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APPLYING AI TO MARKET VOLATILITY ANALYSIS

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Abstract
The global economy is currently changing rapidly. Market volatility is a phenomenon caused by prices, supply and demand, investor confidence, and other factors. Traditional statistical methods are often slow and inaccurate in predicting such changes. Therefore, the use of artificial intelligence (AI) technologies is becoming increasingly important in analyzing market volatility with depth and accuracy. This article analyzes the processes of identifying, modeling, and predicting market volatility using artificial intelligence.

Keywords: Market volatility, artificial intelligence, analysis, investors, global economy

Inroduction

Investments play an important role in the development of firms, regions and states, and their efficiency is a key aspect at both the micro and macro levels of economic analysis. Particular attention is paid to this problem in the context of portfolio investments. The process of accumulation and placement of financial resources, carried out in the financial management system of the country and business entities, is directly related to the functioning of financial markets and institutions. If the task of financial institutions is to ensure the most efficient movement of funds from owners to borrowers, then the task of financial markets is to organize trade in financial assets and liabilities between buyers and sellers of financial resources [2]. With the development of the financial market, the development of the theory of portfolio investment and the development of practical recommendations aimed at improving the efficiency of investment

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strategies in terms of increasing profitability and reducing the risk component of investment activities in the aspect of AI are becoming more in demand.

Innovative technologies are an integral part of modern economic and social systems. Digitalization penetrates into all spheres of human activity, radically restructuring processes. Financial markets are no exception. The active development of neural networks and artificial intelligence technologies have had a very significant impact on this area. Modern dynamically changing realities emphasize the importance of processes occurring in the financial market, which are an integral part of the economic system [1]. Volatility risk is the probability and consequences of adverse events due to sharp fluctuations in the price of a financial instrument if they are realized independently by the investor.

The risk of loss of capital is the probability and consequences of adverse events due to many reasons, with the exception of price fluctuations in a financial instrument, which lead to partial or complete loss of the investor's property regardless of their realization by the investor. Thus, with volatility risk, there is no risk of loss of capital until the investor realizes them, i.e. does not record paper losses with a sharp drop in prices. For example, the price of shares fluctuates greatly, but has a stable upward trend (which is typical for emerging markets, unlike developed ones). In this case, loss of capital is possible only when losses are fixed, when the share price is at the lower limit of the trend.

On the contrary, even with low volatility of a financial instrument, there is always a risk of capital loss as a result of incorrect calculation of the actual value of the company and its potential income, as well as the impact of unpredictable factors such as wars, emergencies, natural disasters, actions of government bodies, taxes, inflation, etc. In this case, regardless of the investor's actions, if an unfavorable event occurs, capital may be lost.

Many investors, including private ones, are moving from using fundamental analysis to using intelligent trading services that reduce time delays in data processing and decision-making. The availability of these technologies allows you to expand the circle of potential investors and often reduces the threshold for entering the stock market.

On the other hand, the development of these technologies has allowed many start-up companies to enter the stock exchange, due to the fact that mass

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investors have become able to buy more expensive shares. This was often achieved through stock splits, a reduction in transactions and also an increase in the availability of platforms. Neural network technologies have begun to be actively used in stock markets. Artificial neural networks are a network of numerical equations. They take one or more input variables and then process them through a sequence of equations, resulting in one or more outputs [2].

One of the most significant early works on artificial intelligence applied to forecasting financial market parameters is the research of R. G. Donaldson and M. Kamstra [3], who in a series of articles proved that methods capable of handling nonlinearities give superior results compared to linear models [4]. These works proved the superiority of basic models and the relative accessibility of network technologies.

The rapid development of artificial intelligence has prompted the study of the application of machine learning methods to forecasting financial time series. Machine learning methods, including artificial neural networks, backpropagation neural networks, and support vector regression, have gained popularity as a means of modeling stock price indices. However, these traditional machine learning algorithms have inherent limitations when it comes to capturing complex relationships within the data. Moreover, they are subject to noise and outliers, which can hinder the improvement of forecasting quality. It should be noted that most existing studies in this area are devoted to forecasting the stock price index [5], namely, by the closing price. Another direction is modeling the maximum and minimum values of the stock index, while there is an opinion that this more fully reflects the overall picture of the development of the financial market.

➢ The concept of market volatility and its economic significance:

✓ Market volatility - as an unstable state of economic equilibrium;

✓ Types of volatility: price volatility, supply/demand volatility, investor psychology;

✓ Methods for determining the level of volatility on the example of financial markets (VIX index, moving average, Bollinger Bands);

✓ Risks and opportunities of volatility for business

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Example: During the 2020 pandemic, stock market volatility reached record levels, which fundamentally changed investment strategies.

➢ The role of artificial intelligence tools in market analysis:

✓ The role of AI technologies in economic analysis

✓ Machine learning models: regression, decision tree, random forest, neural networks

✓ News analysis and sentiment analysis using natural language processing (NLP)

✓ Algorithms for predicting market behavior using artificial intelligence

➢ AI-Based Market Volatility Analysis Practice:

✓ Working with real-world data using Python and TensorFlow

✓ Building an AI model: data preparation, model training, testing

✓ Using an RNN (Recurrent Neural Network) model to predict the VIX index

✓ Determining volatility using real-time market news

A practical example: Using AI to analyze price changes and their causes based on 3 months of Tesla stock data.

Thus, the increased availability of services using neural networks for investors, including unskilled ones, has significantly reduced barriers to entry into the market. A significant number of online materials have appeared introducing the basics of using neural services. Their ability to learn on large volumes of data, extract complex dependencies and adapt to changing market conditions opens up new opportunities for increasing the accuracy and efficiency of forecasting. Machine learning and artificial intelligence technologies, including neural networks, can significantly improve data analysis processes [1].

At the moment, among the neural networks studied, there are none that are fully capable of predicting the behavior of certain data. Neural networks are capable of giving a researcher a direction for development or can partially optimize work through primary processing or verbal consultation on the selection of a research method, writing code, but they are not capable of making a competent conclusion for a person and independently launching and debugging a code, selecting a model for a specific type of data and justifying it.

It is also worth mentioning that the neural networks studied have a volume in the received volume of information and are not capable of qualitatively

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processing large volumes of unstructured data, unlike a person, therefore, when analyzing independently, the machine makes mistakes and can provide incorrect conclusions. Research criticality and the ability to see implicit connections, often not amenable to static-mathematical assessment, are indispensable in terms of analysis and interpretation.

Considering that most investors stereotypically associate investments in a volatile financial instrument with high risk, such an instrument itself is interesting for investment in terms of profitability, and the positive base effect from regular investments increases the attractiveness of volatile assets for patient investors. The most important task of further research in the field of improving not only the author's methodology, but also the entire modern portfolio theory of investment is to develop a different approach to measuring the real risk of capital loss when investing. Today, as has been repeatedly noted in this article, volatility through standard deviation is taken as risk in investments. However, as has been proven, volatility in itself does not pose a threat to the investor's investment capital, but carries a "volatility risk" - the probability and consequences of adverse events due to sharp fluctuations in prices for financial instruments in the event of their independent implementation by the investor in the aspect of AI.

Thus, the developed neural networks are an assistant for the researcher and a modern way to automate routine tasks. Scientific research can subsequently turn into an effective combination of human expertise and the general awareness of artificial intelligence, which can give an additional impetus to the development of critical, analytical and intuitive thinking in humans, and the ability for networks to more reasonably select parameters for specific tasks. Artificial intelligence technologies are much more effective than traditional methods in detecting, analyzing, and predicting market volatility. With the help of AI, investors can receive timely signals, identify risks in advance, and base strategic decisions. In the future, AI-based market analysis will become an integral part of the technological economy.

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