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Empirical Analysis of the Relationship between RMB Exchange Rate and Inflation Based on VAR Model

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Abstract: With the rapid development of the economy, it is crucial to study the relationship between the RMB exchange rate and China's inflation. Based on the VAR model, this paper uses the US dollar-to-RMB exchange rate and inflation rate data from 1985 to 2017 as the research sample. Based on the data, Eviews software is used to empirically analyze the relationship between RMB exchange rate and inflation. The results show that the RMB exchange rate is the one-way Granger cause of inflation, and inflation is not the Granger cause of the RMB exchange rate. And the RMB exchange rate has a positive effect on the inflation rate. However, the impact of the RMB exchange rate on the inflation rate is relatively small, the transmission effect is low, and there is a significant time lag.

Keywords: RMB exchange rate inflation Granger test VAR model

I. INTRODUCTION

In recent years, China's economy has developed rapidly. While our country and the government are paying attention to rapid development, we also attach great importance to the impact of exchange rate changes on inflation. From the perspective of GDP, it has become the world's second largest economy, with rapid global trade. At the moment of development, we have a more direct link with the world economy. Strengthening the circulation of production factors of our country in the world and improving our international competitiveness are also a major development direction for our country in the future. China's exchange rate has changed frequently. In the middle of 2015, it continued to depreciate against the US dollar. Today (at the end of July 2018), the exchange rate (with the US dollar) fell to around 6.63. Generally speaking, the exchange rate rose and the currency appreciated, but the country’s inflationdecreased. China is now in the two-way pressure of RMB exchange rate decline and inflation. As our country's currency joins SDR, the trend of RMB becoming an international reserve currency and freely tradable currency is inevitable, so it’s very importantfor us to know the relationship between RMB exchange rate and inflation expansions. Some domestic scholars have studied the relationship between the RMB exchange rate expansions. Liu Jing [1] analyzed the impact of RMB exchange rate changes on China's inflation. The results show that the transfer effect of RMB exchange rate on inflation level is very low, and there are obvious Time lags. Hu Yuanqing, Wang Guibao[2] The analysis shows that the RMB exchange rate changes are positively correlated with China's inflation, and the exchange rate change is the Granger cause of inflation. In the long run, the RMB exchange rate has a certain negative impact on domestic prices. The contribution to inflation has grown from small to large and has remained stable. Liu Ya,Li Weiping, Yang Yujun [3]Studying the impact of RMB exchange rate changes on China's inflation, the long-term and short-term exchange rate effects are very low; the transfer effect of exchange rate changes on China's CPI is greatly affected by food price shocks. The measurement models and methods used in this paper mainly include: var model, ADF unit root test, Granger causality test, impulse responding function and variance decomposition. Different people have different opinions.

In this paper, the ADF unit root test is used to test the stability of the selected time series. Secondly, in order to prevent the pseudo-regression between economic variables, the Granger causality test is used to test the variables. Whether there is economic significance between them; using impulse response function to analyze the trajectory of specific interaction between short-term variables, study the overall response of the model to one of the shocks of one of the variables, and finally, use the variance decomposition to quantitatively analyze the RMB exchange rate and the relationship with inflation.

II. EMPIRICAL ANALYSIS

2.1 Data Sources

This paper selects the annual data of RMB exchange rate and inflation rate from 1985 to 2017 as an example for empirical analysis. The RMB exchange rate is based on the annual average price of the US dollar against the RMB exchange rate. The data comes from the China Statistical Yearbook of the National Bureau of

Statistics. The inflation rate comes from Baidu Encyclopedia. In the empirical analysis of this paper, the RMB exchange rate is expressed by y, and the inflation rate is represented by x.

2.2 Stationarity test

Time series models generally have to be tested for stationarity. It is well known that stationary time series variables can be analyzed by VAR models. For VAR models with non-stationary time series variables, Johansen co-integration analysis is required. Otherwise, it is highly probable that the regression phenomenon makes the establishment of the model meaningless. Therefore, the unit root test is first performed on the variable x and the variable y by Eviews software. As shown in Fig. 1 and Fig. 2, the unit root test results show that the statistical value of the test was -5.520089, which is smaller than the corresponding critical value at each significance level. Therefore, the null hypothesis of the existence of the unit root was rejected, indicating that the first-order difference data of the variables x and y was a stationary sequence. That is, the sequence after the first order difference was a unit root process with an intercept term.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.520089	0.0001
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(X,2)
Method: Least Squares
Date: 07/22/18 Time: 10:02
Sample (adjusted): 1988 2017
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(X(-1))	-1.211126	0.219403	-5.520089	0.0000
D(X(-1),2)	0.481470	0.170444	2.824796	0.0088
C	-0.000886	0.008714	-0.101653	0.9198

R-squared	0.537268	Mean dependent var	0.001233
Adjusted R-squared	0.502992	S.D. dependent var	0.067607
S.E. of regression	0.047662	Akaike info criterion	-3.154713
Sum squared resid	0.061336	Schwarz criterion	-3.014593
Log likelihood	50.32070	Hannan-Quinn criter.	-3.109888
F-statistic	15.67457	Durbin-Watson stat	1.942929
Prob(F-statistic)	0.000030		

Figure 1 First-order difference result of x

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.921229	0.0004
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(Y,2)
Method: Least Squares
Date: 07/22/18 Time: 10:04
Sample (adjusted): 1987 2017
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-0.902376	0.183364	-4.921229	0.0000
C	0.095205	0.109034	0.873167	0.3897

R-squared	0.455077	Mean dependent var	-0.012661
Adjusted R-squared	0.436286	S.D. dependent var	0.792054
S.E. of regression	0.594681	Akaike info criterion	1.860758
Sum squared resid	10.25572	Schwarz criterion	1.953273
Log likelihood	-26.84175	Hannan-Quinn criter.	1.890916
F-statistic	24.21850	Durbin-Watson stat	2.020719
Prob(F-statistic)	0.000032		

Figure 2 y first-order difference results

2.3 Determine the optimal lag order

This paper used LR, FRE, SC, AIC, and HQ criteria to determine the lag length. The result is shown in Figure 3. From the values of the five statistics under different lag lengths in the VAR model obtained below, it could be seen that the LR, FPE, AIC, and HQ values were the smallest when the lag order isso the optimal lag order of the VAR model It was 2nd order.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-13.21201	NA	0.009147	0.981420	1.073936	1.011578
1	30.15309	78.33697*	0.000722	-1.558264	-1.280718*	-1.467791
2	35.24734	8.545189	0.000676*	-1.628861*	-1.166284	-1.478072*

Figure 3 determines the best lag order results

	X	Y
X(-1)	0.788132	2.166798
	(0.17387)	(2.38549)
	[4.53293]	[0.90832]
X(-2)	-0.426241	-0.114397
	(0.15900)	(2.18156)
	[-2.68068]	[-0.05244]
Y(-1)	0.008562	0.860670
	(0.01484)	(0.20360)
	[0.57694]	[4.22721]
Y(-2)	-0.020472	0.026219
	(0.01442)	(0.19790)
	[-1.41928]	[0.13249]
C	0.113824	0.765107
	(0.03682)	(0.50517)
	[3.09141]	[1.51456]
R-squared	0.643680	0.876104
Adj. R-squared	0.588861	0.857043
Sum sq. resids	0.044718	8.417730
S.E. equation	0.041472	0.568998
F-statistic	11.74202	45.96347
Log likelihood	57.40418	-23.78057
Akaike AIC	-3.380915	1.856811
Schwarz SC	-3.149626	2.088099
Mean dependent	0.054323	6.876294
S.D. dependent	0.064678	1.504904
Determinant resid covariance (dof adj.)		0.000501
Determinant resid covariance		0.000353
Log likelihood		35.24734
Akaike information criterion		-1.628861
Schwarz criterion		-1.166284

Figure 4 lag order results

From Figure 4 we saw that the parameter estimation of the influence of the second phase of x lag on itself was -0.426, and the effect was significant. The effect of the second phase of x lag on y was -0.11, and the value of the t statistic is 2.18. The parameter value of the hysteresis phase 2 y versus x was -0.02, and its t-statistic was about 0.014. The estimated parameter value of the lag phase 2 y on its own was 0.026, and its t statistic was about 0.19. In the regression results, the value of F test was relatively large, while the values of AIC and SC were relatively small, and the value of the coefficient could been closer, the better the fitting effect was, the closer the value was, The value of$R^2$is 0.64. It showed that the degree of interpretation of the equation was significant, and the determination of the lag order was reasonable.

2.4 Model stability test

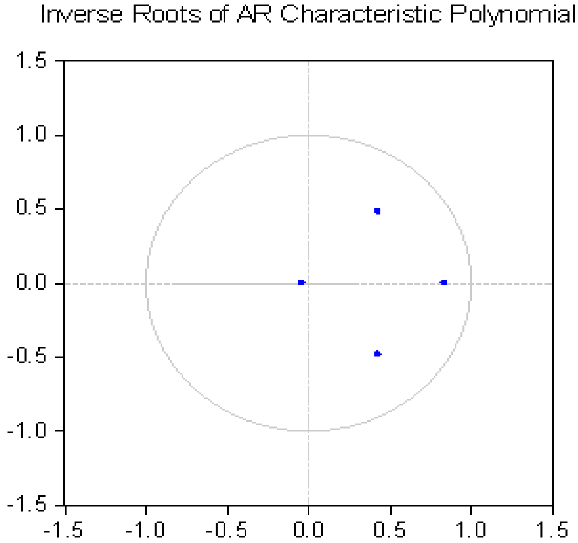

Figure 5 标题呢？

It can be seen from the results of Figure 5 that the feature roots fall within the unit circle, indicating that the established var model is stable.

2.5 Granger causality test

In the Eviews software, the Granger causality test was selected, and the following demonstration results were obtained. The upper and lower sub-tables respectively correspond to the Granger causality test of the two variables. In the table of Figure 6, the chi-square statistic of the LR test is relatively large, and the corresponding P value was less than 10% of the significance level. In the second table, the chi-square statistic value of the LR test was relatively small, and the corresponding P value was greater than 10% significance level. Ywas the Granger causality that causes x changes, but x was not a Granger causal relationship that caused y changes. It was possible to preliminarily speculate on the significant impact of the RMB exchange rate on inflation and to some extent speculate. Explained that the Var model was stable.

Dependent variable: X

Excluded	Chi-sq	df	Prob.
Y	7.411193	2	0.0246
All	7.411193	2	0.0246

Dependent variable: Y

Excluded	Chi-sq	df	Prob.
X	1.220876	2	0.5431
All	1.220876	2	0.5431

Figure 6 Granger test results

2.6 Impulse response function analysis

The concept of impulse response function is widely used in financial time series analysis. The impulse response function reflects the dynamic influence of the impact of one unit standard deviation of the applied variable on other variables, so it can capture the dynamic influence path of one variable to another. Next, the var model is analyzed by the pulse influence function, and the impact of the standard deviation innovation is applied to the random disturbances of x and y respectively, and then how the two influences. The two red dashed lines in the figure indicate confidence intervals, the abscissa represents the number of lag periods, and the ordinate represents the correlation coefficient. It can be seen from the figure that the influence of x on itself is slowly decreasing from the first period to the fifth period, and the slow increase after the sixth period tends to be stable. X has a strong response to the impact of a standard deviation of y, which peaks in the first period and stabilizes after the second period. y has a strong positive impact on x, peaking in the third period, and then slowly decreasing. Explain that the RMB exchange rate has a positive impact on inflation. The effect of y on itself decreases as the number of lag periods increases.

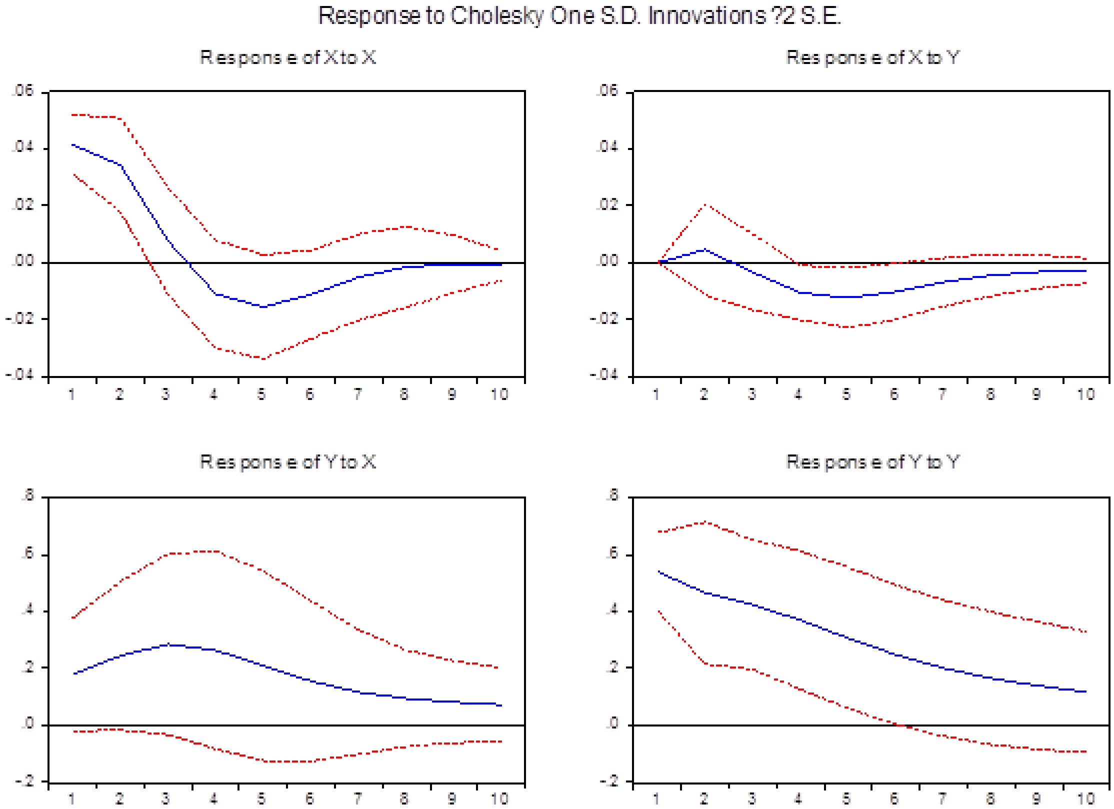

Figure 7 impulse response function analysis results

2.7 Variance decomposition

Variance decomposition can decompose the variance of a variable in the var system onto each disturbance term, providing a relative degree to which each disturbance factor affects each variable in the var model. Therefore, the variance decomposition in var is the contribution to analyse the structural impact affecting endogenous variables. Based on the above the Eviews software's operation, we further decompose the variance, and the variance decomposition result is shown in Figure 8. From the variance result of x, it can be seen that the x effect is 100% in the first phase of the lag, and the second phase is delayed. x is affected by its own effect is 99.26%, when the third phase is delayed, x is affected by its own effect is 98.88, and when it is delayed by 4, x is affected by its own effect is 95.5%. Although the impact of the x self-perturbation term decreases slowly as the number of lag periods increases, x is still largely affected by itself. As the number of lag periods increases, the impact of y on x increases slowly, but the ratio reaches 4%, so x is less affected by y. That is, inflation is not affected by the RMB exchange rate, and it is mainly affected by itself. From the variance results of y, it can be seen that the contribution rate of the impact of the x equation on the y change reaches 9.94% in the first period, 15.3% in the second period, 20% in the third period, and 22% in the fourth period. As the number of lag periods increases, y is increasingly affected by x. The RMB exchange rate can have a certain impact on inflation.

Variance Decomposition of X:

Period	S.E.	X	Y
1	0.041472	100.0000	0.000000
2	0.053967	99.26619	0.733814
3	0.054623	98.88902	1.110980
4	0.056725	95.50596	4.494042

Variance Decomposition of Y:

Period	S.E.	X	Y
1	0.568998	9.945640	90.05436
2	0.774219	15.32886	84.67114
3	0.927465	20.08312	79.91688
4	1.032583	22.73675	77.26325

Cholesky Ordering: X Y

Figure 8 variance decomposition results

III. CONCLUSION

This paper analyzes the 1985-2017 RMB exchange rate and inflation annual data, uses time series correlation theory as a support, establishes the var model, and finds that the RMB exchange rate has a positive impact on inflation through the Granger causality test. The RMB exchange rate is the one-way Granger cause of inflation, and inflation is not the Granger cause of the RMB exchange rate. Through the analysis of impulse response function, the RMB exchange rate has a positive impact on inflation. Through the variance decomposition, it is concluded that inflation is not affected by the RMB exchange rate, and it is mainly affected by itself. As the number of lag periods increases, the RMB exchange rate is increasingly affected by inflation. The RMB exchange rate can have a certain impact on inflation. China needs to properly control the appreciation of the RMB exchange rate in order to fundamentally control inflation.

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