ISSN 2959-6130

The Left-tail Risk and the Cross-section of Stock Returns: Evidence from China

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Abstract:

As a matter of fact, left-tail risk is a common risk in stock market. This study examines the linear correlation considering Value-at-Risk (VaR) and future stock returns within context of the Chinese main board stocks, particularly during periods marked by significant left-tail risk. Processing data from March 2014 to March 2024, this study concentrate to daily and monthly cross-section returns, along with other financial statistics. A suitable Fama-Macbeth regression using in this paper to exam the significance of left-tail risk. The key focus is to investigate the effect of VaR concerning future stock returns under downside market conditions, as indicated by the recent 23% drop in China's benchmark CSI 300 index. The regression analysis indicates a significant negative correlation between VaR and future stock returns, suggesting that higher potential losses as indicated by VaR correspond with lower future returns. This outcome is contrary to traditional asset pricing theories which posit a positive risk-return relationship. The findings will attract attention of investors to consider extreme risk management of public stocks and contributes to the ongoing discussion on risk assessment in financial markets by highlighting the importance of integrating robust risk management tools like VaR in investment strategies, especially in volatile markets.

Keywords: Left-tail risk; equity returns; investor inattention; risk management.

1. Introduction

CSI 300 index which is the China's benchmark index fell by 23% during 2023 to early 2024. This decline highlights an increased left-tail risk, as evidenced by historical data from Chinese markets and may construct new market environment. Therefore, it is crucial to discuss the left-tail risk, which could lead to misleading stock pricing and result in investors receiving lower returns than anticipated. Fundamental asset pricing method have long dominated the literature, assuming rational investors and full access to public information. However, numerous studies suggest that investors' attention and processing capacities are limited, often leading them to make decisions based on a few selectively attended stocks. Investors under risk often underestimate potential losses, a behavior inconsistent with utility theory. According to Barber and Odean [1], individual investors tend to purchase stocks that initially capture their attention, overwhelmed by the plethora of available choices. Cosemans and Frehen indicate that investors frequently rely on past salient returns to form future return expectations, thereby introducing evaluation biases based on portfolio payoffs rather than expected returns [2].

Recent research shows the change in salience (CS) is significant negative related to the expected stock returns by using data from 2005 to 2021 considering Chinese data. This suggests a general inclination toward right-tail profit expectations and an expectation for mean reversion in left-tail risks, possibly leading to underreactions to information indicating potential left-tail risks. Thus, investors may overestimate the stocks that have recently suffered large losses, which will have a surprised negative abnormal return in the future. This phenomenon, known as left-tail momentum, suggests that left-tail risk which expressed by an extreme loss shown in historical data is an inherent feature of equity that significantly impacts future returns and may imply a bad condition . Hence, investigate how investors treat the potential extreme loss which may influence in the future return is the key point in a downside market.

It is crucial to incorporate risk assessment when evaluating stock returns. Value-at-Risk (VaR) play a role as a measurement to quantify the left-tail risk by estimating the maximum potential loss at a specific probability level, thereby playing a vital role in risk management [3]. Research by Iqbal and Azher [4] as well as Aziz and Ansari [5] has demonstrated VaR is significant positive related with expected stock returns in Pakistan and India, rein-

forcing the traditional asset pricing theory that higher risks justify higher returns for investors.

According to the expected utility hypothesis, risk-averse investors pursue higher returns as redeem or premium of increased risk. Thus, there should be a higher expected return as compensation for holding stocks or derivatives associated with greater risk. However, Atilgan et al. argue that in the U.S. and some developed markets, stocks with higher VaR actually experience significantly lower future returns [6]. This indicates that individual investors, expecting higher returns, may choose to hold stocks which just drop significantly in the historical data despite the evidence. This behavior contradicts the well-established positive risk-return trade-off, indicating that investors might be overestimating their ability to predict mean-reversion in stock returns.

The investigations conducted by some researchers focus on the systematic risk associated with the left tail in adverse market conditions [7, 8]. Nevertheless, substantial negative losses within this left tail, which are measurable through the Value-at-Risk (VaR) methodology, remain unexplored in the context of the Chinese market under similar conditions. Moreover, there exists a distortion in the valuation of Chinese equities, specifically that the bottom 30% of these assets exhibit returns that are less correlated with operational fundamentals, as indicated by earnings surprises, and are more influenced by initial public offering (IPO) activities.

Given the persistent nature of adverse market conditions and the distinct attributes of the Chinese market, it is imperative to study extreme scenarios of left-tail losses to bridge the current knowledge gap regarding market risk in China. This study is aim to investigate the linear correlation that how VaR affect the cross-section of one-month ahead returns especially in the downside situation. Such an examination is intended to aid investors in circumventing any irrational mispricing that may arise from neglecting left-tail risk. Therefore, the objective is to investigate if it is possible to devise a profitable arbitrage strategy by controlling risk exposure based on Value-at-Risk, then distinguish the relationship between VaR and future stock returns

2. Data and Variables

The China Stock Market and Accounting Research (CSMAR) database and Yahoo Finance have collected daily and monthly returns, market value, book-to-market ratio, No. of shares, and corporate accounting data for stocks which public on Chinese main board. To ensure data integrity, any months should have more than 15 trading days and the sample corporations with incomplete information are excluded from dataset. The resultant dataset encompasses the period from March 2014 to March 2024. Regarding asset pricing factors, data of the Chinese four-factor model, valid until March 2024, are sourced from the Mingshi database and include the risk-free rate which using the deposit rate in one year.

The 1% Value-at-Risk (VaR1) represents the expected portfolio loss at the 1% probability level within the return distribution. In practice, Following Atilgan et al., by getting the distribution of daily returns during the last 12 months until month t to calculate VaR1 as the value of 1st percentile point, ensuring that at least 200 trading days are available. For ease of comparison, VaR1 is taken by its absolute value for convenience of comparation. The asset pricing model used is CH4 (Chinese 4 factor model), derived from prior research [9]. Additionally, market beta, known as Beta, is the market portfolio risk premium. Market value is marked by MV, and BM is book-to-market ratio. ILIQ is the illiquidity measure according to Amihud [10].

3. Results and Discussion

Table 1 illustrates the main descriptive statistics of variables using in this paper. It interprets the observations of selected data set, Mean, standard deviation, minimums and maximums of variables from a time-series range that collected from March 2014- March 2024. The Return present monthly stock returns for each corporate, with 416,570 observations, shows an average return of -0.0087, reflecting a slight negative average, with a high level of variability that standard deviation of 0.1542. The BM noted for 432,440 observations, has a negative mean with -0.4353, which might suggest a prevalent trend in the data it represents, with a high standard deviation indicating substantial spread among values. Liquidity measurement, as measured by ILLIQ across 416,570 observations, is extremely low on average for 0.000006, with minimal fluctuation. The liquidity value ranges from an incredibly low 0.0000008 to 0.0243577. The MV (market value) variable showcases a significantly high average market value for 16506.09 with a large standard deviation for 58831.19, indicating a wide disparity in company sizes within the dataset. Its values stretch from 61.41 to 2815078, underscoring vast differences in market value.

Table 1. Descriptive statistics

	Observations	Mean	Std	Min	Max
Return	416,570	0.0087	0.1542	-0.8689	5.7348
VaR	379,619	0.0706	0.0209	0.0098	0.2
BM	432,440	0.4353	0.3321	-5.8824	25
ILLIQ	416,570	0.000006	0.00008	0.0000008	0.0244
MV	434,211	16506.09	58831.19	61.41	2815078
Rf	618,673	0.0014	0.0004	0.0011	0.0025
SMB	618,673	0.0050	0.0438	-0.172	0.1841
VMG	618,673	0.0106	0.0386	-0.1028	0.1517
PMO	618,673	0.0064	0.0403	-0.2019	0.1275

Table 2. Zero-cost portfolio analysis

Portfolio	Excess Return
Lowest VaR	1.5312
Highest VaR	-0.0835
High-Low spread	-1.6147

To analyze the significance of left-tail risk on future returns and arbitrage opportunity by controlling risk exposure based on VaR, the first thing is to determine whether the mispricing exist. In another words, the mispricing of stocks will lead to an arbitrage opportunity against asset pricing theory. Sorting all stocks into 10 groups according to their sorted deciles of VaR1, where VaR1 indicates the left-tail risk associated with each stock. Then focus on the most and least extremely risky groups and analyze the portfolio constructed as follow. Then, one takes long positions in stocks with the VaR1 at first decile and short positions in stocks with the VaR1 10th decile to construct a zero-cost portfolio (the highest and lowest left-tail risk portfolio). The only thing should be considered about is the difference in performance of the portfolio. Table 2 shows the portfolio performance within Excess Return. The excess return of portfolio with lowest VaR is 1.53% but that in the highest VaR is -0.08%. It illustrates a negative 1.61% spread that the zero-cost portfolio will generate an abnormal return. That means there actually a mispricing in Chinese market and could be distinguished by indictor VaR. Hence, it is meaningful to put VaR in a regression model and test the significance of parameter caused by VaR.

Using a parametric method, set the excess return as the dependent variable and VaR1 as an independent variable. Follow the estimation approach using the Fama-MacBeth regression model with control variables, which is specified as follows:

$$r_{it+1} = \alpha_t + \beta_{1t} VaR1_{it} + \beta_{2t} Z_{it} + \epsilon_t \quad (1)$$

where r_{it+1} is a $n \times 1$ vector of excess return at month t+1, Z_{it} are vectors included control variables such as: Beta (market risk premia), BM, ILIQ and CH-4 factors which are mentioned in the context.

The results from Table 3, which employs the Fama-Macbeth regression approach, demonstrate important findings concerning Value-at-Risk (VaR) could predict one-month-ahead stock returns in a significant level. As the result from initial regression (column 1), VaR displays a distinct negative relationship with future stock returns, indicating that higher VaR values, which suggest greater risk, are allocated with lower returns in the future. This finding supports the hypothesis that VaR is a significant predictor of adverse movements in stock prices.

In the subsequent analysis (column 2), even after incorporating a variety of firm-specific characteristics and established model factors from prior literature as control variables, VaR is still negatively related one-month ahead returns with robustness. The coefficient of VaR is -0.15 at the 1% significance level which persistently indicates that VaR captures specific risk aspects that are not fully explained by other commonly used predictive and control variables.

Table 3. Fama-MacBeth regressions

	(1)	(2)	T value	Pr > |t|
VaR	-0.2145	-0.1520	(1)-18.856 (2)-15.316	0
BM		0.0049	8.147	0
ILLIQ		-33.1612	-2.431	0.015
SMB		0.8206	142.087	0
VMG		-0.0940	-14.144	0
PMO		0.0260	4.615	0
Mkt-Rf		0.9949	251.636	0

The robust negative coefficient of VaR in predicting stock returns underscores its utility in financial risk management and investment decision-making. The persistence of this relationship, even after adjusting for other influences, highlights the critical role of VaR in forecasting downturns in the market, which can be particularly valuable for individual and institutional investors. However, the findings also suggest a need for caution among investors who rely on VaR. While VaR is effective in capturing general risk trends, its predictive capability does not account for all the nuances of market dynamics. This indicates potential limitations in using VaR as a standalone tool for risk assessment and suggests the necessity for integrating it with other risk measures and market indicators to enhance predictive accuracy and investment strategy.

4. Conclusion

To sum up, this study substantiates the negative influence of left-tail risk on future stock returns and elucidates the potential for arbitrage opportunities through strategic management of risk using sorted VaR. These insights emphasize the necessity of incorporating left-tail risk assessments into comprehensive financial strategies to better anticipate and mitigate potential losses. Moreover, the research identifies significant limitations, including the absence of robustness tests with alternative factor models like the Fama-French Five Factor and fixed effect models that control the time effect, and potential endogeneity issues among the independent variables, which could compromise the validity of the causal interpretations made. Future directions of this research will also exam the relationship between right-tail potential gains and future returns to determine if their effects oppose those of left-tail risks. Additionally, further investigation will analyze the sources of VaR fluctuations, such as policy changes or major economic events, and their impacts on expected returns. Long-term effects of VaR will also be examined to better understand their influence over time. As a conclusion, a valuable insights into the role of VaR in predicting stock returns provided by this study. Ongoing research is crucial to develop more robust asset pricing models that integrate VaR effectively, enhancing the reliability and applicability of financial risk assessments.

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