



Human - currency exchange rate prediction based on AR model

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Abstract: This paper uses the time series correlation theory to take the mid-price of the US dollar against the RMB exchange rate from January 1, 2016 to July 6, 2018 as the research sample, and establish the AR(1) model after the first-order difference of the data, against the US dollar against the RMB. The exchange rate is short-term forecasted to solve the application of import and export enterprises in import and export trade. The empirical research shows that the AR (1) model accurately predicts the exchange rate of the US dollar against the RMB, and the RMB has a small depreciation. Then it theoretically analyzes the impact of RMB depreciation on import and export enterprises, and finally puts forward some suggestions for China's import and export enterprises.

Keywords: Exchange rate, time series, AR model, import and export, suggestions

1. Introduction

China's exchange rate system has successfully realized the transition from a fixed exchange rate system to a managed floating exchange rate system, which makes the exchange rate more market-oriented and the fluctuation range of the exchange rate is further expanded. Recently, on July 6, 2018, the United States officially imposed a 25% tariff on the \$34 billion Chinese product. During the overall strength of the RMB against the US dollar, the RMB exchange rate has depreciated sharply, unexpectedly. It fell below the \$6.63 mark, and since then the exchange rate has experienced large fluctuations as the Sino-US game situation has evolved. This will undoubtedly have a greater impact on China's enterprises engaged in import and export trade. Some scholars at home and abroad also studied the impact of exchange rate fluctuations on the trade of import and export enterprises. Qianjin Lu and ZhiguoLi analyzed the trade data of China from 1994 to 2011, and finally concluded that the depreciation of the RMB is conducive to increasing the trade surplus and improving the trade status; Krugman and Baldwin, Heikie and Hooper, and Moffet studied the real exchange rate and trade balance of the United States respectively, and concluded that the exchange rate depreciation is conducive to improving a country's international trade balance. However, some scholars have found that exchange rate changes are not conducive to a country's import and export trade. Rose and Andrew collected and selected up to 186 international relevant data from 1970 to 1990 to analyze the exchange rate of a country. It will conclude that it will have a negative impact on the country's import and export enterprises. Therefore, it is extremely important to accurately grasp the trend of the exchange rate and make reasonable measures against the positive and negative effects it brings.

Time ARMA prediction is a commonly used method in trend analysis. It ranks the economic statistics indicators in chronological order, and deduces or extends according to the development process, direction and trend reflected by the time series, so as to predict the level that may be reached in the next period or later. Therefore, this paper collects the weekly RMB exchange rate movement data and specific trend chart from January 1, 2016 to July 6, 2018. The first-order difference is used to establish a reasonable AR(1) model for the US dollar against the RMB. The exchange rate will be forecasted for the next five weeks, and then combined with the theory to analyze the impact of RMB depreciation on China's import and export trade, and finally the adverse effects of RMB exchange rate fluctuations, enhance the ability of China's import and export enterprises to avoid foreign exchange risks, and import and export trade to China. Enterprises make targeted recommendations.

The innovation of this paper is to use the AR model to accurately predict the future trend and specific size of the RMB against the US dollar in the short-term, and provide reference for the import and export enterprises to reasonably predict the exchange rate and conduct risk aversion. The point is that only quantitative analysis is used to predict the exchange rate, and some factors such as political factors, national conditions, and psychological expectations are not taken into account, and the lack of comprehensiveness.



2. Empirical analysis

2.1 Data sources and descriptions

The selected data in this paper is derived from the weekly US dollar RMB median price published by Eastern Fortune Network. The sample time range is from January 1, 2016 to July 6, 2018, a total of 132 samples. This paper uses Eview7.2 software to analyze the data and draw the sample into a time series (Figure 1). It can be seen that the RMB exchange rate increased from 2016 to 2017, and decreased from January 2017 to April 2018, April 2018. It is rising in July 2018. This sequence is affected by various accidental factors and shows some randomness, but there is statistical dependence between them.

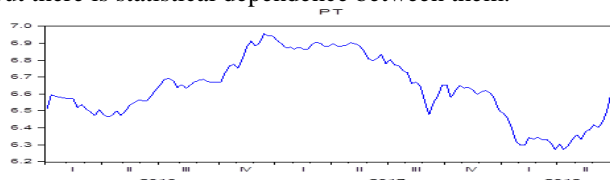


Fig. 1 Dollar to RMB timing chart

2.2 Data processing

2.2.1 Data stability test

Table 1 original time series unit root test

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.267737	0.6432
Test critical values: 1% level	-3.481217	
5% level	-2.883753	
10% level	-2.578694	

The unit root test for pt is shown in Table 1. The test results in the above figure indicate that the test for the hypothesis of the unit of the time series pt has a statistical value of -1.267737, which is greater than the corresponding critical value at each level of significance, so it should be accepted. Pt has the null hypothesis of the unit root, which indicates that the exchange rate closing price pt is a non-stationary time series.

2.2.2 Sequence smoothing

Since the variable pt is non-stationary, it is necessary to make a first order difference to the data, namely:

$$et = pt - pt(-1) \quad (1)$$

Where pt is the weekly exchange rate time series, and et is a new sequence of exchange rate data obtained after processing. After differential processing, a stable time series is usually obtained, and after unitization, the unit root test is performed, as shown in Table 2.

Table 2 first-order differential unit root test

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.062581	0.0000
Test critical values: 1% level	-3.481217	
5% level	-2.883753	
10% level	-2.578694	

It can be seen from Table 2 that the first-order differential post-sequence ADF statistic value is -9.062581, which is less than the threshold value of -3.481217 at the significant level of 1%, so it is the null hypothesis that rejecting the unit root of et indicating that et is stable sequence.

2.2.3 Select the appropriate AR model

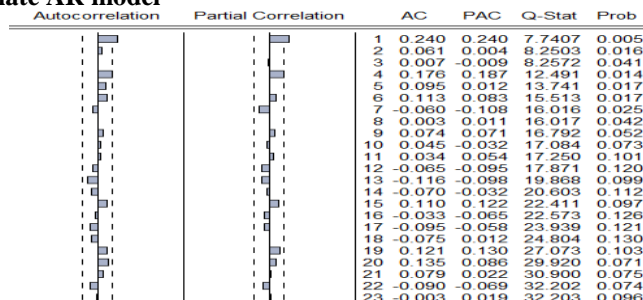


Fig. 2 partial autocorrelation after first-order difference



It can be seen from Fig. 2 that the sequence autocorrelation function converges to zero, exhibiting a tailing phenomenon, and the partial auto-correlation function is truncated at the first order, so the AR (1) model can be fitted to the sequence.

2.2.4 Model regression

Estimating the model with EVIEW yields the following results:

As seen from Fig. 3, the t statistic indicates that each coefficient is significant at the 5% level, the DW statistic is - 1.958368, there is no sequence correlation, and the F value is 8.280149 is greater than the critical value, so the overall significance level of the model is passed.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000185	0.003711	0.049905	0.9603
AR(1)	0.240997	0.083751	2.877525	0.0047
R-squared	0.060758	Mean dependent var		0.000335
Adjusted R-squared	0.053420	S.D. dependent var		0.032999
S.E. of regression	0.032106	Akaike info criterion		-4.024306
Sum squared resid	0.131939	Schwarz criterion		-3.980190
Log likelihood	263.5799	Hannan-Quinn criter.		-4.006380
F-statistic	8.280149	Durbin-Watson stat		1.958368
Prob(F-statistic)	0.004698			

Fig. 3 AR(1)model parameter estimation results

2.2.5 White noise test

In order to check whether AR (1) is valid, it is necessary to test the residual to prove that the residual sequence is a purely random white noise sequence. It is known from Fig. 4 that the prob value is greater than 0.05, indicating that the residual has passed the test.

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.017	0.017	0.0396	0.842
		2	0.011	0.011	0.0557	0.973
		3	-0.051	-0.051	0.4007	0.940
		4	0.183	0.185	4.9403	0.293
		5	0.032	0.026	5.0806	0.406
		6	0.158	0.156	8.5452	0.201
		7	-0.121	-0.116	10.600	0.157
		8	0.020	-0.003	10.658	0.222
		9	0.078	0.086	11.528	0.241
		10	0.037	-0.038	11.720	0.304
		11	0.022	0.064	11.790	0.380
		12	-0.033	-0.058	11.951	0.450
		13	-0.096	-0.092	13.316	0.424
		14	-0.090	-0.110	14.512	0.412
		15	0.140	0.115	17.450	0.293
		16	-0.022	-0.006	17.526	0.352
		17	-0.104	-0.101	19.157	0.320
		18	-0.113	-0.048	21.118	0.273
		19	0.121	0.114	23.375	0.221
		20	0.097	0.106	24.848	0.207
		21	0.086	0.061	26.003	0.206
		22	-0.128	-0.052	28.602	0.157
		23	-0.006	0.006	28.608	0.194

Fig. 4 residual error test results

2.3 Forecast and analysis of us dollar against RMB

According to the AR (1) model, namely $et = 0.000185 + 0.240997et (-1)$ to predict the future trend of RMB exchange rate for dollars. Firstly, according to the model to predict et over the next five weeks, and then using the difference equation between et and pt predicted the dollar over the next five weeks of exchange rates were 6.639685, 6.63987, 6.64005, 6.64024, 6.640425.

3. The impact of RMB devaluation on import and export enterprises

3.1 Increased financial risks of import and export enterprises

With the deepening of economic globalization, many domestic enterprises choose to invest and finance abroad to earn more profits. However, with the intensification of the trade war between China and the United States, the RMB is devaluating continuously. In this context, the import enterprises may take part of the loss due to the investment exchange. For the investment of the Finance Companies, the investment will not be obtained in time. If there is a cash flow problem, the company will face huge losses and lead to the breakup of its financial chain.

3.2 Foreign exchange settlement risk of import and export enterprises increases

Trading risk refers to the possibility of price fluctuations in foreign currency-denominated transactions due to exchange rate changes between foreign currency and foreign currency. When import and export



companies use foreign currency for transaction settlement, they will face trading risks. Under the current trend of RMB depreciation, due to the depreciation of the renminbi, domestic exporters can obtain more money, which will stimulate the export of export enterprises. However, for importers, the depreciation of the renminbi is a disadvantage. Whether it is current settlement or long-term settlement, companies need more RMB when paying for goods. The fluctuation of RMB exchange rate directly affects the risk of foreign exchange settlement of import and export enterprises, and the more frequent exchange rate fluctuations, the greater the relative value, the greater the risk. In the current short-term depreciation of the RMB, import and export enterprises will be greatly affected risk.

3.3 Increased operational risks of import and export enterprises

Export-oriented enterprises benefit from the depreciation of the RMB. First, most of the orders of export enterprises are still denominated in US dollars. The depreciation of the RMB against the US dollar directly benefits the orders of the enterprises. Secondly, the export enterprises have certain dollars and funds. Reserves, this part of the assets will appreciate against the RMB; finally, dynamically, the international competitiveness of exporting enterprises can be improved. On the contrary, the import-oriented enterprises will be damaged due to the depreciation of the RMB, mainly because the import enterprises have more serious damages due to the rising cost.

4. The conclusion

This paper analyzes the historical data of foreign exchange rates from January 1, 2016 to July 18, 2016, and uses the time series theory as a support to establish the AR(1) model. Through empirical research, the model can better describe the USD. The trend of the RMB predicts that the exchange rate of the US dollar against the RMB will rise in the next five weeks, that is, the RMB has a slight depreciation.

First of all, in view of the current Sino-US game situation, the instability of the exchange rate trend, corporate executives should have special responsible personnel to monitor the incidents that affect the exchange rate changes at any time, such as: the Fed resolution, the Fed's board members' comments, etc. It is also necessary to pay attention to relevant economic indicators such as the US dollar index and the price of gold. It is necessary to keep abreast of these economic changes, enhance the forecasting ability of exchange rate fluctuations, and reduce exchange rate risks. Finally, it is necessary to keep in close contact with relevant departments of the domestic government and foreign exchange banks and credit insurance departments. Being able to keep abreast of foreign exchange information and related policies at home and abroad will help companies make correct judgments on the direction of foreign exchange fluctuations.

Secondly, in view of the financial risks, operational risks and economic risks brought about by the depreciation of the RMB, enterprises can rationally operate financial funds to avoid exchange rate risks and reduce foreign currency borrowing, return foreign currency borrowings in liabilities, borrow RMB borrowings, and reduce investment and Reduce spending, reduce the amount of borrowing, avoid exchange rate risk due to RMB depreciation, cash settlement when debts expire; increase the use of derivative financial instruments, use derivative financial instruments, such as foreign exchange forwards, RMB and foreign currency options, RMB and foreign currency futures Etc., the rational use of derivatives will enable enterprises to reasonably avoid the risks brought by exchange rate changes; increase the application of hedging products, in the case of RMB depreciation, the use of hedging products by import companies can avoid price fluctuations. The loss of spot trading can be compensated by the profit of futures trading. This can avoid the risk of exchange rate and establish a sound exchange rate risk management mechanism. Enterprises should establish a separate exchange rate risk management mechanism, improve the exchange rate risk management mechanism, and establish a suitable The company Exchange rate risk management mechanism.

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