analytics techniques (volume, velocity, variety and veracity) affect the prediction of stock prices from the point of view of workers in Jordanian financial intermediation companies?

The following sub-questions branch out from this main question:

1. Does the use of big data analytics techniques represented in “Volume” affect the prediction of stock prices from the point of view of workers in Jordanian financial intermediation companies?
2. Does the use of big data analytics techniques represented in “Velocity” affect the prediction of stock prices from the viewpoint of workers in Jordanian financial intermediation companies?
3. Does the use of big data analytics techniques represented in “Variety” affect the prediction of stock prices from workers' viewpoint in Jordanian financial intermediation companies?
4. Does the use of big data analytics techniques represented in “Veracity” in big data analytics affect the prediction of stock prices in the opinion of workers in Jordanian financial intermediation companies?

2. Literature review

2.1. Big data analytics

The term "Big Data" came to light in recent years and the attempts to benefit from big data analysis have become a common factor among large institutions and startups. It has also offered many opportunities for establishing specialized companies; helps companies that store huge digital content in organizing, processing, storing their data in an acceptable time, and analyzing that data to help companies and parties in making rational decisions that are compatible with upcoming future events (Günther et al., 2017). As contemporary companies that possess huge data face a great challenge in their ability to control them, as storing, managing, and optimally utilizing this data is a real problem. Big data, on the other hand, provides a competitive feature to companies if they are well utilized and analyzed, and this will help officials make correct and accurate decisions within these companies based on the information extracted from big data (Irene, 2019). The use of big data analysis techniques allows these companies to increase their efficiency, rationalize their decision-making significantly, and enhance their competitive stand. Knowing the requirements of the beneficiaries allows contemporary companies to provide services based on those needs and requirements. Consequently, these companies ensure that the beneficiaries are satisfied with the services provided (Janvrin, & Watson, 2017).

In fact, it is not possible to give a specific definition of big data; as it is a term with multiple contents. (Parra & Halgamuge, 2018) defined it as a process of analyzing huge data based on technology, which cannot be processed or analyzed using the usual tools and methods, and that this data is managed through a business intelligence system. While (Yuliarto, et al, 2023) defined it as a set of complex data packages, and it is difficult to deal with and process with traditional database management methods in terms of searching, saving, analyzing, extracting results, sharing, and transferring in an acceptable period. As it is multi-type sources data. (Idil & Destan, 2018) described it as huge amounts of complicated and overlapping data that cannot be processed with traditional database management tools, whether in terms of storage, search, analysis, and extraction of results. It is large in size, with high speed, diverse sources, and multiple formats, and requires innovative ways to process Information to enhance companies' visions and their competitive stand and improve the decision-making process. Big data has also been defined as stocks of information. It is characterized by its huge size, speed, and diversity, which requires innovative and effective ways of processing that differ from the processing of ordinary data. Consequently, it enables its users to improve vision, decision-making, and the automation process (Jiyong & Soonhee, 2020). **From the foregoing, a set of features of big data can be summed up:**

1. Velocity: It means the speed of producing and extracting information from data, as speed is a crucial element in making decision based on this information. speed can be expressed by the time it takes to obtain information from the moment this data is obtained to the moment a decision is made based on it (Alshehadeh et al., 2022). Where big data analytics techniques contribute to the rapid flow of data from its sources such as operational processes, reports, financial statements, networks, social media, databases, etc., as the flow of data is huge and continuous. This speed can help to extract and form the information that is necessary to make rational decisions by those interested. (Van, 2016).

2. Variety: Data comes from different and multiple sources and in different and varied forms, as well as the diversity of the extracted information, which is essential to analysts in choosing special information in their field of work (O'Leary, 2018). Diversity means that big data includes many types of extracted data forms, which helps users, whether they are internal or external stakeholders, to choose the appropriate data for their decision domain (Alshehadeh et al., 2022). Where big data includes structured and unstructured data such as Images, clips, audio and video recordings, map data, reports, and financial statements. It requires time and effort to prepare in an appropriate form for processing and analysis (John & William, 2015). Big data analysis leads to clarifying the content of financial reports and improving forecasting of the risks of corporate work, achieving compatibility among the parties and showing indirect information in the financial reports, which help to reduce cases of information asymmetry and thus improve the credibility of financial reports (Sudeep et al., 2020).

3. Volume: The economics of contemporary companies are featured by the fact that they lead to the generation of large amounts of data that are steadily increasing, which requires a huge space to store them that exceeds the traditional databases (Hung & Binh, 2018). Volume expresses the amount of data generated by the economics of companies that may reach a huge volume of data, as it is large amounts of structured and unstructured data, (Grable & Lyons, 2018)

4. Veracity: It means the credibility of the source and procedures of data preparation, and the extent of its accuracy, validity, and novelty of that data, as the analysis of big data contributes to achieving the reliability of the information, and this in turn will lead to an improvement in forecasting future profits and risks related to the work of companies (O'Leary, 2018). It also leads to improving forecasting future growth opportunities and their continuity, improving forecasting of future sales, predicting financial fraud, and early detection of weaknesses and strengths of the companies' revenue capacity as well. Furthermore, it drives progress in the objectivity of financial reports and then improves the evaluation of the company's performance generally and the market value of companies in particular (Sudeep et al., 2020).

These aforementioned characteristics affect the alleviation of the information asymmetry phenomenon, as big data technologies contribute to using of data processing software to obtain various types of information that meet the decision inputs of parties interested in corporate economies. Through the use of big data tools, unsolicited activities can be quickly detected, such as accounting and financial fraud (Zabihollah & Wang, 2017). The results of big data analysis can also help in revealing the factors of corporate revenue strength and its continuity and producing financial and non-financial analyses Help in making forecasts and in increasing the quality of financial reports (Alshehadeh & Al-Khawaja, 2022).The main importance of big data analytics is represented by the possibility of improving the efficiency and reliability of financial reports for companies in the context of using a large amount of data of different types. If huge data has been analyzed and used properly, companies can have a better vision of their business, and competence in making decisions and thus Identifying the current and future positions of parties interested in corporate economies (Van, 2016). The analysis of big data leads to a better understanding and analysis of the content of the information contained in the financial reports more clearly, and then shows the unclear information and provides a better picture of the results of the companies' business (Sudeep et al., 2020), and the analysis of the big data also leads to getting rid of the ambiguity in the information in financial reports, to improve understanding of the company's

strategic performance, to elevate understanding of the company's various operations and then improving recognizing of the company's performance as a whole (Alshehadeh et al., 2022). It is also possible to use analytical techniques for big data collected from various sources effectively and share this data among all users inside and outside the company to facilitate the creation of knowledge and its management towards effective decision-making in companies, providing big data exchange services between varied data systems (Vasarhelyi et al., 2015).

The results of previous studies (Alshehadeh, 2021) (Sophie & Mark, 2018) agreed that the use of big data analytics techniques can effectively achieve the following advantages:

- Developing methods of measurement and presentation of data to suit the different interests of users, and mitigate the limitations and risks of agency theory.
- Achieving the qualitative characteristics of information beginning with objectivity and comparability, providing services to beneficiaries right on time, and providing the information required for decision-making processes.
- Providing financial information using clear and accurate language by removing incomprehensible words in the financial statements.

2.2. Big data techniques and stock price forecasting

Reports issued by companies are the most important source for assessing companies' future direction and rationalizing investment decisions, but they differ in the nature and quality of the information contained therein, which affects investors' demand for information due to their different tendencies, desires, and abilities to obtain information and the possibility of analyzing and interpreting this information (Dima, et. al, 2013). The financial reports of the companies do not provide all the information that the investor or the financial analyst needs to make decision. The reports published by companies trading their shares in the market have positively contribute in providing part of information that is necessary for the investor to make decisions concerning shares prices, which help in identifying the variables that can be used to determine the share price, and in analyzing the company's performance (Laila, 2023), (Asif & Akbar, 2016).

The use of big data technologies by those interested in corporate economics, particularly stock prices, enables them to obtain appropriate information related to the operational, administrative, and productivity efficiency of the activities of various companies. Therefore, the use of big data technologies is part of the process of change in the information industry, which aims to increase the relevance and reliability of published information related to productivity, completion, and the survival elements in the market through traded stock prices (Hung & Binh, 2018), (Buabbas,2022). Big data technologies are considered the basic rule on which companies build their competitive advantage for these technologies have an active and key role in obtaining information in a timely manner that serves investment decision makers, especially buying and selling stocks. In addition to considering big data technologies as an important source for economic development and growth to the companies concerned with contributing to the information industry required for those interested in these company's economics, as no company can collect, store, analyze, publish and benefit from information without the availability of modern and developed methods and technologies. Computers, software, computer networks, information systems, and artificial intelligence systems, Internet, and others become a key of the various activities and functions of companies such as production, marketing, finance, and others (Almutairi & Albloshi,2022), (Ndubuisui et al., 2018).

Using of big data technologies to providing and presenting financial and non-financial information about companies whose shares are traded in the financial markets helps investors in making investment decisions based on that information and its analysis (Heba, 2022). The market reflects the performance of stocks and all available and free information through the interaction between available information and investment decision makers, and the extent to which they rely on that information contained in the financial reports of companies (Vijitha & Nimalathan, 2014). Information on market indicators is also

published and analyzed regularly in the form of data analytics, which helps in making decisions related to dealers, especially investors (Alshehadeh & Atieh, 2020), (Al-Fawaz, 2022). In order for the financial markets to play their role, they must be competent and effective, and one of the most important pillars on which the efficiency of the financial market is based is the existence of an effective information system through which the appropriate information flows at the right times and at the suitable cost so that the investor can choose the best available alternatives to invest at the right price. Information and analysis of its nature and implications is considered one of the basic factors for investment decision-making in the financial market (Anthony & Adewale, 2014).

Information is an essential pillar for making all investment decisions available in the market and trading on its basis through which the time period required to retain each alternative is determined. Big data analyses are of high value to the investor in the financial market, therefore the outputs of these analyses, whether good or bad, the market will comply with in a way compatible with the quality and nature of this information (Mohammad, 2019), (Al-Omouh et al., 2022). This means that in order for the financial market to be characterized by a strong level of efficacy, it must have mechanisms and constraints that ensure a high level of transparency and disclosure of information in a high degree that makes all information circulated in the market publicly accessible to all its employees without exception (Miah, 2012). So that this information is reflected in stock prices to the extent that it reflects the financial performance of the companies issuing those shares (Chandrasegaran, 2021). Therefore, one of the most important requirements for providing an element of general efficiency in the market is the absence of what is known as the phenomenon of internal information, that is, private information that is available to a special category of market dealers and not others, through methods and means that are not linked to the regular mechanisms of the market, but rather through leaks and rumors that exist for some parties. It provides them with exceptional opportunities to intervene in stock price trends in order to reap unusual profits due to irregular fluctuations in stock prices (Wang & Luo, 2013).

Big data analyses play an important role in the stability of the financial market by providing appropriate information of securities to the main dealers (market makers) who play an important role in regulating and revitalizing the stock market, which leads to constantly raising of the liquidity in this market (supply and demand) and Pricing efficiency and facilitation of buying and selling with reasonable competitive margins (Menike & Prabath, 2014). The existence of market makers and meeting their demands from big data analytics leads to an influx of selling offers that are met by purchase orders or the presence of purchase orders to be matched by selling orders on the other side. Thus, the markets always maintain a state of balancing between supply and demand and narrowing the difference between buying and selling prices. Consequently, these markets will achieve their most important function, which is the ability to liquidate securities quickly and easily, and also make a continuous balance between supply and demand, which limits price fluctuations, up or down, and leads to their stability and closeness to the fair price, as well as a guarantee of market continuity in carrying out its duties and achieving its goals (Dima et al., 2013).

3. Methodology

The study population consisted of two categories:

The first category: includes workers in financial intermediation companies licensed in Jordan, and they are (53) companies. The analysis unit is consisted of all workers working in the higher administrative levels (managers and their deputies), and it includes the middle administrative levels (director of the shares investment department, financial broker, Operations Officer) in these companies amounted to (180) individuals. (180) electronic questionnaires were distributed, and (161) questionnaires were retrieved. It was found that (15) questionnaires were not valid for analysis because the information was not completed. Hence, the final study sample consisted of (146) respondents.

The second category: is the industrial companies listed in the Amman Stock exchange, and there are (53) companies. An intentional sample of (24) companies whose financial statements have data on

the dependent variable during the years of the study was selected (from 2015 to 2021). These companies have been chosen according to a set of conditions, the most important of which are:

1. The availability of complete financial reports of these companies during the study period from 2015-2021).
2. The companies that changed the date of preparing their financial statements during the study period were excluded.
3. The continuity of listing their shares in the stock exchange.

The research relied on two approaches: the analytical descriptive approach by developing a questionnaire to collect primary data for measuring the elements of the independent variable, where the questionnaire consisted of two parts, the first includes general data about the respondent, while the second part included (20) paragraphs related to the characteristics of big data (volume , Velocity, Variety, and Veracity), and the applied approach to measure the dependent variable by relying on the financial statements of the industrial companies listed on the Amman Stock Exchange for the year (2015-2021), where the dependent variable related to predicting stock prices was measured using the ratio of market value to book value (Price to book value ratio). (Ruhland, 2006; Nuryaman, 2014) study explained that this ratio is considered an indicator for investors' evaluation of the company, as investors are expected to pay a price higher than the book value of the company's shares, and this ratio is calculated by dividing the share price in the stock market by the book value of the share, if the value of this indicator is greater than one, this means that the company is performing well according to the evaluation of investors in the financial markets, and this was reflected in the rise of share price in the market above the share book value, and the higher this ratio is than one, is the better. But if the ration is less than one, this indicates that company is estimated at less than the total value of its assets, which means that its shares are valued at less than their price, which means that the company achieves a weak return on its assets. This indicator is calculated as follows:

$$\text{Market to Book Value (PB) Ratio} = \text{Market Value} / \text{Book Value}$$

The statistical program (SPSS) was used to analyze the data, test the hypotheses through the multiple regression test, and the aggregate model for the multiple regression test is formed through the following equation:

$$PBi,t = \alpha + \beta_0 + \beta_1 Volume_{i,t} + \beta_2 Velocity_{i,t} + \beta_3 Variety_{i,t} + \beta_4 Veracity_{i,t} + \epsilon_{i,t}$$

4. Data analysis and hypotheses testing

Table 1. The average of arithmetic means and standard deviations for the independent and dependent study variables

No.	Variable	Symbol	Arithmetic Mean	Standard Deviation	Rank
1	Volume	Volume	4.23	0.86	2
2	Velocity	Velocity	4.34	0.94	1
3	Variety	Variety	3.89	0.73	4
4	Veracity	Veracity	4.12	0.92	3
5	Predicting Stock Prices	Stock Price Prediction	1.07	0.79	5

Table 1 indicates that the arithmetic averages of the items related to the big data analytics variable ranged between (3.89- 4.34), and the velocity variable came first, with an arithmetic mean (4.34) and a standard deviation (0.94), and the variable related to variety came in the last rank with an arithmetic mean (3.89) and a standard deviation of (0.73). The arithmetic means of a variable predicting stock prices as a whole was (1.07), with a standard deviation of (0.79). The previous results indicate that the

opinions of the members of the study community about the characteristics of big data analyzes were positive, and the high value of the arithmetic mean for all variables indicates that. While the average share price was also positive, and this indicates that the companies under study perform well according to the evaluation of investors in the Amman Stock Exchange.

There is no statistically significant effect at the level of significance ($50.0 \geq \alpha$) for the use of big data analytics techniques (Volume, Velocity, Variety, and Veracity) on predicting stock prices from the employees' viewpoint in Jordanian financial intermediation companies. To test this hypothesis, multiple linear regression analysis was used through the Stepwise method, to reveal the impact of big data analytics techniques (Volume, Velocity, Variety, and Veracity) on stock prices prediction from Jordanian financial intermediation companies' viewpoint. Multiple linear regression analysis was used, illustrated in Table 2:

Table 2. Testing multiple linear regression analysis between big data analytics techniques (Volume, Velocity, Variety, and Veracity) and predicting of stock prices from the point of view of Jordanian financial intermediation firms.

Dependent Variable	Multiple Correlation Coefficient R	Correlation Coefficient Square R2	F Value	Statistical Indication	Independent Variables	Non-Standard Transactio (B)ns	Standard Coefficients (Beta)	T-Value	Statistical Indication
PB	0.624	0.513	1321.27	**0.000	constant	0.028		1.523	0.176
					Volume	0.536	0.751	36.154	**0.000
					Velocity	0.898	0.381	16.214	**0.000
					Variety	0.827	0.574	23.223	**0.000
					Veracity	1.537	0.491	22.285	**0.000

** Statistically significant at the significance level ($\alpha = 0.05$)

The results showed that the absolute value of the multiple correlation coefficient between big data analytics techniques (Volume, Velocity, Variety, and Veracity) and predicting stock prices from the point of view of Jordanian financial intermediation firms amounted (0.624), and the square of the correlation coefficient was ($R^2 = 0.513$). This means that the big data analytics techniques (Volume, Velocity, Variety, and Veracity) explained (51.3%) of the variation in predicting stock prices, and the value of (F) was (1321.271), which is statistically significant at the level of ($0.05 \geq \alpha$), and this indicates the acceptance of the alternative hypothesis, which states: "There is a statistically significant effect at the level of significance ($0.05 \geq \alpha$) for using big data analytics techniques (Volume, Velocity, Variety, and Veracity) on predicting stock prices from the point of view of workers in Jordanian financial intermediation firms". which indicates the significance of the multiple linear regression, which means that (the use of big data analytics techniques related to (Volume, Velocity, Variety, and Veracity) affects the prediction of stock prices from Jordanian financial intermediation firms' viewpoint. As the results shown in the table above indicates that each four independent variables affect the prediction of market prices of shares, where there is a difference in the regression coefficient (B) between them, and this indicates that this effect varies among these variables, as Veracity variable ranked first in the influence degree. While, volume variable came in the last place, and this result can be explained by the fact that dealers in the ASE pay more attention to the veracity of the data received from the companies and the big data analyses at the expense compared to the rest of other information characteristics.

5. Conclusion and Recommendations

This study is a serious attempt to identify the impact of big data analytics techniques on predicting stock prices for those who are interested in the company's economics currently and prospectively. As well as market makers (main dealers). It becomes clear by the result of this study that big data techniques

(Volume, Velocity, Variety, and Veracity) have the ability to support parties dealing in capital markets by providing them with information fairly, so that this information becomes predictive and appropriate for decision makers to determine shares' prices of companies traded in the Stock Exchange, either in buying or selling.

These results confirm the importance and role of big data analytics techniques in providing appropriate and reliable information for predicting stock prices compared to traditional methods. the most prominent of which is financial analysis processes using financial ratios, which contribute to dismantling financial data and making it clearer and more useful to the decision-maker. as many studies confirmed (Dima, et.al, 2013, Marie, et.al, 2019, Naimy, 2008 Alshehadeh, et.al, 2023, Laila,2023) that there is no relationship between the information provided by the financial analysis of the data issued by companies, and the prediction of stock prices traded on stock exchanges. Simultaneously, the authors of this study realize that the results are based on a fundamental assumption that the members of the study community have sufficient knowledge of the content and elements of the questionnaire distributed to them. This was confirmed by (Cronbach's Alpha) test, where it was found that the lowest value obtained for each independent variable was (82.3%). As confirmed by (Creswell & Creswell, 2018) that the lowest value of this coefficient that can be accepted is (0.70%) and more than that gives an indication that it is a strong indicator for judging the stability of the scale.

Based on the results of the statistical analysis of the data and the opinions of the research community, we conclude that the huge volume of big data has become difficult to process using traditional data processing applications, particularly financial analysis operations. As it was found that there is a statistically significant relationship between the analytics techniques of big data and traded stock prices prediction from the point of view of workers in Jordanian financial intermediation companies. Here it is necessary for those in charge in the companies whose shares are listed on the stock exchange to develop modern techniques that are capable to analyzing big data with high efficiency through which it can help in determining the most appropriate data for the target groups of investors, market makers and other beneficiaries. Analyzing the use of big data technologies allows these companies to understand the needs of interested parties more in terms of data and information to increase the predictive ability of information that serves decisions related to shares' buying and selling. Thus, contributing to achieving the efficiency of capital markets, as decisions based on data processed accurately and logically will contribute significantly in reducing information asymmetry between interested parties and thus achieving the most important characteristics of an efficient market.

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