Analyzing the risk contagion effect of stock market and foreign exchange market in the context of Sino-US trade frictions based on the perspective of behavioral finance

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Abstract. For the empirical study in this paper, the trade friction variables represented by the effectively applied weighted average tariffs imposed by the U.S. on China and technical barriers to trade have a negative impact on the size of China's export trade, and the impact of technical barriers to trade has a lag. In the analysis of the impact of trade structure, from the perspective of technology intensity, the impact of Sino-US trade frictions on China's exports to the United States of low- and medium-technology industries is significantly greater than that of high-technology industries, mainly due to the high technology level of high-technology products, strict standard requirements, strong innovation capacity, the impact of trade frictions is not significant; from the perspective of product end-use, investment goods are significantly more affected by Sino-US trade frictions than consumer goods, and the impact on industrial manufactured products is much greater than primary products, the results of the difference is mainly affected by the nature of the product, export volume and the area of friction.

1.Introduction

As China changes from pursuing economic growth rate to pursuing high quality economic development, the structure of China's export trade changes, and the main products exported are industrial manufactured goods, among which, labor-intensive products and capital- and technology-intensive products show an inverse change, and the proportion of capital- and technology-intensive exports increases, and machinery and transportation equipment gradually become the main products of China's exports to the United States, and the similarity of the commodity structure between China and the United States increases [1]. At the same time, the competitiveness of Chinese products in the U.S. market has risen, industrial manufactured goods have a significant comparative advantage in the U.S. market, and the U.S.-China economic and trade relations have gradually changed from cooperation to competition [2].

2.COMMON RISK MEASURES ARE SUMMARIZED

The purpose of analyzing and studying risk transfer is to manage and control it and reduce it to an acceptable level, but "no measurement is no management", so it is necessary to measure the risk in order to analyze its nature and determine the acceptable level [3]. The traditional risk measurement methods and the three risk measurement methods proposed by Basel (basic indicator method, standard method and advanced measurement method) also focus on the measurement of static risk, without giving clear guidance on the risk transfer method [4].

2.1 Probabilistic method

Probabilistic methods can traditionally be divided into subjective and objective probabilistic methods [5]. The subjective probability method originates from the result of people's estimation of the probability of a certain risk occurring; while the objective probability method is the statistical result of people's estimation of the probability of a certain risk occurring according to certain assumptions through a large number of experiments and statistics. However, the objective probability method relies on the accumulation of a large amount of historical data, which is formally lacking in China [6]. The subjective probability method requires commercial banks to select certain experts and give their personal view of the likelihood of risk occurrence by simulating several possible scenarios using the experience and insight of the experts, and then have the analytics weighted average to arrive at the probability closest to the actual likelihood of occurrence [7]. This approach unfolds on three main levels:

(1) Commercial banks use statistical methods to identify sources of risk occurrence by analyzing existing historical events;

(2) Commercial banks use statistical analysis to then identify the vectors of risk transmission;

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(3) The risk accrual is calculated in segments according to the operational risk path, using the subjective probabilities of the experts.

2.2 Statistical valuation method

The method is based on the objective probability method, which uses historical statistics to determine the probability of occurrence of a certain risk score or the probability of occurrence of a certain risk based on different levels of risk loss under a variety of economic conditions. The method mainly uses the probability distribution of risk transmission to predict the frequency of risk occurrence of the degree of loss, and its probability distribution types are mainly discrete risk distribution, continuous distribution, binomial distribution, Poisson distribution and normal distribution [8].

2.3 GARCH-CoVaR model

This approach, originally proposed by Adian and Brunnermeier in 2008, is mainly based on the conditional value-at-risk CoVaR model, which reflects the transmission of risk by calculating the incremental and relative increments of CoVaR [9].The conditional value at risk CoVaR represents the maximum potential loss in the future caused by a commercial bank's loss value VaR to other institutions or banking operations at a specific time in the future for a specific holding period and at a certain confidence level [10]. The risk transmission impact calculated using this method can be used both as Eq.

$\Delta CoVaR_q^{i,j} = CoVaR_q^{i,j} - VaR_q^i$ Performing the calculation, the formula expresses the value of risk volatility of commercial bank i is the conditional value at risk of commercial bank j to commercial bank i $CoVaR_q^{i,j}$ with its own unconditional value at risk VaR_q^i the difference between the. This is the absolute impact value of risk transmission. Also we can use $\%CoVaR_q^{i,j} = \Delta CoVaR_q^{i,j}/VaR_q^i$ the relative impact value of risk transmission is calculated. The method was further divided into quantile regression method and GARCH model method by the later.

3.RISK TRANSFER METRIC BASED ON RISK ACCUMULATION

I am going to try to derive the accumulation of risk transmission effects below based on my own little experience [11]. Through the previous calculation analysis and study of risk assessment, we can initially sort out a risk transfer calculation idea. We assume that the business Xa of bank A in country M, and the business Xb,Yb of company B in country M exist between this transaction, while the business Xb of company B and the business Xc,Yc of company C in country N exist between this transaction, and the business Yb of company B and the business Zc of company C exist between this transaction. To facilitate understanding we will sort out the business relationship between A, B and C as shown in Figure 1:

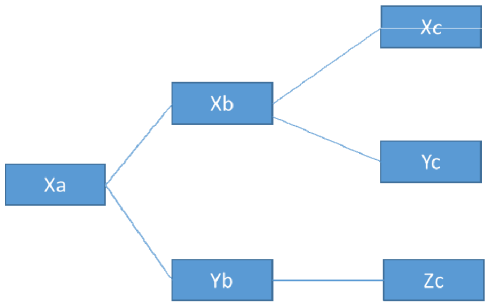

Fig. 1. Risk transfer relationships

Suppose that the value at risk for companies A, B and C, according to the calculation method, As shown in table 1.

Table 1. Risk assignment table

Company A		Company B		Company C	
Risks	Risk Value	Risks	Risk Value	Risks	Risk Value
Xa	3	Xb	2	Xc	3
		Yb	1	Yc	1
				Zc	2

We further assume that the business dependence between A, B, C, and the firm is:

The dependence of Xb on Xa is D(Xb,Xa)=0.3;
The dependence of Yb on Xa is D(Yb,Xa)=0.4;
The dependence of Xc on Xb is D(Xc,Xb)=0.2;
The dependence of Yc on Xb is D(Yc,Xb)=0.1;
The dependence of Zc on Yb is D(Zc,Yb) = 0.5;

(The degree of dependence can be calculated as the proportion of the business volume with related companies to the total volume of the business. For example, the dependence of Xb on Xa can be calculated as (Xb's dependence on Xa's revenue)/(Xb's total revenue)).

We can therefore make the following simple calculation:

If the risk of Xa is transmitted to company B, it will affect company B's business Xb and business Yb to the following extent, respectively:

$I(Xa,Xb) = Xa * Xb * D(Xb,Xa) = 3 * 2 * 0.3 = 0.18$
$I(Xa,Yb) = Xa * Yb * D(Yb,Xa) = 3 * 1 * 0.4 = 0.12$

Therefore, we can calculate the total risk value of Xb of company B as Xb's own risk plus the impact value of Xa's risk transmission, i.e., 2+0.18=2.18; similarly, the risk value of Yb is 1.12, and so on we can also calculate other risk values by analogy.

Since risk is a cumulative process, the risk of Xa is transmitted to Xc through Xb, then the effect of Xa on Xc is:

$I(Xa,Xc) = I(Xa,Xb) * 3 * 0.2 = 0.108$, so the value of the effect of Xa on Xc is 0.108; at the same time, Xb also has an effect on Xc, that is, $I(Xb,Xc) = Xb * Xc * D(Xc,Xb) = 2 * 3 * 0.2 = 0.12$, so we can conclude that the overall risk faced by Xc is the risk generated by Xa on it plus the risk generated by Xb to it and its own risk, i.e. $3 + 0.108 + 0.12 = 3.228$.

The calculation of other risk transfers can be done by analogy, so it is not difficult to deduce that the formula for calculating risk should be:

$$R(A) = Ra + \sum_{\infty}^{1} Ri \qquad (1)$$

where R(A) is the risk of a particular business A, Ra is the risk of business A itself (i.e., direct risk), and Ri is the risk passed on by other factors.

Given the complexity of the risk elements, a computer-assisted implementation is recommended.

In fact, the significance of risk calculation is mainly for risk comparison, and visual risk monitoring helps to detect abnormal risk movements and take preventive measures in time.

The calculation here is only an idea for the risk transfer calculation, an attempt for the follow-up study, and a more scientific and accurate risk calculation, which needs to be studied in depth by interested parties.

3.1 Sklar's theorem

Sklar's theorem is the theoretical basis of the Copula function used to construct the joint probability distribution of random variables, which is based on the principle that the joint distribution of random variables X and Y is $H(x,y)$ whose marginal distributions are $u = F(x), v = G(y)$, respectively, then there must exist a Copula function $C(u,v)$ such that for any $x, y \in R$ are:

$$H(x,y) = C(u,v) = C(F(x), G(y)) \quad (2)$$

The function H(x, y) in the above equation is obtained by uniting two edge distribution functions F(x), G(y) through the Copula function. In summary, it can be seen that Copula function can solve the difficult problem of how to reasonably construct the joint distribution under the premise of multivariate marginal distribution, so Copula theory has achieved good application in analyzing the joint distribution probability of multivariate in hydrological water resources.

3.2 Copula function type

From the research progress of domestic and foreign experts and scholars on the application of Copula function in the field of hydrology, it can be seen that in recent years, Copula is widely applied in the field of hydrology because different parameters are often used in hydrological analysis to analyze the rainfall characteristics of watersheds, and Copula function is just able to analyze the rainfall characteristics by establishing the joint distribution function of different parameters. Archimedean Copula function, Elliptic Copula function, Plackett Copula function and Vine (Vine) Copula can be obtained in the summary of the research progress are the Copula functions that frequently appear in the research. Moreover, Archimedean Copula function and Elliptic Copula function are the two most popular functions among scholars in applications.

(1) Archimedean Copula function

The multidimensional Archimedean Copula function is established based on the two-dimensional one-parameter Archimedean Copula function, the principle of which is constituted by the following equation:

$$C(u_1, u_2) = \emptyset^{-1}(\emptyset(u_1) + \emptyset(u_2) \quad (3)$$

where the function ∅ is the generating element of the Archimedean Copula function, and the function ∅ has a first-order derivative less than 0 and a second-order derivative greater than 0 for any$0 \le t \le 1$, i.e., ∅ is an open-down monotonically decreasing function. Function $\emptyset^{-1}()$ is the inverse function of the generating element ∅, strictly monotonic in the interval $[0, \infty)$.

3.3 Choice of Copula function

(1) Fitting test of Copula function

Researchers in the field of hydrology will select the Copula function that is appropriate to the available hydrological information. In order to test whether the selected Copula function can accurately characterize the correlation relationship between the variables, a hypothesis test of the selected Copula function is required. The selected Copula function is judged to be acceptable by determining the critical value at the confidence level and analyzing it in comparison with the statistics of the measured data. In this paper, the commonly used Kolmogorov-Smirnov (K-S) test will be used to fit the joint distribution frequencies of total and peak rainfall intensities to the joint measured samples.

(2) Evaluation of the goodness-of-fit of Copula function

In order to determine the optimal fitted Copula function, the root mean square error (RMSE) criterion method, the AIC information criterion method and the BIC criterion method will be used to evaluate the results of fitting the multivariate joint distribution of seven Copula functions The following is a brief description of the various methods for evaluating the goodness of fit.

(3) Root mean square error criterion method

The root mean square error is the square root of the deviation between the predicted value and the true value and the ratio of the number of observations n. In the actual evaluation analysis, the number of observations n is always limited, so the true value is generally replaced by the best value, so the root mean square error is the error between the "observed value" and the "true value", and its emphasis is on the "error". Therefore, the root mean square error is often used to test the fitting effect.

(4) AIC Information Criteria Method

AIC information criterion method is Akaike information criterion, this criterion is based on the mean square error (MSE), which is used to reflect the excellence of the fitting results. This criterion reflects the effectiveness of the fit of the estimated Copula function for different parameters with empirical and theoretical frequencies. The formula for the AIC Information Criteria Method is as follows:

$$MSE = \frac{1}{n}\sum_{i=1}^{n}[Pe_i - P_i]^2 \quad (4)$$

$$AIC = nln(MSE) + 2m \quad (5)$$

The smaller the AIC value, the better the fit of the Copula function.

(5) BIC information guideline method

The BIC information criterion method is also based on the mean square error (MSE), which is calculated as follows:

$$BIC = nln(MSE) + mlnn \quad (6)$$

The smaller the value of BIC, the better the fitting effect of Copula function.

(6) Linear fit accuracy test

One-dimensional linear regression analysis:

$$y = kx + b \quad (7)$$

Eq:

k is the slope; the closer the slope k of the linear function is to ±1, the smaller the deviation.

y is the theoretical frequency, which serves as the dependent variable;

x is the empirical frequency, as the independent variable

4.CONCLUSION

Macroeconomics and microeconomics are two different levels of economic activities and economic operations. Macroeconomy and microeconomy are closely related. Micro-economy is the basis of macro-economy, and the good condition of macro-economy is the necessary condition for micro-economic activities to be carried out smoothly. Socio-economic activities are a whole in themselves, and the macro and micro are closely connected with each other, and all the links of production, circulation, distribution and exchange are closely linked together. In the process of transformation from socialist planned economy to market economy, planning and market are two different means of economic regulation. Under the conditions of modern socialized commodity economy, only the rational use of the two economic means of allocating resources, the plan and the market, can more effectively achieve proportional development of social production. Plan and the market, the market is in a more basic position, the plan is in the role of the market to play the macro-regulatory functions and micro-guidance functions. Only the organic combination of planning and market can promote the sustainable, rapid and healthy development of China's economy. In the transition period from planned economy to market economy, the state especially needs to use macroeconomic legal means to regulate and control. Macro economy is a concept corresponding to micro economy. The production, distribution, exchange and consumption activities carried out by individuals, families and enterprises in the market economy are the micro-economy. Although the modern market economy is still based on a single microeconomic entity as the basic unit, with the increasing scale of the market, the growing development of commodity exchange and the increasing socialization of production, economic activities are no longer purely individual behavior, but increasingly show the overall characteristics of interconnection and mutual influence. The increase of individual wealth, family welfare and enterprise profits no longer depends solely on one's own efforts, but also necessarily on the overall economic situation, and the whole economic operation is increasingly showing obvious aggregate, comprehensive and global characteristics

In this paper, moment estimation is used for parameter estimation in the process of establishing multivariate joint probability distributions using the copula function, and three correlation indicators, Pearson linear correlation coefficient r, Kendall rank correlation coefficient and Spearman rank correlation coefficient, are introduced in the correlation analysis among the variables, and the Kolmogorov-Smirnov (K-S) test is used in the fitting test of the copula function. The Kolmogorov-Smirnov (K-S) test is used in the fit test of the copula function. In order to determine the optimal copula function, the root mean square error (RMSE) criterion method, the AIC information criterion method and the BIC criterion method are used in this paper to evaluate the copula function. The world is not yet free from the impact of the global economic crisis, China's commercial banks with the increase in openness, may reproduce some of the problems of developed countries, so it is more important to strengthen risk prevention, especially should be for the problems that also exist in the financial system of developed countries, more worthy of in-depth research, in order to achieve prevention before it is too late, to provide stable and reliable financial support for the development of China's economic development development. To achieve this goal, it is necessary to optimize the allocation of financial resources and develop practical and reliable preventive mechanisms against the international financial crisis, so as to achieve sound development. At the same time, we should study and introduce advanced international banking experience, strive to create a macroeconomic environment, advocate social integrity, strengthen the construction of credit database, improve the socialist legal system of justice and fairness, build a solid and reliable risk management system for commercial banks, and provide an opportunity to actively explore and develop a development model for the commercial banking industry in line with Chinese characteristics.

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