A Review of the Recent Quantitative Crisis and Suggestions for Future Developments

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Abstract: *Recently, the China Finance 40 Forum (CF40) held a closed-door seminar on Quantitative Trading and Stock Market Volatility.*

Quantitative investing, at its essence, is to replace human decision-making with mathematical models. Investment philosophy, financial theory, and computer are the three main elements. Quantitative investing mainly includes two types: fundamental and technical analysis. Quantitative trading in China originated in 2010 and, after explosive growth from 2018 to 2021, has now entered a stage of high-quality development.

The quantitative crisis at the beginning of 2024 could mainly be attributed to the homogenization of quantitative strategies, which also reflected underdeveloped risk management, valuation pricing, and regulation functions in China's capital market. The quantitative crisis and the abnormal fluctuations in the market have the same root cause. Only by continuously encouraging value investing and long-term investing can the Chinese market fundamentally avoid crowded trading and stampedes.

Experts at the seminar proposed recommendations for future development, regulation, and institutional reform for the sector, pointing out that to make the market healthier and more stable, it's necessary to reposition the development model of quantitative funds and improve the supervision and trading systems.

I. Understanding Quantitative Investing and Development Status in China

Definition and classification of quantitative investing. Quantitative investing, at its essence, is to use quantitative methods to identify statistical regularities, to replace human decision-making with mathematical models, and to smooth market impacts through algorithmic trading.

The three elements of quantitative trading are investment philosophy, financial theory, and computer. Based on these elements, quantitative trading can broadly be divided into two categories: fundamental quantification, which has a lower trading frequency and longer holding periods, and technical quantification, which could be seen as an advanced form of K-line investment.

Process and profit mechanism of quantitative investing. A complete quantitative investment process consists of five major stages: The first stage is data analysis, where the front-end data team gathers various types of data, including price and volume data, fundamental data, and alternative data, as well as using AI models to extract textual information for sentiment analysis; the second stage is factor discovery, involving manual digging based on investment logic and AI-driven mining for specific targets; the third stage is return forecasting, where AI experts extract features from the factor library and use various models to predict future returns; the fourth stage is portfolio optimization, utilizing AI technologies such as deep learning and reinforcement learning to optimize a set of mathematical functions into a tradable strategy portfolio; the final stage is algorithmic trading, where AI algorithms are used to

predict short-term market trends for precise execution and real-time monitoring.

The excess returns of quantitative investing mainly come from two parts: α and β. β represents the volatility relative to the market's ups and downs, and can be divided into market β and Smart β for subdivided industries (large/small cap, value/growth). α represents the performance over and above the market baseline. The risk level of market β, Smart β, and α decreases in that order, while the difficulty of obtaining them increases from low to high. Obtaining α means finding mispricing in the market, which is, in a sense, the crown jewel that many quantitative teams are truly after.

The development and current status of quantitative investing in China. The launch of stock index futures in 2010 marked the birth of domestic quantitative trading. The period from 2010 to 2013 was the embryonic stage, followed by the growth stage from 2013 to 2015. In 2015, quantitative trading entered a bull market phase. However, from 2015 to 2018, it experienced a downturn due to the impact of the stock market crash. There was some recovery from 2018 to 2020, and with the opening up of the stock index futures market, various quantitative strategies performed well. From 2021 onwards, it has entered a period of high-quality development. In terms of scale, the years from 2018 to 2021 saw explosive growth in quantitative trading, with the scale increasing from less than 200 billion to 1.4 trillion yuan by the fourth quarter of 2021. Subsequently, it has maintained a level of 1.4-1.5 trillion yuan, with the growth rate of the quantitative scale slowing down.

II. The Beginning and End of the Quantitative Crisis in Early 2024

The early 2024 quantitative crisis was primarily set against the backdrop of extreme divergence and shift between large and small market caps. Quantitative strategies inherently prefer high-volatility small-cap stocks, given the lack of hedging tools in the Chinese stock market and the economic downturn in 2023, a large number of quantitative funds unanimously chose to sell liquid large-cap stocks and buy small-cap stocks, leading to highly crowded trading. It was not until the beginning of 2024 when Central Huijin consistently purchased the 300ETF that a drastic shift in market style from small-cap to large-cap stocks occurred, with market capital accelerating the sell-off of small caps, causing significant drawdowns of quantitative products.

The early concentration of snowball knock-ins acted as the fuse for the crisis. As small-cap stocks plunged, on January 22, the CSI 500 fell by 4.73% and the CSI 1000 by 5.77%, breaching multiple knock-in levels for the CSI 500 and CSI 1000 snowball products. After the knock-ins were triggered, brokers holding snowball products had to sell a large amount of corresponding stock index futures to hedge risks, leading to a continuous decline in stock index futures prices. This caused futures prices to fall below spot prices (a state of discount) and the difference relative to spot prices (the basis) to widen, rapidly expanding the discount of stock index futures.

Since quantitative neutral strategies generally involve going long on stocks with α while shorting stock index futures to achieve excess returns that have diversified systemic risk, the widening of the futures discount led to a significant increase in hedging costs at the expiration of quantitative neutral strategies. Some quantitative neutral strategies began to close positions to lock in floating gains, selling stock positions while covering short positions in stock index futures. At this time, the stock positions of quantitative products were mainly in small-cap stocks, which further accelerated the decline of small stocks, leading to a liquidity crisis in micro-cap stocks.

During the liquidity crisis from February 5th to February 7th, rescue funds and regulatory influences acted as a catalyst. Before the Spring Festival, the CSI 500 and CSI 1000 received liquidity support from rescue funds, leading to a rise in the index constituents and creating a siphon effect of continuous capital inflow into these constituents. This further triggered a liquidity shortage in stocks outside the CSI 500 and CSI 1000 constituents, such as those in the CSI 2000 and other micro-cap

stocks. Additionally, due to regulatory restrictions on closing sales of certain DMA (Direct Market Access) hedging products, DMA products could only adjust their portfolios by swapping non-CSI 500 and non-CSI 1000 constituent stocks for index constituent stocks. The liquidity of non-constituent micro caps was rapidly depleted, and as stock index futures were heavily purchased, the basis quickly narrowed from a significant discount.

For quantitative neutral strategies (including DMA), this was akin to having their short positions continuously bought up and their long positions continuously sold off, suffering a double squeeze from both the long end (micro-cap stocks) and the short end (index constituent stocks + basis). This led to margin calls, forced reductions in positions, or even forced liquidations in extreme cases, bringing the liquidity crisis in small and micro-cap stocks to the peak.

After February 8th, the liquidity crisis began to ease. Regulatory restrictions on closing positions for DMA products were lifted, alleviating the situation. As rescue funds started to flow into the 2000ETF on the last day before the festival, it greatly eased the panic in the small and micro-cap market. The A-share market began to stabilize overall, some quantitative products that withstood the crisis managed to recover some losses, and small and micro-cap stocks also saw a bounce back from their oversold conditions.

III. Causes of the Crisis and Lessons Learned

First, homogenization of quantitative strategies is the main reason for the crisis, and quantitative institutions should build diversified and differentiated strategies. This round of quantitative crisis was essentially a case of crowding. From the perspective of quantitative managers, strategies should be diversified as much as possible. However, domestic investors often focus on short-term performance, and the monthly and weekly ranking system has a low tolerance for performance fluctuations, which is not conducive to the differentiation of strategies. From the investor's perspective, it's important to educate and encourage investors to evaluate performance from a longer-term perspective, which is also beneficial for creating differentiated strategies.

Second, the quantitative crisis and the abnormal fluctuations in the stock market share the same root cause, and it's essential to continuously improve China's capital market to guide value investment and long-term investment. Compared to more mature capital markets, a significant portion of transactions and funds in the A-share market are concentrated in small-cap stocks, leading to a problem of "speculating on new, small, and poor-performing stocks." Combined with quantitative deep learning models' preference for high volatility in small-cap stocks and the lack of hedging tools in the Chinese stock market, this leads to homogenization of quantitative strategies. Only by continuously improving China's capital market to guide value and long-term investments can the market fundamentally avoid crowded trades and stampedes.

Third, the core functions of risk management, valuation pricing, and regulation in China's capital market are somewhat lacking, and there is a need to push financial institutions towards market-based development, rule-of-law practice and international alignment.

The risk management function of financial institutions as brokers is missing. Securities companies and fund companies play the role of intermediaries in the market. In addition to providing transaction avenues, they also serve to balance financing and securities lending. Due to China's securities and settlement system being a single tier registration system, all securities registration is conducted at the China Securities Depository and Clearing Corporation, a central institution, preventing securities companies from holding the physical or ownership of securities purchased by clients. In other words, securities companies cannot directly use the securities they hold for securities lending and need to "finance" by borrowing stocks from other institutions or directly purchasing securities to meet clients' demands for short selling. This increases the financial leverage and risk of the securities companies, and as a

result, they have to rely on government rescue when extreme risk events occur. Shifting China's trading and settlement system from a single-tier registration to a dual-tier registration system (first registering at the exchange or other markets, followed by registration at a central clearing and settlement institution) may promote the balance in securities firms' financing and securities lending, and prevent significant market fluctuations.

The valuation and pricing function of financial institutions as market makers is lacking. Market makers can effectively match the demands of buyers and sellers within their own bid-ask spread, profiting from the spread. In reality, it's challenging for market makers to achieve an absolute balance of buying and selling; at this point, market makers need to use their own net capital to cover risk exposure. The requirement for net capital ensures that market makers have sufficient funds and assets to support their market operations. The prerequisite for net capital requirements is proper valuation and pricing, which is based on the disclosure of information by listed companies. Continuously improving the information disclosure system of China's capital market is essential for enabling financial institutions to better perform their valuation and pricing functions.

Regulation of financial institutions is insufficient. There's significant room for improvement in the regulation of fund companies in China. For example, banking wealth management does not fall within the China Securities Regulatory Commission (CSRC) system and is not subject to the Law of the People's Republic of China on Securities Investment Funds, leaving space for regulatory arbitrage. The core of strengthening the regulation of fund companies lies in the fiduciary duty, which requires fund managers to ensure openness only to qualified investors and demonstrate that their strategies benefit investors, meaning the investment decisions and operating strategies of funds should reflect positively on investors' interests, and information disclosure needs to be improved. Strengthening the regulation of futures companies is based on the balance between hedging and arbitrage, and the balance between bullish and bearish views, which helps the normal functioning of price discovery and risk management. Only when the three core functions of risk management, valuation pricing, and regulation in the capital market are well performed can China gradually grow into a financial powerhouse.

IV. Suggestions for Future Development, Regulation, and System Reform of Quantitative Trading

First, the complexity of quantitative products increases market risk, necessitating stronger regulation to provide higher quality financial products. The two core triggers of the stampede this time (snowball products and DMA) both involve issues of financial product access, where product complexity and off-exchange trading make regulation particularly challenging, also increasing the risk of exacerbating market volatility. After 2015, China adopted a series of measures to restrict futures trading, including limiting new positions, raising margin requirements, commission ratios, cross-regulation, etc. However, the real solution lies in designing and providing higher quality financial products, which can fundamentally improve market ecology, structure, and investor behavior. Additionally, early detection and timely intervention are crucial for the risks brought by non-standardized over-the-counter financial derivatives trading, which are critical directions for financial regulation in the future.

Second, the underdeveloped trading system provides fertile ground for crowded trading, necessitating reforms in the quantitative trading system to promote market fairness and efficiency. The 2019 Central Politburo meeting proposed reforming quantitative trading, partly due to China's unique stock trading system of "first-level trading, first-level settlement." Under this system, there's no concept of nominal holder, and all trades must go through the exchange's system, leading to unfair trading, such as algorithmic quantitative trading being much faster than other traders. In more developed capital markets abroad, only securities companies can directly enter the exchange's system, providing a level playing field for

both quantitative funds and other investors in terms of order speed and channels. In an underdeveloped trading system, "trading for the sake of trading" easily occurs, which is one of the reasons for crowded trades.

Third, this round of quantitative crisis also played a role in prompting adjustments to the securities lending system, and it's important to correctly understand the relationship between quantitative trading and the securities lending system. Starting from March 18, 2024, the market-oriented agreement declaration for securities lending was adjusted from "T+0" to "T+1". Against the backdrop of the continuous deepening of the registration system reform, continuing the "T+0" system means that almost all targets in the market could be immediately shorted, which would undoubtedly increase market volatility and short-selling pressure. The adjustment of the securities lending system helps stabilize market expectations and avoid severe market fluctuations caused by excessive speculative behavior. For quantitative investment, reasonably utilizing the securities lending system allows for short selling certain stocks or assets to hedge risks, thus reducing the overall volatility and risk exposure of the investment portfolio.

In summary, it's necessary to reposition the development model of quantitative funds, and improve product regulation and trading systems to ensure a healthier and more stable market.