

# Analysis Dynamics of the Market Development of Funds for Investment: on the Example of Major ETF

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**Abstract:** *The sustainable functioning and development of both the economy as whole and individual business entities requires constant investment. Such an investment is possible both with the help of bank lending and on the basis of investment. Each of the approaches has its own advantages and disadvantages. In this paper, we consider investment. Investing comes in various types and forms. One of the types of investment is raising the necessary funds through investment funds. For these purposes, stock market instruments are used. We are considering an ETF fund. We examine the dynamics of the fund's main ETF instruments. For this analysis, we use descriptive statistics and wavelet analysis tools. The paper presents many graphs and charts that allow you to understand the course of the study and evaluate the results.*

**Keywords—analysis; ETFs investment; dynamics; time series; investment fund; comparative analysis; stock market**

## 1. INTRODUCTION

Successful and effective economic development, both of a separate business entity and the economy as a whole, involves the implementation of a constant and purposeful investment. For this, various sources of free funds and tools for attracting and using them can be used: from bank lending to investments [1], [2]. This is the reason for the close attention to this research topic.

At the same time, investment is one of the key attributes of economic relations, a factor in the development of production and the economy as a whole. Investing is the process of investing money in order to make a profit [3]. Investment has various forms and types. It can be the purchase of real capital, the purchase of securities, investments in foreign exchange, precious metals and much more [4]. In any case, such a process requires close attention and appropriate analysis.

Among the various areas of investment are the so-called investment funds [5]. An investment fund is an institution that promotes the realization of collective investments [6], [7]. The investment fund allows you to accumulate the necessary funds for joint investment through the purchase of securities. Thus, various instruments of the securities market are also involved.

Especially among investment funds, the ETF fund should be singled out. ETF is one of the most well-known and available investment instruments today for realizing investment goals. This is the reason for the special attention to the ETF fund.

To analyze the investment process, evaluate its effectiveness, achieve the most acceptable and necessary results within the established time frame, various methods and

approaches, both classical [8]-[14] and non-standard [15]-[22], which are used in other areas of research, can be used. Therefore, an important aspect is the analysis of the dynamics of investment investments, consideration of the possibility of using various methods and approaches for the analysis of investment decisions. This determines the relevance of this research topic, its practical significance.

Thus, the main purpose of this study is to consider the dynamics of investment investments based on ETF fund. We also consider the main ETF instruments of the fund and the dynamics of their relationship.

## 2. BRIEF LITERATURE REVIEW

Analysis of the dynamics of various indicators of economic activity is constantly in the focus of attention of researchers [23]-[25]. This also applies to indicators of the development of the investment fund market. Below is a brief overview of relevant publications.

L. Klapper, V. Sulla and D. Vittas consider general issues of development and operation of mutual investment funds [26]. The authors note that such equity funds predominate in Anglo-American countries, while bond funds prevail in most of continental Europe and in middle-income countries [26]. The main determining factor in the development of such funds is the sustainable development of the capital market. At the same time, the development of the capital market is a reflection of investors' confidence in the integrity, liquidity and efficiency of such a market. This highlights the importance of analysis in the development of investment funds and the capital market.

M. Jayadev analyzes the performance of mutual funds based on the dynamics of their monthly income [27]. For this purpose, the risk-adjusted performance metrics proposed by

Jenson, Traynor, and Sharp are used. The author notes that higher returns can be obtained either through marketing, or through the choice of securities at a lower price. The paper also concluded that, in terms of overall risk, funds do not offer investors the benefits of diversification and professionalism [27]. Thus, an important issue is the analysis of the mutual dynamics of the various instruments of such funds.

D. Fernando, L. F. Klapper, V. Sulla and D. Vittas analyze the global growth of mutual funds [28]. The authors note that the growth of such funds is significant throughout the 1990s. At the same time, such development is observed against the background of the development of the capital market. This in turn reflects investor confidence. The paper also emphasizes that restrictions on the selection of capital market products served as a catalyst for the development of the money market and bond funds [28].

Z. Chen and R. Lin consider evaluations of the effectiveness of mutual funds [29]. For such assessments, the authors use a data coverage analysis methodology with new measures of risk. Thus, the authors properly reflect the asymmetry in the distribution of returns on actively managed funds. New risk measures are also being introduced – value at risk (VaR) and notional value at risk (CVaR). In order to correctly assess the relative performance of the same fund in different periods of time, the authors creatively refer to the same fund in different periods as different decision-making units [29]. At the same time, the paper notes that the attitude to the same fund in different periods of time as to different funds can not only show specific differences in the results, but also reveal the reasons for such differences [29].

T. Jagric, B. Podobnik, S. Strasek and V. Jagric explore the risk-adjusted performance of mutual funds [30]. To do this, the authors use various tests to evaluate the performance of mutual funds. The work calculates the performance of mutual funds, then they are ranked according to the results. In particular, the authors use the ratings obtained by fulfilling the Sharpe and Traynor rules. If the ratings are almost the same, this means that the funds are well diversified. The authors also note that the development of the stock market largely depends on the development of institutional investors.

M. R. Randall, D. Y. Suk and S. W. Tully consider various indicators of the stock market and investment funds [31]. The authors make this consideration on the basis of a mutual analysis of the relevant cash flows. The authors note that, according to a number of indicators, mutual funds have grown dramatically as a means of investing in stock portfolios [31]. At the same time, investment funds have become major players in the stock markets. It also notes the importance of using a streaming approach to conduct an appropriate analysis. The authors showed that the analysis of the flows generated by investment funds indicates that the flows of such funds can be an important factor explaining the movements of stock market returns [31].

B. Liang and H. Park consider the risk measures of various investment funds [32]. To do this, the authors use a cross-sectional approach. The authors compare semi-variance, value at risk (VaR), expected deficit (ES), and tail risk (TR) with standard deviation at the individual fund level as well as at the portfolio level [32]. The authors use the methodology of Fama and French and combined data on existing and non-existing hedge funds from TASS [32]. The authors also substantiated that the Cornish-Fisher decomposition is superior to the nonparametric method in estimating ES and TR [32].

C. Daraio and L. Simar explore the effectiveness of investment funds [33]. For these purposes, a non-parametric approach is used to assess and explain the effectiveness. At the same time, the authors note that the topic of measuring the effectiveness of mutual funds is of increasing interest, both from an applied and theoretical point of view [33]. The authors propose conditional efficiency decomposition and analyze its usefulness for economic interpretation. This approach is illustrated by the use of US mutual fund data categorized by purpose. The economies of scale, reserves and market risks are also studied [33].

E. Pástor and M. B. Vorsatz investigate the efficiency and sustainability of investment fund flows during the COVID-19 crisis [34]. The authors provide a comprehensive analysis of actively managed U.S. equity mutual funds during the 2020 COVID-19 crisis. The authors note that during a crisis, the most active funds lag behind passive benchmarks, which contradicts the popular hypothesis [34]. That being said, funds with high sustainability ratings perform well, as do funds with high star ratings. Therefore, investors prefer funds that apply the exclusion criteria and funds with high viability ratings [34].

We can note various directions in the study of the dynamics of the development of the market for investment funds. At the same time, both various investment funds and various tools for conducting an appropriate analysis are considered. At the same time, an important aspect of such an analysis remains the study of the mutual dynamics of various instruments that determine the respective investment funds.

### 3. ETF FUND AS A TYPE OF INVESTMENT FUNDS

Among the funds for investment, one can single out their natural diversity, which in general makes up a whole set of investment instruments. Thus, the ETF is a holistic investment vehicle. As part of the ETF, you can collect shares of various companies on some basis, and on their basis a fund is created [35]-[37].

One of the main advantages of ETFs is accessibility. You can also invest in an entire industry with ETFs. There are many different stocks in the fund and the fall of one stock can compensate for the rise of another.

Tokenized ETFs include:

SPDR S&P 500 ETF Trust, which consists of shares of the largest companies in the S&P 500 [38],

iShares 20+ Year Treasury Bond ETF, which is an index and consists of long-term, 20-year US Treasury bonds [39],

iShares Emerging Markets ETF, which consists of shares of large and mid-cap companies in emerging markets - China, Brazil, Turkey and others [40],

Vanguard Total World Stock ETF – the fund covers many sectors of the economy of different countries and consists of shares of American, Chinese, European companies, it includes more than 7800 companies [41],

SPDR Gold Shares – the shares of this fund are 100% backed by their own gold reserves [42],

ETFMG Alternative Harvest ETF – The fund invests in the most promising medical marijuana companies in the US [43],

First Trust NASDAQ Clean Edge is a fund that allows you to invest in emerging clean energy companies [44],

VanEck Vectors Oil Services ETF – the fund reflects the dynamics of 25 oil companies whose shares are traded on the US stock market [45],

iShares US Healthcare ETF – Tracks the Dow Jones U.S. Select Healthcare Providers Index, which consists of shares of US companies in the healthcare sector [46],

VanEck Vectors Gaming ETF – The fund tracks the global index of MVIS, the video game and esports industries [47].

At the same time, it is possible to single out the key (most significant) ETF fund instruments, which we will consider further. At the same time, the market in which the relevant instruments operate is important.

#### 4. FUND'S MAIN ETF INSTRUMENTS AND THEIR STATISTICAL CHARACTERISTICS

Among the most important ETF instruments considered are investments in (at least for the US market):

United States Oil Fund, LP (USO);

VanEck Gold Miners ETF (GDX);

iShares MSCI EAFE ETF (EFA);

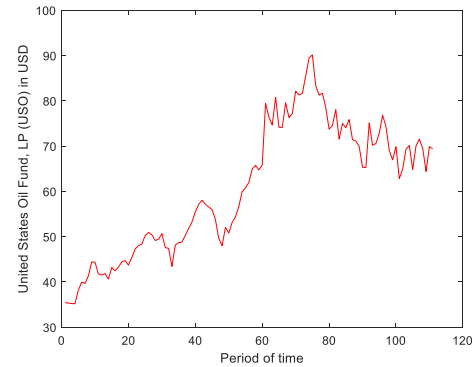
iShares MSCI Emerging Markets ETF (EEM);

Invesco QQQ Trust (QQQ);

SPDR® S&P 500 (SPY).

Below are the charts of such instruments and their statistical characteristics. All data covers the period from 03.01.2021 to 12.02.2023 on a weekly average. Data from <https://www.investing.com/>.

On fig. 1 shows the dynamics of quotes for such an ETF fund instrument as United States Oil Fund, LP (USO).

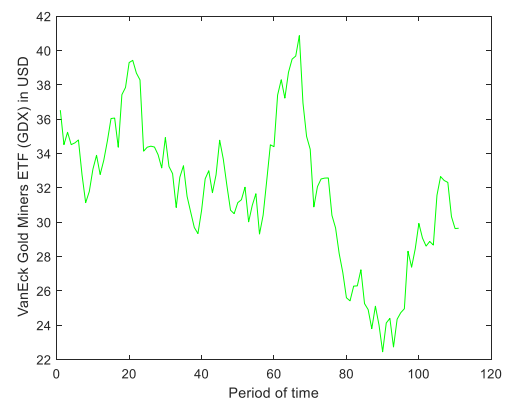


**Figure 1.** Dynamics of quotations for United States Oil Fund, LP (USO)

We can note the growth of quotes in the first two thirds of the period under study. In the last third, there is a decrease in the corresponding quotes.

Such dynamics is described by the following characteristics: mean – 60.67; median – 61.97; standard deviation – 14.45; sample variance – 208.82; kurtosis – -1.19; skewness – 0.01; confidence level – 95.0%.

On fig. 2 shows the dynamics of quotes for such an ETF fund instrument as VanEck Gold Miners ETF (GDX).

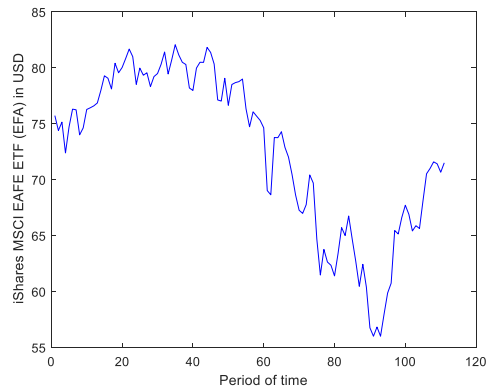


**Figure 2.** Dynamics of quotations for VanEck Gold Miners ETF (GDX)

We can observe the diverse dynamics of quotes for the VanEck Gold Miners ETF (GDX).

Such dynamics is described by the following characteristics: mean – 31.78; median – 32.31; standard deviation – 4.15; sample variance – 17.29; kurtosis – -0.33; skewness – 0.19; confidence level – 95.0%.

On fig. 3 shows the dynamics of quotes for such an ETF fund instrument as iShares MSCI EAFE ETF (EFA).

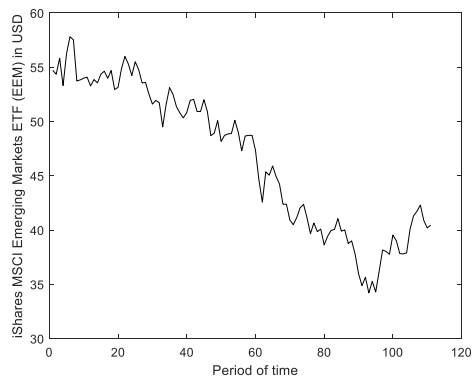


**Figure 3.** Dynamics of quotations for iShares MSCI EAFE ETF (EFA)

The first third of the corresponding dynamics is characterized by the growth of iShares MSCI EAFE ETF (EFA) quotes, then we observe a general decline in these quotes. At the same time, iShares MSCI EAFE ETF (EFA) quotes have also been growing recently.

Such dynamics is described by the following characteristics: mean – 72.59; median – 74.64; standard deviation – 7.21; sample variance – 52.06; kurtosis – -0.77; skewness – 0.60; confidence level – 95.0%.

On fig. 4 shows the dynamics of quotes for such an ETF fund instrument as iShares MSCI Emerging Markets ETF (EEM).

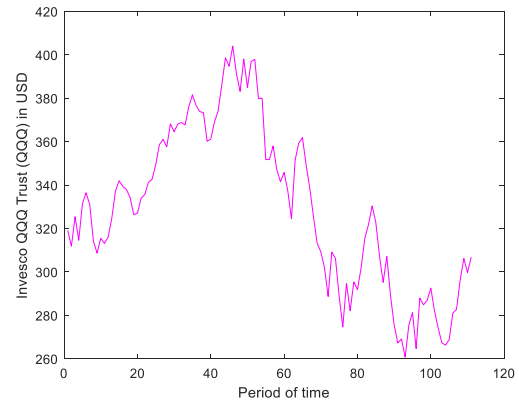


**Figure 4.** Dynamics of quotations for iShares MSCI Emerging Markets ETF (EEM)

It should be noted the general decline in iShares MSCI Emerging Markets ETF (EEM) quotes over the studied time interval.

Such dynamics is described by the following characteristics: mean – 46.63; median – 48.70; standard deviation – 6.71; sample variance – 44.98; kurtosis – -1.41; skewness – 0.17; confidence level – 95.0%.

On fig. 5 shows the dynamics of quotes for such an ETF fund instrument as Invesco QQQ Trust (QQQ).

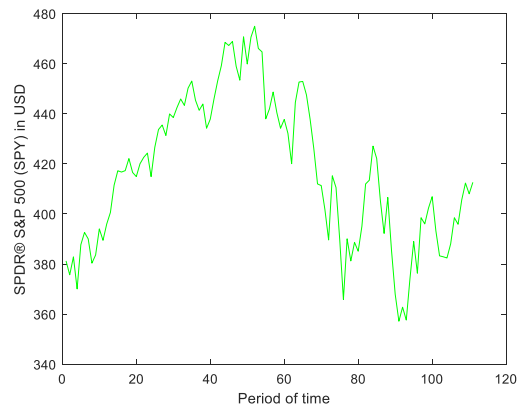


**Figure 5.** Dynamics of quotations for Invesco QQQ Trust (QQQ)

It should be noted first the growth of Invesco QQQ Trust (QQQ) quotes, and then the rapid decline of such growth.

Such dynamics is described by the following characteristics: mean – 329.12; median – 327.01; standard deviation – 37.79; sample variance – 1428.75; kurtosis – -0.97; skewness – 0.09; confidence level – 95.0%.

On fig. 6 shows the dynamics of quotes for such an ETF fund instrument as SPDR® S&P 500 (SPY).



**Figure 6.** Dynamics of quotations for SPDR® S&P 500 (SPY)

We can note that the performance of the SPDR® S&P 500 (SPY) is similar to that of the Invesco QQQ Trust (QQQ).

Such dynamics is described by the following characteristics: mean – 416.72; median – 414.94; standard deviation – 29.52; sample variance – 871.49; kurtosis – -0.94; skewness – 0.06; confidence level – 95.0%.

In general, it should be noted that the ETF fund instruments presented above have different quote dynamics. This is the explanation that the risk of investing in such funds can be



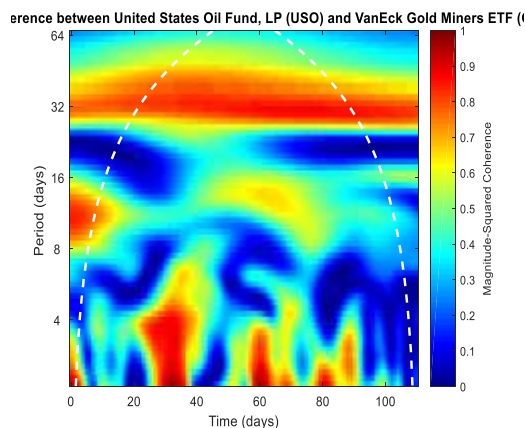
reduced. However, it is also important to consider the mutual dynamics of such instruments.

**5. MUTUAL DYNAMICS OF THE MAIN INSTRUMENTS OF THE ETF FUND**

Consideration of mutual dynamics is one of the tools of analysis. Such analysis helps to understand the relevant dynamics and make better investment decisions. To consider mutual dynamics, one can use the wavelet methodology, which has found effective application in the analysis of economic data [48]-[52]. Among the tools of the wavelet ideology, one should single out the method of estimating wavelet coherence, which is used for mutual analysis of data presented in the form of time series [53]-[55].

Below are the results of wavelet coherence assessments between individual ETF instruments that were discussed above.

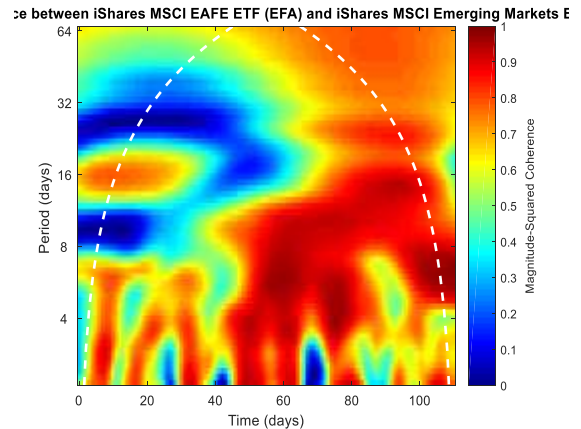
On fig. 7 shows an estimate of the wavelet coherence between the United States Oil Fund, LP (USO) and VanEck Gold Miners ETF (GDX) quotes.



**Figure 7.** Estimation of wavelet coherence between United States Oil Fund, LP (USO) and VanEck Gold Miners ETF (GDX) quotes

We see fragmented consistency between United States Oil Fund, LP (USO) and VanEck Gold Miners ETF (GDX) quotes. At the same time, in general, the assessment of consistency between the dynamics of United States Oil Fund, LP (USO) and VanEck Gold Miners ETF (GDX) quotes is insignificant. At the same time, we can determine those time intervals when such consistency is significant. This helps to better understand and develop an appropriate investment strategy, to determine the timing of investment transactions with a particular instrument of the ETF fund.

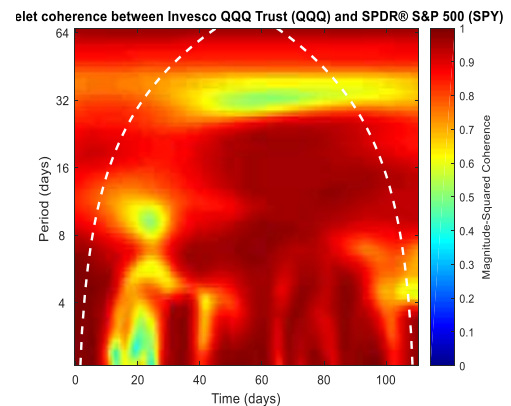
On fig. 8 shows an estimate of the wavelet coherence between iShares MSCI EAFE ETF (EFA) and iShares MSCI Emerging Markets ETF (EEM) quotes.



**Figure 8.** Estimation of wavelet coherence between iShares MSCI EAFE ETF (EFA) and iShares MSCI Emerging Markets ETF (EEM) quotes

Here we should note a significant manifestation of consistency between the iShares MSCI EAFE ETF (EFA) and iShares MSCI Emerging Markets ETF (EEM) quotes. This consistency is manifested in the second period of time that we are exploring. This allows you to make mutual substitution of such instruments when investing in a specified time period.

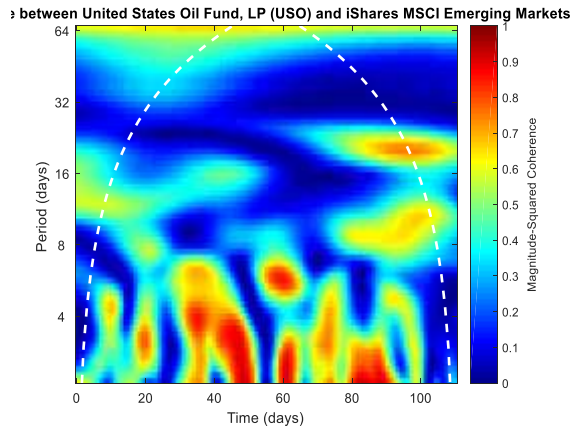
On fig. 9 shows an estimate of the wavelet coherence between the Invesco QQQ Trust (QQQ) and SPDR® S&P 500 (SPY) quotes.



**Figure 9.** Estimation of wavelet coherence between Invesco QQQ Trust (QQQ) and SPDR® S&P 500 (SPY) quotes

We see complete consistency between Invesco QQQ Trust (QQQ) and SPDR® S&P 500 (SPY) quotes. This is evidence of the complete compatibility and interchangeability of such tools over the time interval that we are exploring.

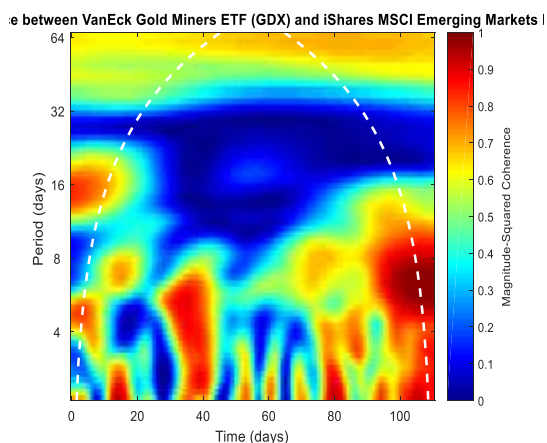
On fig. 10 shows an estimate of the wavelet coherence between the United States Oil Fund, LP (USO) and iShares MSCI Emerging Markets ETF (EEM) quotes.



**Figure 10.** Estimation of wavelet coherence between United States Oil Fund, LP (USO) and iShares MSCI Emerging Markets ETF (EEM) quotes

It should be noted a slight and fragmentary consistency between the dynamics of United States Oil Fund, LP (USO) and iShares MSCI Emerging Markets ETF (EEM) quotes. This should be taken into account when choosing investment instruments.

On fig. 11 shows an estimate of the wavelet coherence between VanEck Gold Miners ETF (GDX) and iShares MSCI Emerging Markets ETF (EEM) quotes.



**Figure 11.** Estimation of wavelet coherence between VanEck Gold Miners ETF (GDX) and iShares MSCI Emerging Markets ETF (EEM) quotes

Here, too, there is some slight consistency between VanEck Gold Miners ETF (GDX) and iShares MSCI Emerging Markets ETF (EEM) quotes.

In general, it should be noted that the above allows you to justify and choose the best investment strategy, to make the most effective decision.

## 6. CONCLUSION

The paper deals with the analysis of the dynamics of the development of the market of funds for investment. The

importance and necessity of the investment process from different sources is substantiated. As one of the sources is investing by raising funds in the stock market. It is this source that was chosen as the object of study.

We are considering funds for investment. Fund's ETF instruments are selected as specific examples. We explore the overall dynamics of such instruments based on descriptive statistics. The issues of analyzing the mutual dynamics of various ETF fund instruments are also considered. To do this, we use the wavelet coherence estimate.

The results obtained can be used in the investment process to determine a set of tools for raising funds, determining the time to enter the market with a certain investment instrument. In general, this helps to make effective investment decisions.

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