

The dollar index, the correlation between the dollar circulation and the dollar interest rate

———— Based on TVP-VAR, an empirical analysis of the modelr

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Abstract. Dollar index, dollar interest rate, and dollar circulation are the three important indicators to study the change of the dollar exchange rate, and they have a close relationship among the three. The dollar interest rate is positively correlated with the dollar index. In general, the US interest rate falls and the dollar index weakens; the US interest rate rises and the dollar index prefers trends. While the dollar circulation shows a negative correlation with the DOLLAR index. If the dollar circulation increases and the dollar depreciates, the DOLLAR index will be relatively reduced, which also means that a large amount of capital overflow to foreign countries. This paper will use the TVP-VAR model to explore the correlation between the DOLLAR index, dollar interest rate and dollar circulation from the perspective of empirical analysis, and analyze it based on the impulse response diagram, and finally make a summary of the empirical results, hoping to draw some scientific and valuable conclusions.

Keywords: Dollar index; Dollar interest rate; Dollar circulation ;TVP-VAR model.

1. Introduction

The US dollar index is obtained from the average exchange rate of the US dollar and six major international foreign exchange rates, and is a comprehensive indicator of the exchange rate changes of the US dollar in the international foreign exchange market. The dollar interest rate refers to the interest rate that the customer deposits in the bank account under the agreed terms, where the interest amount and the loan amount is the principal. Dollar issuance refers to the amount of money issued by the Federal Reserve. The dollar index, the dollar circulation and the dollar interest rate these three important indicators have a close relationship. The dollar interest rate is positively correlated with the dollar index. In general, the dollar index is weak; the US interest rates rise, and the dollar index prefers trends. While the dollar circulation shows a negative correlation with the DOLLAR index. If the dollar circulation increases and the dollar depreciates, the DOLLAR index will be relatively reduced, which also means that a large amount of capital overflow to foreign countries. This paper will explore it from the perspective of empirical analysis. First, TVP-VAR is briefly introduced, and then the indicators and data required in the research process are explained and processed. Finally, an empirical model is constructed and analyzed based on the pulse response map, and finally a summary of the empirical results is made.

2. A brief overview of the TVP-VAR model

VAR model promotion use from the famous econometric economist Christopher Sims literature published in 1980, using multiple equations form, through the generalized pulse corresponding function and variance decomposition method of the dynamic interaction between multiple variables, however VAR model defect is cannot describe the relationship between variables, then evolved SVAR model, SVAR model very well solve the disadvantages of VAR. The TVP-VAR model evolved from the SVAR model, allowing the coefficients and variance-covariance to change over time, so as to capture the nonlinear structural changes among the variables, and thus find the dynamic relationship among the economic variables over time.

3. Data selection and processing

3.1 Data acquisition

This paper selects the US dollar index, the US dollar interest rate and the monthly US dollar issuance data from January 2020 to December 2022 to build the TPP-VAR model. Data were all obtained from the wind database.

3.2 Data smoothness and co-integration test .

This paper uses the ADF unit root method to test the stability of the three time series of the dollar index, the dollar interest rate and the dollar circulation. The conclusion is the dollar index, the dollar interest rate and the dollar circulation army are the 0 order single unstable, and the stable sequence after the first order difference. Table 1 shows the results of the ADF unit root test, completed with the help of Eviews8.0.

Table 1 ADF root of unit test results table

variable	t-Statistic	Prob.*	smoothness
dollar issuance	-2.383868	0.3810	not smooth
dollar interest rate	-1.225662	0.8894	not smooth
dollar index	-1.607621	0.7695	not smooth

variable	t-Statistic	Prob.*	smoothness
dollar issuance	-6.084866	0.0001	smooth
dollar interest rate	-4.496497	0.0055	smooth
dollar index	-4.358165	0.0077	smooth

Dollar circulation:

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.383868	0.3810
Test critical values:		
1% level	-4.243644	
5% level	-3.544284	
10% level	-3.204699	

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.084866	0.0001
Test critical values:		
1% level	-4.252879	
5% level	-3.548490	
10% level	-3.207094	

Dollar interest rate:

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.225662	0.8894
Test critical values:		
1% level	-4.243644	
5% level	-3.544284	
10% level	-3.204699	

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.496497	0.0055
Test critical values:		
1% level	-4.252879	
5% level	-3.548490	
10% level	-3.207094	

The dollar index:

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.607621	0.7695
Test critical values:		
1% level	-4.243644	
5% level	-3.544284	
10% level	-3.204699	

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.358165	0.0077
Test critical values:		
1% level	-4.252879	
5% level	-3.548490	
10% level	-3.207094	

Whether a set of data has a stable equilibrium relationship requires a co-integration test to test whether the causal relationship described by their regression equation is pseudoregression, i. e., whether there is a long-term stable relationship between variables. The premise of co-integration test is that the sequence is the same order single integer. The above has proved that all the sequences in this paper are the first order single integer, which meets the requirements of co-integration test. Using the Johansen co-integration test, all the sequences were tested to determine whether they had a co-integration relationship. From Table 5.2, there is a long-term and stable equilibrium relationship among the three selected indicators at the 5% significance level, so empirical analysis can be performed.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.562975	43.67470	29.79707	0.0007
At most 1 *	0.361499	15.53067	15.49471	0.0494
At most 2	0.008120	0.277200	3.841466	0.5985

4. Parameter estimation

Before the empirical demonstration, we need to determine the lag order. The choice of the lag order is crucial. The too large order is not easy to estimate, while the accuracy of the too small model estimation will be reduced. We refer to the AIC criterion, the Akchike information criterion, the SC criterion, and the Schwartz criterion, and choose order 1 as the optimal lag order. Therefore, the TVP-VAR model with lag 1.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-449.3691	NA	1.62e+08	27.41631	27.55235	27.46208
1	-344.7744	183.8331*	495167.9*	21.62269*	22.16687*	21.80579*
2	-337.4316	11.57044	556330.4	21.72313	22.67545	22.04356
3	-331.4335	8.361006	694095.4	21.90506	23.26552	22.36281

Table 2

ESTIMATION RESULT						
Parameter	Mean	Stdev	95%L	95%U	Geweke	Inef.
sb1	0.5700	0.0257	0.5220	0.6234	0.803	0.92
sb2	0.0228	0.0025	0.0184	0.0282	0.771	14.99
sa1	0.1400	0.1978	0.0415	0.7327	0.010	148.00
sa2	4.6879	21.3999	0.0459	52.5261	0.245	181.23
sh1	0.6261	0.2760	0.2563	1.3679	0.002	192.54
sh2	0.5745	0.1802	0.2772	0.9686	0.431	104.47

The estimation results of the TVP-VAR model are listed in Table 2. As can be seen from the table, the Geweke probability value cannot reject the original hypothesis of parameter convergence of the posterior distribution (the critical value is 1.69), indicating that the simulation sampling is effective for the TVP-VAR model. MCMC simulated 10000 times, according to the conventional practice, the first 1000 simulation results were discarded as the "to burn" (burn-in) stage.

Graph 1

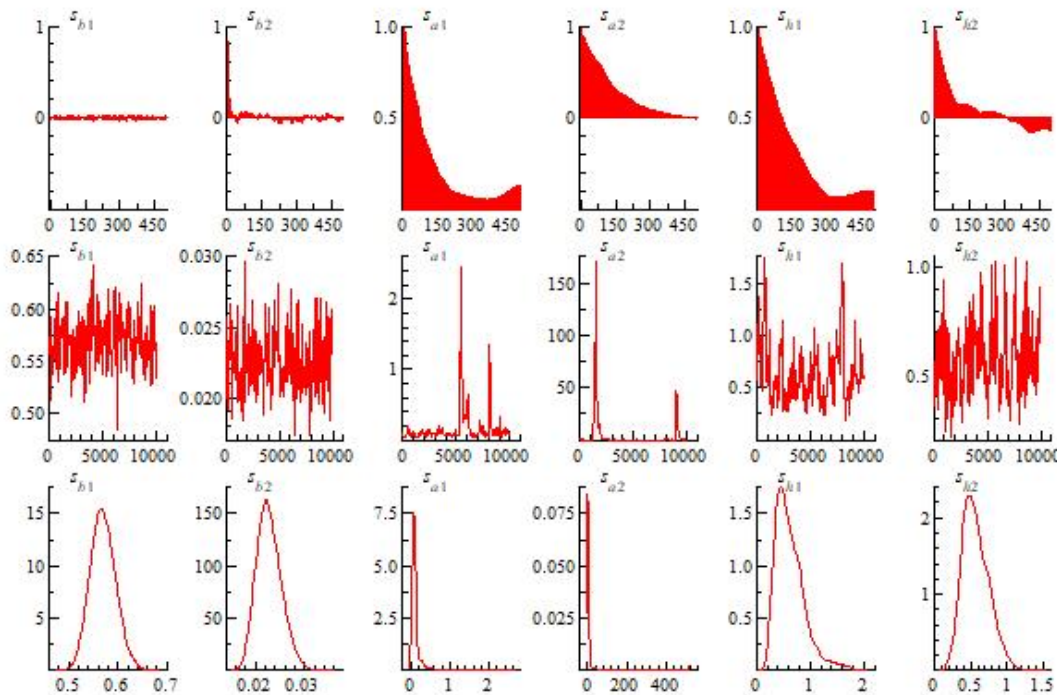


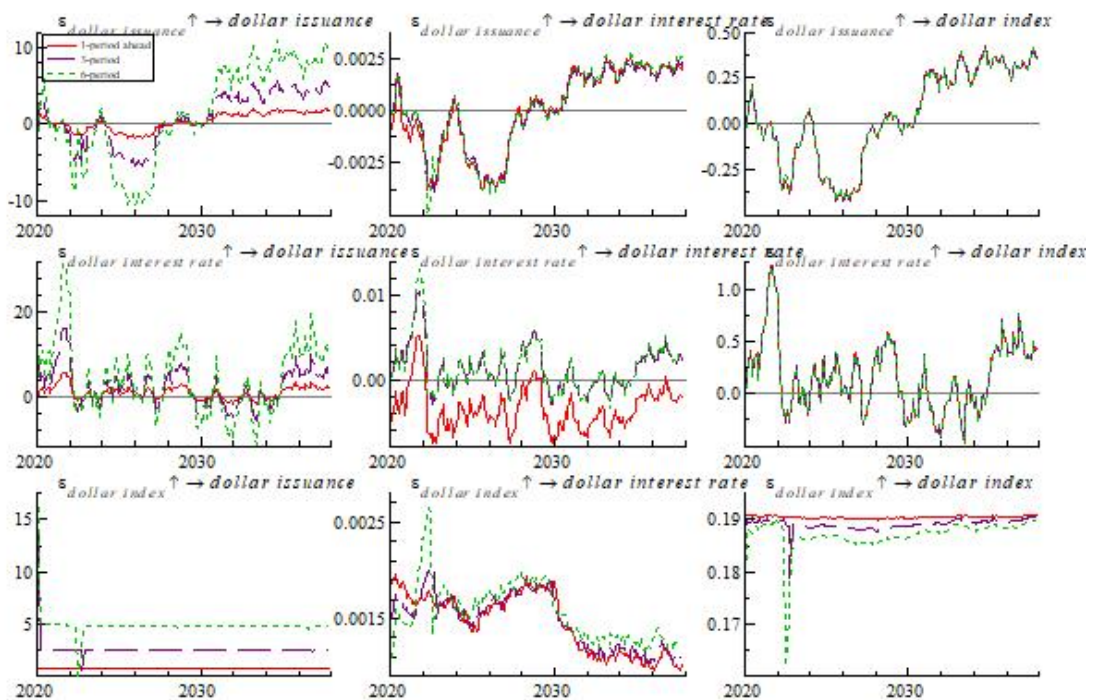
Figure 1 gives six autoregressive coefficient and parameters simulation path, the first row shows the sample autoregression coefficient, the second behavior sample path, the third behavior posterior density, can see from the regression in fluctuation after several periods, 10000 effective sample sample path is also uniform, the path shows significant fluctuation clustering phenomenon, shows that MCMC sampling method is effective

5. Corresponding analysis of the time-varying pulses

Sample parameter estimates for the TVP-VAR model are time-varying, and model estimates are obtained once in each issue. TVP-VAR can produce two kinds of pulse response function: one is the interval pulse response function, can analyze time variation, the other is the point pulse response function, used to analyze the selection of the special point model variables on mechanism impact, through the two kinds of pulse response can analyze the mechanism of interaction between the variables in the model. In order to analyze the relationship between dollar index, dollar circulation

and dollar interest rate, this paper selects 1,3 and 6 months as equal interval pulse response to observe the time change.

Graph 2



5.1 The pulse response function to the US dollar interest rate of the US dollar index

Graph 3

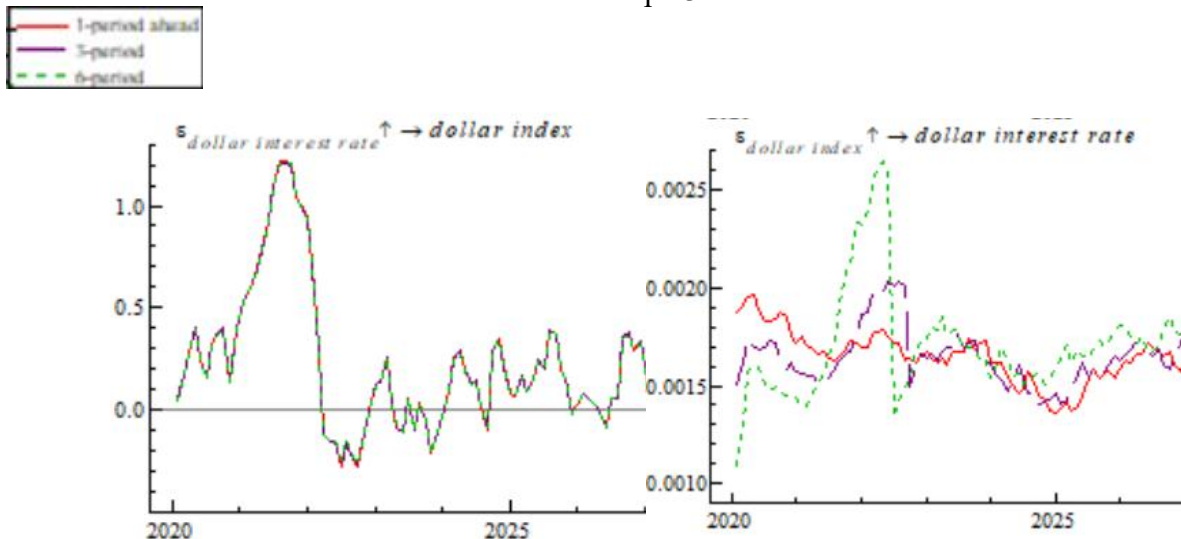


Figure 3 Medium interval pulse response chart shows that from January 2020 to February 2022, the DOLLAR interest rate will have a positive impact on the DOLLAR index and a surge around June 2021. However, after February 2022, the impact on the DOLLAR index becomes negative, and this negative effect will decrease with the passage of time. In addition, the impact of the dollar interest rate on the dollar index in the short, medium and long term performance is very similar, the curve almost overlap. Generally speaking, the impact of the US dollar interest rate on the US dollar index is positive. The dollar index on the dollar interest rates also exist, from the figure of the dollar index on the dollar interest rate impact is always positive and impact surge around January 2022, the impact of the dollar index on the dollar interest rates in the short and medium, long-term

performance is not synchronized, and long-term impact volatility is bigger, medium moderate, the short-term smaller. Therefore, we can judge that the impact of the US dollar interest rate on the US dollar index is similar in the short, medium and long term. The impact of the dollar index on the dollar interest rate is more obvious in the long term.

5.2 The pulse response function of the dollar index

Graph 4

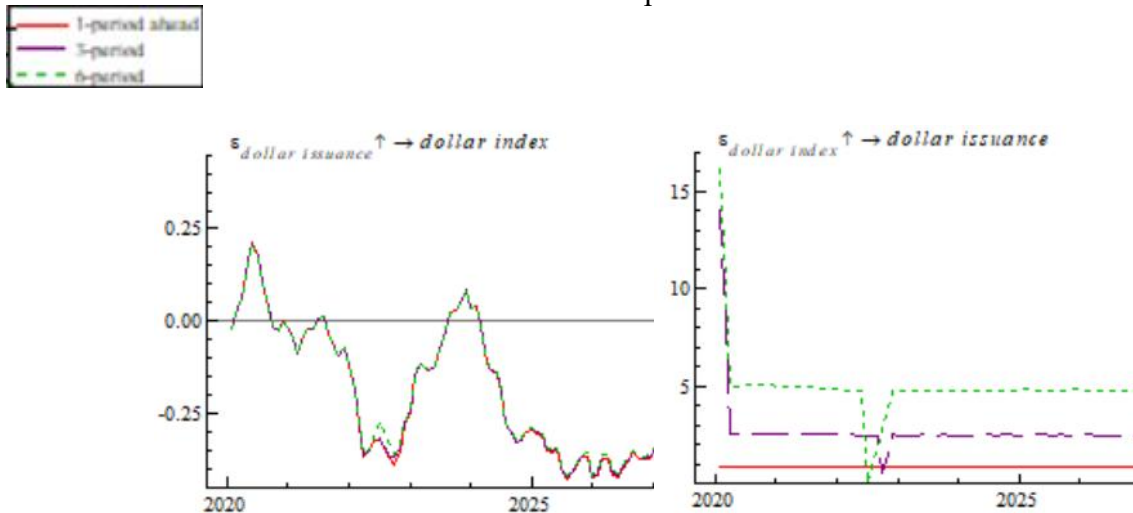


Figure 4 medium interval pulse response diagram shows that in January 2020 to November 2020 dollar circulation positive impact on the dollar index and around June 2022 impact surge, and in December 2020 the dollar interest rates for the dollar index impact into negative and in March 2022 impact surge. In addition, the impact of the dollar interest rate on the dollar index in the short, medium and long term performance is very similar, the curve almost overlap. Overall, the impact of dollar issuance on the dollar index is negative. Dollar index on the dollar circulation also exist, from the figure know the dollar index impact on dollar issuance is always positive and in June 2022 impact mutation, the impact of the dollar index in the short-term, medium and long-term performance is not synchronized, and long-term impact volatility, medium moderate, short-term almost no short-term fluctuations. So we can judge that the impact of dollar issuance on the dollar index is similar in the short, medium and long term. The impact of the dollar index on the dollar circulation is more obvious in the long term, with almost no impact in the short term.

5.3 The pulse response function of the dollar interest rate and the US dollar circulation

Graph 5

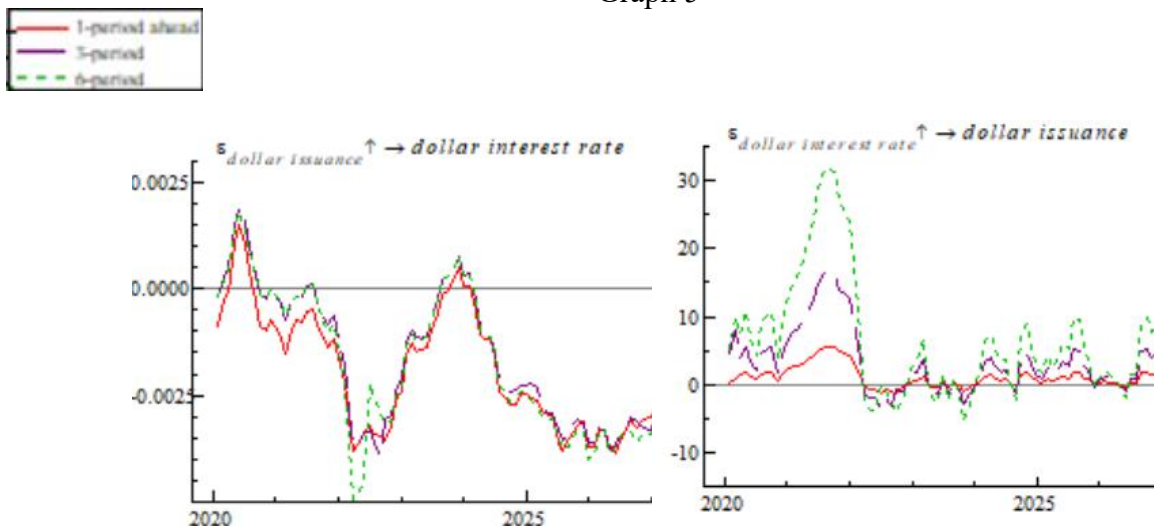


Figure 5 medium interval pulse response diagram shows that in March 2020 to September 2020 dollar issuance on the dollar interest rate impact from negative positive and in June 2022 around impact surge, and after September 2020 dollar issuance for the dollar interest rate impact into negative and impact surge in February 2022. In addition, the impact of the dollar interest rate on the dollar index is similar in the short, medium and long term, and the long-term impact volatility is large, and the medium-term and short-term fluctuations are similar. In general, the impact of dollar issuance on US dollar interest rates is negative. Dollar interest rates on the dollar circulation also exist, from the figure know the impact of the dollar interest rates on dollar issuance before 2022 is positive and in August 2021 impact mutation, the impact on the dollar interest rate in January 2022 become negative, and gradually tend to 0, in general, the influence of the dollar interest rates on dollar circulation is positive. The impact of US dollar interest rate on US dollar issuance is not synchronized in the short term and medium term, and the long-term impact fluctuates greatly, always in the medium term and small in the short term, so we can judge the impact of US dollar issuance on US dollar interest rate and the impact of US dollar interest rate on US dollar issuance are more obvious in the long term.

Conclusion

In this paper, the TVP-VAR model is adopted. From the perspective of empirical analysis, the time-varying vector autoVAR model is used to explore the correlation between the dollar index, dollar interest rate and dollar circulation, and analyze the correlation between the three based on the pulse response map. The research results show that the US dollar interest rate is positively correlated with the DOLLAR index. In general, when the US interest rate falls, the dollar index moves weak, while the US interest rate rises and the dollar index prefers trends. The impact of the DOLLAR index on the dollar interest rate is not synchronized in the short, medium and long term, and the long-term impact fluctuation is large, moderate medium term and small short term, indicating that the impact of the dollar interest rate on the DOLLAR index is similar in the short, medium and long term. The impact of the US dollar index on the US dollar interest rate is more obvious in the long term. The dollar circulation shows a negative correlation with the DOLLAR index. If the dollar circulation increases and the dollar depreciates, the DOLLAR index will decrease relatively, which also means that a large amount of capital overflow to foreign countries. The impact of the dollar index on the short term and medium term circulation is not synchronized, and the long-term impact is volatile, moderate in the medium term and almost no volatility in the short term. This suggests that the impact of dollar issuance on the dollar index is similar in the short, medium to long term. The impact of the dollar index on dollar issuance is obvious in the long term, with little impact in the short term. In addition, there is also a correlation between the dollar interest rate and the dollar issuance. Overall, the impact of the dollar interest rate on the dollar issuance is positive. The impact of dollar interest rate on dollar issuance is not synchronized in the short term and medium term, and the long-term impact is large, in the medium term, and the short term is small, which shows that the impact of dollar issuance on the dollar interest rate and the impact of dollar interest rate on dollar issuance are more obvious in the long term. These conclusions provide useful reference for the future research on the relationship between the dollar index, dollar interest rate and dollar circulation, and I hope they can be implemented in practice.

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