Figure 9
Residual and Conditional Standard Deviation of CSI 300 Index After GARCH Filtration

5.3 Estimation of Extreme Value Distribution Parameter and Fitting Test

In this paper, the maximum likelihood estimation is used

to fit the GPD function with 10% as the threshold and get the CSI 300 Index new message sequence.

Lower tail distribution parameter of GPD are as follows:

Table 3
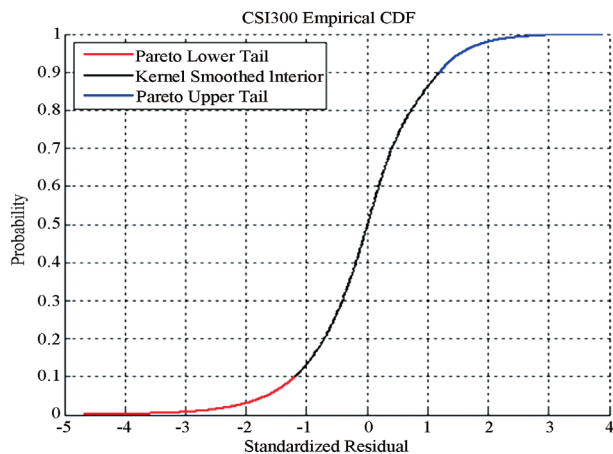**Parameters of the GPD Distribution Estimate**

GPD distribution	CSI 300 index	
	Shape parameter	Scale parameters
Upper tail distribution	-1.963768	1.963037
Lower tail distribution	-1.008724	0.100872

5.4 Fitting Test

In order to visually see the fitting of GPD, taking CSI 300 Index as an example, we draw the CDF chart of CSI 300 index sub-sequence fitting experience, and use GPD fitting at the next tail. The other parts are fitted with empirical CDF. It can be seen from the figure that the scatter is closely distributed around the reference line, indicating that the fitting state is good and the model is suitable.

Figure 10
Fitting of the GPD

5.5 Parameter Estimation of Copula Functions

According to the above analysis, this paper first uses the GPD distribution as the marginal distribution of Copula function. Secondly, the probability distribution of the CSI 300 Index and Gold Index futures sequences is uniformly distributed by the K-S test. Finally, the Gaussian Copula function is used to estimate the parameters (see Table 4).

Table 4
Correlation Coefficient Matrix of *t*-Copula Function

R	CSI 300 index	Gold index
CSI 300 index	1	0.0709
Gold index	0.0709	1

5.6 Equal Weight Portfolio VaR Comparison

First, we use Gaussian-Copula to simulate the next day with the correlation coefficient and degree of freedom we have obtained from the previous step. The number of mimicking times is 10,000 times, and the residual sequence of $U(0,1)$ is uniformly distributed. Then, the residual sequence is simulated by GARCH (1,1) to generate 10,000 × 4 analog yield series. Second, The VaR of CSI 300 Index and Gold Index are calculated under the four different confidence conditions set at 95%, 99%