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The Research on the Monetary Integration of China and ASEAN: From the Perspective of Economic Shock Symmetry

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Abstract

ASEAN is an important part of the"21st-Century Maritime Silk Road". To explore the extent of Chinese and ASEAN monetary integration, and whether economic conditions of the RMB regionalidation in Southeast Asia are ripe, this paper constructs a five variables SVAR model system, using sample data from 1999 to 2016 to calculate the correlation of five impacts between countries in "10+1" organization(Chinese and ASEAN). The results show that five kinds of shocks correlation is not remarkable, which indicates that the degree of monetary integration in ASEAN is not enough to establish a comprehensive single optimal currency area, but it is possible to respectively form a sub-currency zone. The realization of the regionalization of the RMB in Southeast Asia will be a gradual process.

Keywords

Monetary integration; RMB regionalization; Chinese and ASEAN; SVAR.

1. INTRUDUCTION

Along with the initiative of the Silk Road Economic Belt and the 21st-Century Maritime Silk Road ("the Belt and Road ") expanding its influence, the countries along the routes will gradually increase the RMB share in trade, investment and financing, financial transactions and foreign exchange reserves, which provides sufficient impetus for the RMB to become the main international currency .Based on the theory of optimal currency area, this paper analyzes the degree of monetary integration in Southeast Asia, and discusses whether the "10+1" organization (China& ASEAN) is suitable for forming a currency area, whether the economic prerequisite for RMB becoming the key currency in the region exists, and whether the region is suitable for the promotion and usage of RMB.

2. LITERATURE REVIEW

Chen (2015) pointed out that when promoting the internationalization of RMB in the implementation of "the Belt and Road Initiative", we should seek effective breakthroughs in four aspects: commodity pricing, settlement, infrastructure financing, industrial park construction and cross-border e-commerce [1]. Ren (2016) considered the internationalization of RMB as the core of "the Belt and Road", and discussed the opportunities, obstacles of RMB internationalization [2-3]. Zong (2017) explored the inner relationship between "the Belt and Road" and RMB internationalization and strategic synergy effect [4].

On the other hand, most empirical studies of monetary integration in specific regions adopt VAR model. Ding and Li (2006) used the three-variable SVAR model to test the monetary integration of East Asia, Eurozone and The South Cone countries in America, and found that East Asia has sufficient conditions to further promote institutionalized regional economic

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cooperation and policy coordination on the existing basis [5]. Cui et al. (2007) found that East Asia did not satisfy the conditions of establishing currency area through three-variable SVAR model. But Japan and Thailand, as well as South Korea, Malaysia and Taiwan, have the possibility of establishing "sub-currency area" respectively. Ma and Zhao (2009) used four-variable SVAR model to test the feasibility of establishing an optimal currency area in East Asia. The study shows that East Asia does not satisfy the conditions of establishing a comprehensive single optimal currency area, but two groups of countries/areas - "China, Hong Kong, Philippines, Thailand" and "China, Malaysia, Philippines" could take the lead in establishing sub-currency areas respectively [7]. Zhang et al. (2015) used the five-variable SVAR model to test the four economies in Greater China region. He believed that the economic premise of forming a currency area in Greater China region already existed [8]. Zhang et al. (2015) analyzed the monetary integration development of China, Russia and Central Asia based on the simplified DMP model, and judged the feasibility of RMB becoming the anchor currency of the region [9]. Based on the theory of optimal currency area, Wang et al. (2016) analyzed the openness, similarity of economic structure, internal trade, mobility of labor and capital, and similarity of economic cycle in Southeast Asian countries, in order to draw the obstacles and prospects of monetary and financial cooperation in Southeast Asia [10]. Li and Yuan (2017) used the five-variable VAR model and selected the sample data from 1995 to 2015 to calculate the correlation of five kinds of shocks among different countries on the ancient Silk Road. They found that the countries along the Silk Road had a high degree of monetary integration and met the economic conditions of RMB regionalization [11].

3. THEORY

Optimal Currency Area (OCA) theory is the core theory to study regional monetary integration. It was first put forward by Mundell and McKinnon in the 1960s, and has been being developed and improved by many economists so that it became increasingly mature. The optimum currency area refers to a country or region that meets certain economic and financial conditions and establishes a closely related monetary system, such as a fixed exchange rate system, or even uses a unified currency. The criteria for establishing a currency area mainly includes following indicators: factor liquidity, economic openness, product diversification, international financial integration and inflation rate similarity.

The theoretical basis of this paper comes from a new research direction of the theory of optimal currency area - indirect standard, which benefits from the theoretical progress of econometric analysis. This method does not focus on the establishment of "real" economic characteristics indicators of the member countries/regions of the optimal currency area, but mainly examines macroeconomic indicators that can reflect and summarize potential economic phenomena, such as symmetry of economic shocks, exchange rate volatility and so on. Symmetrical shock means economic shocks have roughly same or similar impact on different economies, which is reflected in fluctuations, government policies and economic structure; and asymmetrical shocks refer to shocks that have different impacts on different economies. Mondale (1961) believed that countries with symmetrical economic shocks were more suitable for joining a common currency area, because countries with such characteristics could adjust or eliminate the imbalances of their economies simultaneously through the implementation of unified policies in the region after joining the currency area, without some countries restoring equilibrium while some countries out of equilibrium and imbalance increasing [12]. Bayoumi and Eichengreen also believe that the lower the correlation of shocks among a group of countries is, the higher the cost of abandoning monetary and exchange rate policy instruments will be; and the stronger the correlation of shocks is, the higher the anti-shocks ability and stability of monetary areas will be, so the cost of implementing a single currency area will be lower [13]. Following the basic idea of the theory of optimal monetary area, when the economic

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interference is mild, there is little need to regulate and control the economy by policy means, and the economy is in the optimal path of steady-state growth.

4. ECONOMETRIC MODEL

Referring to the multi-variable SVAR econometric model constructed by Ma (2009) and Zhang (2014), this paper uses a five-variable SVAR model to study regional monetary integration. The impact on a country's economy is divided into two external shocks and three domestic economic shocks, the former including global shocks and regional shocks, and the latter including domestic demand shocks, domestic supply shocks and currency shocks.

For the estimation of SVAR model, we first consider an infinite order vector moving average VMA (∞) model:

$$Y_t = A_0\varepsilon_1 + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \cdots = \sum_{i=0}^{\infty} A_i\varepsilon_{t-i} \tag{1}$$

Its matrix form can be written as follows:

$$Y_t = A(L)\varepsilon_t \tag{2}$$

Among them, $Y_t = [\Delta y_t^{ws}, \Delta y_t^{rs}, \Delta y_t^{s}, \Delta e_t, \Delta p_t]'$, y_t^{ws} represents the global total output, y_t^{rs} represents the total regional output of "10 + 1" area, Δy_t^{s} represents the total supply of a country, e_t represents the real exchange rate and p_t represents the domestic price level of a country. These variables are in the form of first-order difference. A is a 5×5 matrix that defines the impulse response curve of each variable to structural shocks. ε_t is a structural shocks faced by an economy, which consists of global supply shocks (ε_t^{ws}), regional supply shocks (ε_t^{rs}), domestic supply shocks (ε_t^{s}), domestic demand shocks (ε_t^{d}), and currency shocks (ε_t^{m}). That is, $\varepsilon_t = [\varepsilon_t^{ws}, \varepsilon_t^{rs}, \varepsilon_t^{s}, \varepsilon_t^{d}, \varepsilon_t^{m}]'$. Assuming that they are not serial correlated and are orthogonal, so that the variance-covariance matrices are unit matrices. The system equation is as follows:

$$\Delta y_t^{ws} = A_{11}(L)\varepsilon_t^{ws} \tag{3}$$

$$\Delta y_t^{rs} = A_{21}(L)\varepsilon_t^{ws} + A_{22}(L)\varepsilon_t^{rs} \tag{4}$$

$$\Delta y_t^{s} = A_{31}(L)\varepsilon_t^{ws} + A_{32}(L)\varepsilon_t^{rs} + A_{33}(L)\varepsilon_t^{s} + A_{34}(L)\varepsilon_t^{d} + A_{35}(L)\varepsilon_t^{m} \tag{5}$$

$$\Delta e_t = A_{41}(L)\varepsilon_t^{ws} + A_{42}(L)\varepsilon_t^{rs} + A_{43}(L)\varepsilon_t^{s} + A_{44}(L)\varepsilon_t^{d} + A_{45}(L)\varepsilon_t^{m} \tag{6}$$

$$\Delta p_t = A_{51}(L)\varepsilon_t^{ws} + A_{52}(L)\varepsilon_t^{rs} + A_{53}(L)\varepsilon_t^{s} + A_{54}(L)\varepsilon_t^{d} + A_{55}(L)\varepsilon_t^{m} \tag{7}$$

Formulas (3) and (4) show that global and regional gross output are external variables and are not affected by internal shocks. For internal shocks, there are following assumptions:

Firstly, currency shocks do not have a long-term impact on exchange rates.

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$$\text{i.e. } \sum_{i=0}^{\infty} A_{45i} = 0 \tag{8}$$

Secondly, monetary shocks and demand shocks do not affect GDP in the long run, while domestic supply shocks can affect GDP in the long run.

$$\text{i.e. } \sum_{i=0}^{\infty} A_{34i} = 0, \sum_{i=0}^{\infty} A_{35i} = 0, \sum_{i=0}^{\infty} A_{33i} \neq 0 \tag{9}$$

Thus we can rewrite the system model as follows:

$$\begin{bmatrix} \Delta y_t^{ws} \\ \Delta y_t^{rs} \\ \Delta y_t^{s} \\ \Delta e_t \\ \Delta p_t \end{bmatrix} = \begin{bmatrix} A_{11}(L) & 0 & 0 & 0 & 0 \\ A_{21}(L) & A_{22}(L) & 0 & 0 & 0 \\ A_{31}(L) & A_{32}(L) & A_{33}(L) & 0 & 0 \\ A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) & 0 \\ A_{51}(L) & A_{52}(L) & A_{53}(L) & A_{54}(L) & A_{55}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_t^{ws} \\ \varepsilon_t^{rs} \\ \varepsilon_t^{s} \\ \varepsilon_t^{d} \\ \varepsilon_t^{m} \end{bmatrix} \tag{10}$$

Here, observable variables can be used to estimate the simplified form of the VAR model. The modified VAR model is used to estimate the moving average model. In the modified VAR model, the exogenous variables follow the autoregressive (AR) process, and the three endogenous variables are functions of the lag factors of the exogenous variables and themselves.

$$\Delta y_t^{ws} = \alpha + \sum_{j=1}^{n} \beta_j \Delta y_{t-j}^{ws} + u_t^1 \tag{11}$$

$$\Delta y_t^{rs} = \alpha + \sum_{j=1}^{n} \beta_j \Delta y_{t-j}^{rs} + \sum_{j=1}^{n} \gamma_j \Delta y_{t-j}^{ws} + u_t^2 \tag{12}$$

$$Y_t = \alpha + \sum_{j=1}^{n} \beta_j Y_{t-j} + \sum_{j=1}^{n} \gamma_j \Delta y_{t-j}^{ws} + \sum_{j=1}^{n} \theta_j \Delta y_{t-j}^{rs} + u_t \tag{13}$$

Among them, $Y_t = [\Delta y_t^s, \Delta e_t, \Delta p_t]'$. β_j, γ_j and θ_j are the matrix coefficients. u_t^1, u_t^2 and $u_t = \left[u_t^3, u_t^4, u_t^4\right]'$ are the residual matrix, which is the combination function of ε_t, reflecting the structural impact.

Formula (13) is converted to VMA to obtain the simplified formula of domestic variables and the relationship between these variables and the corresponding structural impact.

$$Y_t = \rho + \sum_{j=1}^{n} \lambda_j u_{t-j} \tag{14}$$

$$\rho = (1 - \sum^{n} \beta_j)^{-1} (\alpha + \sum^{n} \gamma_j \Delta y_{t-j}^{ws})(\alpha + \sum^{n} \theta_j \Delta y_{t-j}^{rs}) \tag{15}$$

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In this paper, we define λ_j as a reflection function that can get from the following mathematical expressions:

$$\sum_{i=1}^{\infty} \lambda^i L^i = (I - \sum_{j=1}^{n} \beta_j)^{-1} \tag{16}$$

The classification of structural impact can be obtained by OLS estimation of equation (13). This is a system of 25 equations, in which $\lambda_0 = I$, $\lambda_0 u_t = A_0 \varepsilon_t$, then $u_t = A_0 \varepsilon_t$. Consistent with many literatures, this paper also assumes that the structural shocks ε_t sustained by economies are continuous irrelevant and orthogonal, then $\Omega = E(u_t u_t^{'}) = A_0 A_0^{'}$. Along with the 10 long-term constraints mentioned above, it tells us that $A(L)$ is the only Cholesky lower triangle. Therefore, we can use $\varepsilon_t = A_0^{-1} u_t$ to fully identify structural matrix and time series structural shocks ε_t, i.e., structural shocks can be simplified as linear combination of error terms. We solve all kinds of shocks in order to get the magnitude of correlation of the same kind of shocks in different countries and its absolute level. This paper evaluates the correlation of the shocks in countries in "10+1" area and compares it with the data of the major eurozone countries to assess whether Southeast Asia is an optimal currency area at the present stage and to provide decision-making basis for the regionalization of RMB in the region.

5. EMPIRICAL ANALYSIS

5.1. Variables Definition and Data Sources

In this paper, real world GDP is used to represent global total supply (y_t^{ws}). Real regional GDP is used to represent regional total supply (y_t^{rs}). Real GDP of a country is used to represent its total supply (y_t^{s}). Real exchange rate represents e_t, and domestic price level of a country p_t is replaced by inflation rate. These variables are expressed in the form of first-order difference (). World and regional gross output, total output of each country, exchange rate and inflation data are from the World Bank database.

5.2. Empirical Scheme and Process

Firstly, the time series of each variable should be tested for stationarity. The ADF test results show that the original hypothesis cannot be rejected. After first-order difference, the original hypothesis can be rejected at 5% significance level. The original sequence is first-order monolithic and is recorded as $I(1)$. The stationary sequence after difference satisfies the condition of building structural VAR model. Then, we set the optimal lag order of the structural VAR model and test the stability of the model. According to the criterion of minimizing AIC and SC, the lag order of SVAR models in all the countries studied is set to 2.

A simple method for investigating the impact symmetry of candidate countries in the optimal currency area is to calculate the impact correlation. When estimating the symmetry and asymmetry of structural shocks, it is usually assumed that if there is a positive correlation, the shocks are symmetric, indicating that the impact of such economic shocks on two economies is similar; on the contrary, if there is a negative correlation or statistical insignificance, the shocks are considered asymmetric. Therefore, the correlation coefficients between global supply shock, regional supply shock, domestic supply shock, domestic demand shock and currency shock will be calculated to judge the symmetry of economic shocks between Southeast Asian countries.

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The absolute value of structural endogenous shocks suffered by countries in the region is also an important basis for analyzing whether countries in a region are suitable to form a currency area. The magnitude of impact is calculated from the coefficient of impulse response function, which reflects the impact of a unit of shock on economic variables. This paper mainly considers the size of three Endogenous Structural shocks. Supply shocks have a long-term effect on total economic output. The absolute value of the effect that one unit shocks on the change rate of real total economic output in 10 years is taken as the approximate value of the impact magnitude. Demand shocks and currency shocks have only temporary effects on total economic output. Their magnitude is respectively expressed by the average of the absolute impact of a unit shock on the real exchange rate and the price level change rate within two years, and then the calculated variables are compared with those of the core EU countries (France and Germany).

5.3. Analysis of Empirical Results

5.3.1 Global Supply Shocks Correlation and Regional Supply Shocks Correlation

Only half of the global supply correlation coefficients are significant positive, and even some countries have negative correlation coefficients. Among them, Thailand has negative correlation coefficients with many countries; Singapore has the most significant positive correlation coefficients with other countries; China has significant positive correlation with Malaysia, Laos, Vietnam and Cambodia only. Similarly, only about half of the correlation coefficients of regional supply shocks are significantly positive, which shows that the degree of monetary integration in the region is not enough. Because higher external shocks correlation means more benefits from establishing monetary union for countries.

5.3.2 State Supply Shocks Correlation

As for result, supply shocks are symmetrical among some countries, and the correlation coefficient between supply shocks in China and half of ASEAN countries is significantly positive. Two potential sub-currency areas can be considered: Indonesia, Singapore, Brunei and the Philippines. The correlation of supply shocks among these countries is significant; supply shocks are also symmetrical among China, Malaysia, Laos, Vietnam and Cambodia. Supply shocks between some countries are asymmetric, which is caused by the differences in economic exchanges and internal economic structure.

5.3.3 Demand shocks correlation and currency shocks correlation

There are many negative and insignificant values in the correlation coefficient tables. Only a small group of countries show symmetrical demand shocks: Malaysia, Laos, Vietnam and Cambodia. China and ASEAN countries do not show significant symmetry of demand shocks, because China has become the main import source of ASEAN countries. There are significant currency shocks correlations of Thailand with many ASEAN countries. This is similar to what happened before the establishment of the EU: the demand shocks correlation and currency shocks correlation among EU countries also lack a coherent pattern, and they are only significant in sub-group countries. The impact of demand shocks and currency shocks on the economy is temporary and closely related to macroeconomic policies. This result reflects that countries can coordinate their macroeconomic policies in a small scale.

5.3.4 Size of Economic Shocks

The larger the scale of economic shock is, the greater the endogenous variables i.e. macroeconomic fluctuation will be. It increase demand for independent monetary policies that can eliminate these fluctuations, which hinders the implementation of the unified monetary policy. On the contrary, if the scale of economic shocks is relatively small, even asymmetric economic shocks will not have a significant impact on the economy. Therefore, countries that suffer large economic shocks are not suitable to join in the optimal currency area. The size of

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three kinds of endogenous shocks in different countries is compared with that in the core countries of the European Union (France and Germany)1.

Table 1. Size of economic shocks in different countries

Country	Supply shock	Demand shock	Currency shock
1999-2016			
China	0.0026	0.0165	0.0043
Malaysia	0.0276	0.0073	0.0065
Indonesia	0.0161	0.0268	0.0081
Thailand	0.0084	0.0123	0.0123
The Philippines	0.0108	0.0119	0.0023
Singapore	0.0309	0.0124	0.0089
Brunei	0.0188	0.0123	0.0132
Vietnam	0.0330	0.0145	0.0127
Laos	0.0173	0.1013	0.0065
Myanmar	0.0381	0.5077	0.0420
Cambodia	0.0104	0.0039	0.0047
Average	0.0195	0.0661	0.0110
1980-1998			
France	0.0613	0.0192	0.0043
Germany	0.0585	0.0144	0.0036

From the results showed in the above table, we can find that compared with the two core countries of the euro zone, from the perspective of the size of economic disturbances, some economies have already had the basis for establishing currency areas or adopting fixed exchange rate regimes among themselves. The supply shocks in “10+1” countries are smaller than those of France and Germany, but the average value of demand shocks and currency shocks is larger than that of France and Germany. Individually, some economies have suffered large shocks, such as Myanmar, Thailand and Vietnam. Therefore, these economies are not suitable for joining the common currency area. While China, Malaysia, Indonesia, the Philippines, Singapore and Cambodia all have smaller or near-average economic shocks, so these countries have the feasibility of joining the same currency area.

6. CONCLUSION

By investigating the impact correlation and the size of endogenous structural shocks of countries in the "10+1" region (China and ASEAN), this paper argues that the degree of monetary integration in the region is not high enough, and the conditions for establishing a unified monetary area and implementing a unified monetary policy are not yet available, but the possibility of establishing a sub-monetary area exists. The regionalization of RMB in Southeast Asia will be a gradual process, which requires not only the economic conditions to be

1 The data of impact size in France and Germany are quoted from: Y. Li, “The Study on the Monetary Integration of ‘21st century Maritime Silk Belt’”, Journal of Xi'an Jiaotong University (Social Sciences), 2017,(3), p44-49.

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met, but also the maturity of non-economic factors such as social, cultural, political and historical factors.

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