

# Application of Quantitative Investment Principles in Market of Financial Derivatives

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## Abstract

In recent years, quantitative investment has become a focus in the development of international capital market. Quantitative investment, fundamental analysis, and technical analysis are considered as the three dominant investment methods. Owing to the stable performance of the trading strategies, quantitative investment has been increasingly favored by international investors, with its market size and share continually expanded. In China's capital market, investors are attracted by the high income of financial derivatives, but they are daunted by the high risks and high leverage. Quantitative investment provides investors with a more rational investment method. This paper believes that the combination of financial derivatives transaction and quantitative investment will help investors to achieve stable and sustainable income. In this paper, the basic concept of quantitative investment was described first, and then the correlation between financial derivatives and quantitative investment was illustrated, and finally, the risks of the quantitative investment strategies in the market of financial derivatives were further analyzed and corresponding suggestions were proposed.

## Keywords

**Quantitative Investment; Financial Derivatives; Investment Strategies; Risks and Suggestions.**

## 1. Introduction

As a scientific trading tool, which uses mathematics and computer to efficiently analyze financial market to achieve automatic trading, quantitative trading, is widely used by market makers and professional investors. Quantification has been extensively applied in various fields as a science-based method, such as pricing, valuation, quotation, trading strategies, asset portfolio allocation, risk management, and real-time supervision of products in different markets.

Quantitative trading is essentially a technical tool which realizes trading strategies by overcoming the weakness of human nature, which means to make the trading ideas of investors regularized and executable. Therefore, the cooperation between financial derivatives and quantitative investment is expected to achieve a win-win outcome. Through quantitative investment, investors can avoid subjective losses, make rational decisions, and make better use of financial derivatives to achieve risk aversion. In addition, the development of financial derivatives broadens the investment level and horizon of investors while optimizing the trading environment of financial market, thereby providing a better application platform for quantitative investment.

## 2. The Concept and Development of Quantitative Investment

Quantitative investment refers to programmed trading realized by computer programming on the basis of combining statistics, mathematics, and computer technology, which uses the powerful data mining and processing abilities of computer to find investment opportunities

that can bring income from a large amount of historical data. Based on effective historical data and analysis methods, quantitative investment quantifies the effective information of the market into multiple indicators and effective factors that are subsequently strategically developed through the knowledge in various realms such as statistics, mathematics and behavioural economics. After the quantitative strategy is determined, the strategy is actualized and concretized by computer. Then, the developed quantitative strategy is tested for a period of time. If the tested quantitative model can produce excess earnings in the simulated market, the quantitative strategy can be applied to the real market gradually and in batches to help the investors to obtain excess earnings.

Quantitative investment uses a determined quantitative model, advanced knowledge of various disciplines, and a large amount of data to conduct transactions with fixed procedures, which avoids human subjective judgment, reduces the impact of investor’s emotional fluctuation, and effectively prevents investor from making irrational investment decisions such as “buying the winners” when the market is unstable. Compared with qualitative investment, quantitative investment performs data-based modeling on the basis of qualitative theoretical research, and searches for investment targets that meet the strategic standards in the entire market with the help of the powerful data processing abilities of computer, thus it can catch the targets that meet the strategic standards with almost zero omission. At the same time, assisted by computer-based programmed transaction, the quantitative strategy effectively avoids the subjective deviations on the investment targets caused by investors’ subjective emotions and psychological factors, and can completely reflect the investor’s investment strategy to realize real rational investment.

With the continuous progress in machine learning, neural networks, big data application and computer hardware conditions, quantitative investment institutions have begun to use computer modeling and big data analysis to replace human subjective judgment. The steady development of quantitative strategies has also attracted increasing attention from investors. Judging from the development of the existing quantitative investment funds in the current market, quantitative funds expanded rapidly during the bull market in 2007 and 2015. In 2015, the number of quantitative funds issued hit a record high. The issuance of quantitative funds has never been interrupted, showing an upward trend overall. It is expected that quantitative investment strategies will be favored by more and more investors in the future.

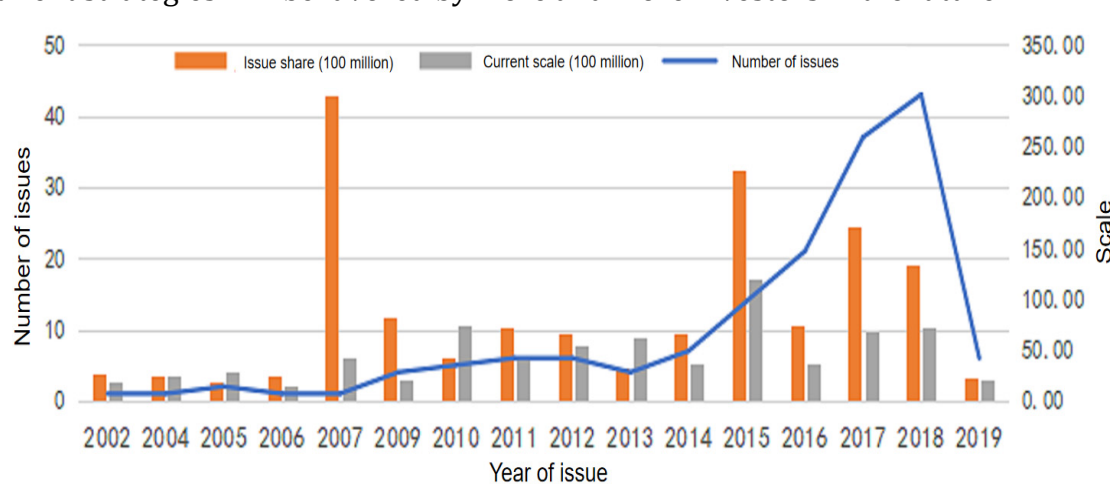


Fig 1. Development of quantitative investment funds

### 3. The Correlation between Financial Derivatives and Quantitative Investment

Due to the high leverage and specialization of financial derivatives, and the limited popularization of professional knowledge about financial derivatives for Chinese investors, the market of financial derivatives is developing relatively slowly. Using the principles and methods of quantitative investment based on computer programming will become an important direction for the future development of investment transactions.

One of the functions of financial derivatives is risk aversion. Usually, risk aversion is realized by holding positions with less investment using high leverage to hedge against changes in spot prices. At present, most of the domestic quantitative hedging practices are realized through the futures market. The limited trading categories caused single quantitative investment product strategy in China. With the emergence of financial products such as stock index futures and individual stock options, investors have access to more risk aversion channels, and a new situation for quantitative investment has been created, bringing diversified and creative choices of quantitative investment strategies. Another main function of financial derivatives is price discovery, which refers to the situation where a large number of market participants constantly update the price system through public auctions and other methods based on personally obtained information and price expectations, and continue to reflect the real relationship between supply and demand in the market. These prices spread quickly and become a bellwether of price changes in the entire market, helping market participants to make correct decisions. It can be anticipated that quantitative investment based on its advantages in "speed and rules" will be extensively applied, thereby leading to more frequent market quotations and transactions, greatly increasing market liquidity. Moreover, due to the similarity of certain strategies, the future market price changes may show regularity and high volatility.

### 4. Risks of Quantitative Investment Strategies

#### 4.1. The Data Trap of "Information Cocoons"

In traditional investment methods, investor's emotion affects the investment process. By extracting and stripping investment value from data, quantitative investment constructs models and makes decisions based on the analysis results, which excludes individual's emotion. However, there may be hidden risks in the data. In the era of big data, investors are besieged by data, and they cannot identify valid data. Modeling and analyzing defective data may lead to conclusions that are contrary to the actual situation.

#### 4.2. The Hidden Danger of System Failure

First, network problems or hardware failure affect model analysis results. Second, during the design of the model, the lack of sufficient consideration of capital allocation and positions will result in a mismatch between the two. Third, a unified standard certification for the existing transaction system is absent, and is usually designed by each institution itself. Fourth, there is a risk of delay in the exchange's processing system.

#### 4.3. The Hidden Danger of Market Manipulation

At present, in China's capital market, most users of quantitative investment strategies are institutional investors, who have strong capital and high-tech talents, and may cause market volatility to a certain extent. However, a majority of the investors in China's capital market are retail investors, that is, small and medium investors, who usually do not have strong capital and professional technical analysis, and rarely use quantitative investment strategies in transactions. This indicates that there is a hidden risk of market manipulation in quantitative investment strategies.

## 5. Suggestions on the Optimization of Quantitative Investment

### 5.1. Innovate Quantitative Investment Technology

In the current stage, quantitative investment has completed two stages. The programming stage refers to embedding the integrated transaction experience into algorithms to complete the primary transaction. The factor library decision-making stage refers to the establishment of a factor library for the decision-making process, and the buy-up or buy-down strategy is determined automatically through the order logic. In addition to these two aspects, innovating quantitative investment technology also requires the analysis of unstructured data. Through assigning weights, factors that have weak correlation are also included in the quantitative investment model to enrich the model's dimension and enhance its accuracy. Besides, efforts can be made to accelerate the integration of artificial intelligence and quantitative investment strategies, and based on quantification, user experience should be considered simultaneously. Through the establishment of a database and the model algorithms, decisions are generated, scale quantitative investment strategies are achieved, and feedback strategies are generated.

### 5.2. Promote System Construction

First, the data interfaces of securities and futures companies can be standardized, and the specific content of the interfaces can be reported to the China Securities Regulatory Commission. Meanwhile, the exchange can limit the orders sent before the transaction, set the maximum position of the day, realize synchronous monitoring, and trigger the emergency response mechanism when the strategy transaction is abnormal, and handle it immediately. Second, the risk supervision process for securities and futures companies needs to be improved, and the orders with faulting instruction and the transaction orders beyond the credit rating of investors should be controlled in a timely manner. And when the amount of the programmed transaction account exceeds a certain limit, its strategy and procedures should be reported confidentially to the exchange, so as to provide a basis for accountability in the future major events.

### 5.3. Strengthen Process Monitoring

First, the minimum duration of the order can be set, and attention needs to be paid to false active market caused by the split of large orders and frequent order cancellations. Second, the training on risk control process for quantitative investment strategies should be strengthened, and a large-value transaction supervision mechanism can be established to track large orders, so as to prevent speculators from illegal arbitrage by manipulating market prices.

The best investment method in the market of financial derivatives should be dominated by "quantitative investment" and supported by "qualitative investment". Quantitative investment is an efficient analysis method based on big data. However, due to the occasional deception of big data, the specific implementation strategies of quantitative investment must be combined with qualitative investment, and investors need to adapt to the changing circumstances according to personal experience. With the continuous improvement of the domestic financial market and the constant launching of derivatives, the quantitative trading model will also be continuously innovated, and the "financial derivatives+quantitative investment" market will be exploited steadily.

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