Prediction of Stock Market Instability Based on MS-VAR Model

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Abstract. Prediction model is established further in this essay based on the basic filtering procedure of state-space model with Markov zone conversion to predict the dynamic predicted value and total predicted value of the system variables in the future sixty stages and to predict the zone conversion probability of the system. The prediction results show that the monetary policy action mechanism of the system varies in different processes of zone conversion.

Keywords: Markov zone conversion, dynamic prediction, total prediction.

1. Introduction
With various countries in the world introducing more scientific and perfect monetary policy, it plays more and more important roles in promoting economic stability and development [1]. Therefore, it is of great theoretical and practical significance to study the relations between monetary policy changes and stock market volatility and to make further prediction based on this.

This essay constructs a three-zone conversion system of monetary policy and stock market for the first time, and constructs a prediction model based on the basic filtering steps of the spatial model with Markov regional system conversion to predict the dynamic prediction value and the total prediction value of the system variables in the future 60 stages and to predict the system conversion probability of the prediction system as well as the monetary policy reasons in conversion.

2. Data selection and theoretical model

2.1. Data selection and processing
In this essay, currency amount and interest are taken the control variables of monetary policy. The currency amount adopts M2 month-to-month growth data, which is recorded as LM2. Therefore, the selected interest rate indicator is the monthly data of the benchmark interest rate of 1-year deposit, which is recorded as OYR in the essay. The data is from RESSET financial database [10-11].

The Shanghai Composite Index is selected as the proxy change of the stock price, and the logarithmic difference processing is performed on the original data to eliminate the unit root, which is recorded as SPR. Turnover rate in the stock market is taken as the proxy variable of liquidity index of the stock market [12-13]. All of the data are from China Economic Network database.
This essay sets the period for studying samples as from January 1997 to July 2019, and adopts monthly time sequence data, with a total of 275 datasets. The research period lasts for more than 20 years.

The MS-VAR model can calculate interaction between the variables during conversion between different regime systems. Based on this model, five sets of system variables and regime system conversion probabilities are also predicted.

2.2. Analysis results of MS-VAR model
MS-VAR system model including currency amount (LM2), interest (OYR), stock price (SPR), stock market volatility (VOL) and liquidity of stock (LIQ) is constructed in this essay. Through three-regime system division, selection of the model lag order, selection of the system model and the nonlinear test, it is finally determined that the fitting effect of MSIH(3)-VAR(2) model is optimal, that is, the system has three states, lags two order and the variance and intercept vary with different states.

| LM2  | OYR  | SPR  | VOL  | LIQ  |
|------|------|------|------|------|
| C (1) | 0.9282 | 0.4162 | 0.1375 | 0.2644 | 1.3138 |
| C (2) | 1.6225 | 0.2786 | 0.0998 | 0.2554 | 0.7355 |
| C (3) | 2.6050 | 0.6255 | 0.2978 | 0.5435 | 2.7804 |
| S (1) | 0.8025 | 0.1545 | 0.0675 | 0.2047 | 0.3354 |
| S (2) | 0.4505 | 0.1002 | 0.0502 | 0.0650 | 0.2454 |
| S (3) | 0.7784 | 0.3786 | 0.0841 | 0.5224 | 0.5004 |

Note: C stands for intercept term; S stands for standard deviation.

Fig. 1 is the estimation probability of three-regime system of MSIH (3)-VAR (2) system, which describes the filtered probability, smoothed probability and predicted probability of 275 samples in three-regime system. By observing Figure 1 it could be found description of the regional probability map is consistent with the reality. The three-regime system model proposed in this essay can describe better the actual conditions of monetary policy and stock market volatility in the past 20 years. It could be seen from the estimation results in Table 1 that regime 1 is the depressed regime system, regime 2 is the steady regime system and regime 3 is the expansion regime system.
From the above analysis of the three-regime probability map of monetary policy and stock market stability and the analysis of characteristics of different regimes, it could be seen that the impact of China's monetary policy on stock market stability has obvious three-regime characteristics. In other words, instability of China's stock market has an inherent cyclicality, which could be affected by monetary policy and financial policy.

3. Prediction of three-regime conversion system

3.1. Dynamic prediction results of the system

First, in this section, the basic filtering and prediction method based on the MS-VAR model is adopted to predict the growth rate of money, the interest rates, the stock prices, the stock market volatility and the stock market liquidity indicators. The model implements dynamic forecasting, cumulative forecasting, and transition probability of the data. This essay analyzes the data for 60 stages after August 2019, that is, data of five years.

![Dynamic forecast graph of backward 60 stages.](image)

Note: The blue part are the initial data and the red part are the dynamic forecast values of 60 stages.

As shown in Fig. 2, it could be seen that in the next 5 years, the growth rate of the currency will increase slightly, remaining at around 15%; the benchmark interest rate will recovery to about 20%, but still remains at a relatively lower interest level. In short, seen from the forecast results, in the next five years, China's monetary policy may not change much, the currency amount will maintain steady growth, and the interest rate will rebound slightly.
3.2. Cumulative prediction results of the system

![Cumulative forecasts of LM2 from 2019(8) to 2024(7)](image)

![Cumulative forecasts of OYR from 2019(8) to 2024(7)](image)

![Cumulative forecasts of SPR from 2019(8) to 2024(7)](image)

![Cumulative forecasts of VOL from 2019(8) to 2024(7)](image)

![Cumulative forecasts of LIQ from 2019(8) to 2024(7)](image)

Note: The blue part is the actual value of 60 stages of downward accumulation at the end of the sample period, and the red part is the cumulative predicted value of the upward 60 stages.

**Figure 3.** 60-stage cumulative prediction.

As shown in Fig.3, with the last stage of the sample (July, 2019) as zero, calculate the upward 60-stage cumulative predicted values and downward 60-stage cumulative actual values. Generally, the volatility of the stock market in the next five years is less than the volatility of the previous five years, and the liquidity of the stock market will be greater than the liquidity of the previous five years in the next five years.

3.3. Regime system conversion probability and reason forecast

Fig. 4 shows the prediction of the regime conversion probability of the system under different regimes. It can be seen that when the system is in recession, the predicted probability to convert to expansion period is small, but the predicted probability of maintaining at the recession period or converting to the stationary period is large. This shows that when the system is in expansion, the predicted probability of maintaining at the expansion stage will decrease rapidly; and when the system is in recession, the probability of the system remaining in downturn will be relatively stable.
Figure 4. Prediction of regime conversion probability.

It can be seen from Fig. 5 that the interest rate exhibits a more significant positive effect in the process, that is to say, the influence against the monetary policy and the theory could lead the system maintaining or converted to regime 1. In short, money amount and interest rates play a role in promoting the conversion process, and the cumulative impact of money amount is greater than the impact of interest rate.
Figure 5. Cumulative impact prediction of monetary policy during the maintenance and conversion of the regime system.

4. Conclusion
(1) Instability of China's stock market has significant internal periodicity. Moreover, it is predicted that cyclical fluctuations will occur again in the next five years, suggesting that China's stock market is generally in a cyclical fluctuation of stable period, expansion period and recession period for long time, and the fluctuation period is gradually shortening.

(2) It is found that when the stock market is in recession, the money amount and the stock price are positively correlated, while the interest rate and the stock price are negatively correlated, which could reflect the regulation effect of monetary policy. Therefore, the monetary authorities need to consider the state of the stock market when formulating monetary policy.

(3) The monetary growth will rise slowly in the next five years, and the interest rate will rebound slightly; the stock market volatility and liquidity are kept in a stable range. However, if the system is in recession, the prediction probability that the system remains in a downturn will be relatively stable.

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