Analysis of Influencing Factors of Import and Export Based on Neural Network Gray Prediction

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Abstract: Import trade and domestic consumption may be closely related to the industrial structure. The purpose of this paper is to study the impact of RMB exchange rate jump risk on China's import and export trade from a macro level. Based on GARCH-JUMP model, this paper proposes a combined forecasting method of energy demand based on grey correlation analysis and BP neural network to solve the problems of single influencing factors, neglect of macro-policy factors and lack of forecasting accuracy in energy demand forecasting. Impulse response analysis and variance decomposition analysis based on VAR model are carried out. The empirical results show that the impact of RMB exchange rate jump risk on import and export trade is more significant in the short term than in the long term, and the impact on import and export trade changes from positive to negative and then to positive. And the impact on import trade is greater than that on export trade. The domain is divided according to the pertinence and direction of the macro policy, and the indicators of each field are analyzed; secondly, the grey correlation analysis method is used to calculate, sort and screen the initial indicators of the macro policy in each field after analysis; finally, the selected initial index is used as the input of BP neural network, and the neural network is used to predict energy demand, and an example is carried out to simulate and analyze the forecasting results of energy demand combination forecasting. The result of an example shows that the proposed energy demand combination forecasting method focuses on the impact of macro policy, and effectively improves the prediction accuracy. It is practical and reliable to conduct empirical research and analysis on the impact of RMB real effective exchange rate on China's import and export, in order to better stabilize China's RMB real effective exchange rate, reduce the impact on China's import and export trade, and stabilize China's economic development. We will promote the better improvement of China's balance of payments environment and promote the better development of China's import and export trade.

1. Introduction

The research of energy demand forecasting has become the focus of scholars at home and abroad. With the development of the national economy [1], the problem of energy bottleneck is becoming more and more obvious, in order to better deal with the balance between energy demand and supply.

In recent years, scholars have become more and more aware of the importance of import trade. For example, the expansion of imports is conducive to making up for the weak links in the process of domestic trade transformation. While enriching supply, it can promote the transformation of industrial structure and further stimulate consumption [2]. But on the whole, the phenomenon of attaching importance to exports, underestimating and even neglecting imports generally exists in the process of economic growth. Therefore, it is of great significance to explore the relationship among the current import trade, tertiary industry structure and domestic consumption, and promote the benign interaction and development among the three, for the sustainable development of the current domestic economy under the background of the new normal [3].

From the perspective of traditional analysis, most people think that the appreciation of the renminbi against the export in our country, but for imports, the balance of trade state of China's foreign trade economy produce very big effect [4], the article on the concepts and problems of RMB real effective exchange rate fluctuations impact on import and export of our country in empirical research, to promote the stability of the RMB real effective exchange rate of China is better, to reduce the influence of the RMB real effective exchange rate on China's import and export trade, import and export trade in our country better, more comprehensive development.

2. SVAR-Model structure

VAR model is proposed by Cooley and other scholars on the basis of modifying the vector autoregressive model [5]. This model can not only extract the current relationship of the intermediate variables hidden in the error term of the general VAR model, but also avoid the problems of too many parameters and the loss of degrees of freedom, and explore the time path of information shock through the impulse response function [6].

The general expression of the model is:

$$A_0 y_1 = \sum\nolimits_{j=1}^{p} \gamma_j y_{t-j} + u_t \left(t = 1, 2, \cdots, T \right) \tag{1}$$

Where into, yt is the column vector composed of all variables at time t, p is the lag order, A0≠Ik, γj is the variable coefficient matrix with lag order j, and is the structural random variable vector with white noise property. In the SVAR model in this paper, the specific forms of A0, γj and Ut are set as:

$$A_0 = \begin{bmatrix} 1 & -a_{12} & -a_{13} \\ -a_{21} & 1 & -a_{23} \\ -a_{31} & -a_{32} & 1 \end{bmatrix} \tag{2}$$

Matrix A reflects the simultaneity relationship between variables, and matrix B reflects the influence of random disturbances from different variables on the system. A and B are invertible matrices, and they meet the following requirements:

$$A \varepsilon_t = B \mu_t \tag{3}$$

$$A(L) y_i = u_t, E\left(u_t, u_t^- \right) I_3 \tag{4}$$

3. Grey correlation analysis

3.1 Theoretical principle

Grey correlation analysis will reflect the object of study, a series of numerical fitting on a curve, and various influence factors of the research object of curves are compared, and quantified respectively, calculate the research object and the correlation between various influencing factors, by comparing the correlation to determine the size of the influence factors on the influence of the research object.

3.2 Specific steps

(1) Determine the analysis index system, collect analysis data, and determine the comparison sequence and reference sequence. The data sequence composed of factors affecting system behavior is called comparison sequence and denoted as

$$X_i' = \left(x_i'(1), x_i'(2), \cdots, x_i'(m) \right)^T \tag{5}$$

The data sequence that reflects the behavior characteristics of the system is called the reference sequence and denoted as

$$X_0' = \left(x_0'(1), x_0'(2), \cdots, x_0'(m) \right)^T \tag{6}$$

(2) Conduct dimensionless treatment for reference sequence and comparison sequence. Due to the different physical meanings of the various factors in the system, the dimensionality of the data is not necessarily the same, and the values of different dimensionality generally cannot be directly compared. Therefore, the dimensionless processing of data is usually carried out in the grey relational degree analysis. Commonly used dimensionless processing includes averaging and initial valuing, which are respectively:

$$x_i(k) = \frac{x_i'(k)}{\frac{1}{m}\sum_{k=1}^{m} x_i'(k)} \tag{7}$$

$$x_i(k) = \frac{x_i'(k)}{x_1'(1)} \tag{8}$$

(3) Calculate the grey correlation coefficient matrix ξi(k). The so-called degree of correlation, in fact, refers to the degree of fitting between curves. Therefore, the difference value of the corresponding points of the curve can be used as a scale to measure the degree of correlation. A reference sequence X'0 usually has several comparison sequences X'I, each comparison sequence (X'1, X'2..., X'n) and the reference sequence X'0 have corresponding correlation coefficient matrices at each moment.

Reflects the correlation relationship between each influencing factor and the reference sequence, namely, the correlation degree Ri, and the formula is:

$$r_i = \frac{1}{m}\sum_{k=1}^{m} \xi_i(k) \tag{9}$$

4. Model test and stability

4.1 Model test

In terms of data processing, the total amount of trade imports per unit of ten thousand US dollars is used as the index to measure import trade (IM). Industrial structure (INS) is measured by the percentage of the added value of the tertiary industry in the GDP of the corresponding period; Domestic consumption level (CON) is measured by household consumption level (Yuan).

The specific constraint equation is as follows:

$$A\varepsilon_t = B\mu_t, A = \begin{bmatrix} 1 & 0 & b_{11} & 0 & 0 \\ a_{21} & 1 \\ a_{31} & a_{32} \end{bmatrix}, B = \begin{bmatrix} 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix} \tag{10}$$
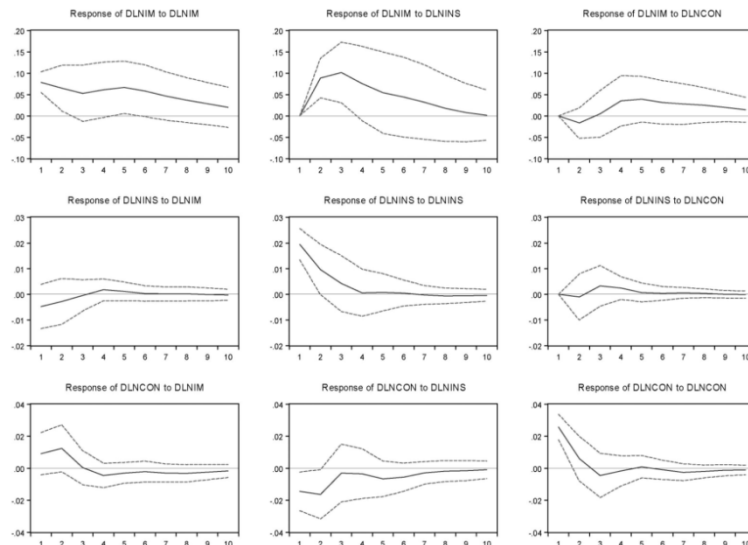

Figure 1. Impulse response analysis

At the same time, it should be pointed out that since IM and CON are quantitative indicators and INS are proportional indicators, in order to eliminate the influence of heteroscedasticity and other problems, logarithms of the three indicators are taken for analysis, which are respectively denoted as LNIM, LNINS and LNCON.

In the second period, the impact of industrial structure on import trade changed from negative effect to positive effect, and the positive effect gradually weakened with the increase of time, while the impact from domestic consumption level became positive and weakened gradually after the second period. For the impact from itself, it is a positive effect and basically remains at a steady level of 0 after the third period.

The positive effect of import trade on the impact from industrial structure gradually stabilizes after reaching the highest value in the third period; for the impact from the level of domestic consumption, it changes from negative effect to positive effect in the second period and gradually stabilizes after reaching the highest level in the fourth period; for the impact from itself, it has maintained a strong positive effect. As far as the impact of domestic consumption level on import trade is concerned, after reaching the maximum positive effect in the first period, it turns into a negative effect in the second period, and tends to stabilize gradually.

The lag order of VAR model is determined to be 4 order. After the VAR model is established for estimation, the stability of the model is tested based on the AR eigenvalues, and the reciprocal values of all eigenvalues are in the unit circle, so the VAR model is a stable system.
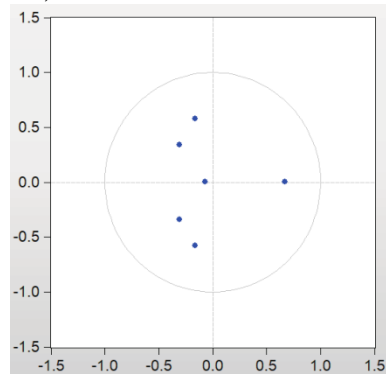

Figure 2. Model stability

4.2 Methods

We will actively promote industrial upgrading and structural adjustment, with the tertiary industry as the core, and in particular increase the proportion of emerging service industries in the tertiary industry. We will encourage technological innovation and guide the transfer of capital and labor to higher value-added industries

The property of RMB exchange rate asset price is also gradually exposed, making the normal intervention in foreign exchange market gradually reduced. The reform of RMB exchange rate should be carried out in a controllable and prudent manner, so as to avoid the sharp impact of large fluctuations and jumps in the exchange rate on the amount and structure of import and export trade.

We should develop import trade actively and exert its long-term positive transmission effect. China's import trade has gone through the initial stage, to the export-oriented and import-auxiliary stage, to the stage of equal emphasis on import and export, and finally to the current stage of active import expansion.

5. Conclusions

There are many factors that affect energy demand, and scholars are keen to study this area, but in recent years, studies often ignore macro policy, which is an important factor with comprehensiveness and complexity.

From the current point of view, import trade will have a negative impact on the level of domestic consumption and industrial structure, but the impact on the industrial structure is not significant, the current industrial structure has a significant positive impact on domestic consumption. The impact of long-term import trade will have a positive effect on the industrial structure, the level of domestic consumption and import trade itself; the impact of domestic consumption level and import trade on the industrial structure is negative at the beginning of the period and then becomes positive and gradually weakens.

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