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Quantitative analysis of the impact of foreign bank greenfield investment on stability of China's banking system

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Abstract. By analyzing the data of the stability of banking system, the entry level of foreign bank Greenfield investment and control variables during 2004-2014, the paper makes empirical analysis using Johansen Co integration test, VEC Model and impulse response function and reveals the long-term and short-term effects of foreign Greenfield investment on the stability of the banking system of our country, the results show that: (1) Foreign Greenfield investment is the Granger cause of China's banking system stability. (2) There is a long-term and stable equilibrium relationship between them; long-term effects have a regulatory role on short-term fluctuations. The positive influence of foreign Greenfield investment on China's banking system stability is greater than the negative influence, and the hysteresis effect and cumulative effect exist. (3)The macroeconomic growth has a positive effect on the stability of the banking system and the entry level of foreign bank Greenfield investment; bank concentration has a negative effect on the stability of the banking system and the entry level of foreign bank Greenfield investment. The negative impact of bank concentration on banking system stability is greater than the positive impact.

Key words. foreign bank, Greenfield investment, Banking system, Stability.

1. Introduction

With rapid development of global economy, globalization and liberalization tendency of financial development is increasingly obvious. Confronted with world trend of international operation of financial industry, our country will open financial industry to the outside world step by step and in order, which is not only the promise made when our country joined the WTO, but also the important power for our country to accelerate and deepen reform of financial system, and the most impor-

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tant constituent part of financial openness progress of our country is opening of banking system to the outside world. In recent years, limiting conditions on admission of foreign capital have decreased gradually, and development of foreign capital in banking system of our country is characterized by expansion of institution number, widening of business scope, widening of territorial scope, multielement of service object and diversity of form change. Its penetration degree is deepened increasingly, and foreign capital develops cooperation and competition with domestic commercial bank, which promotes adjustment of internal pattern of banking system of our country. Especially in recent years, openness of Chinese financial industry to the outside world has been deepened continuously, RMB is entitled to special drawing rights and settlement of RMB in cross-border trade is developed rapidly, which promotes continuous improvement of openness of capital item, and it will be more free and convenient and fast for foreign capital to access to China. Therefore, continuous extension of scale of foreign capital in China will be necessary tendency for future development, and effect of foreign capital on banking system stability of our country after its entry cannot be underestimated.

The fact shows that effect of entry of foreign capital on banking system stability of our country is a double-edged sword with positive effect and negative effect. Under present situation, is the effect of greenfield investment of foreign banks on banking system stability of our country dominated by the positive one or negative one? How to promote openness of banking system to the outside world reasonably and orderly under that premise that national financial safety and bank stability are guaranteed? All above problems become quite important and severe in future development of banking system of our country.

Many relevant literatures have analyzed effect of entry of foreign capital in greenfield investment way on banking system stability of host country, and empirical research is mainly implemented through 2 ways: one way is to analyze their relationship by choosing several panel data of host country where foreign banks are introduced and by establishing panel model; the other is to make static analysis after establishing linear regression model by choosing time series data of greenfield entry degree and measured value of banking system stability, but regulating effect of model established on short-term fluctuation in aspect of long-term stability and long-term effect is not discussed, and dynamic effect of entry impact of foreign capital on banking system stability in several future periods is discussed rarely. This paper will measure long-term and short-term expression further of relationship between greenfield investment of foreign capital and banking system stability through Johansen co-integration and VEC model, thus guaranteeing that multivariable system researched will possess long-term stability to avoid appearance of "spurious regression" phenomenon, and measures regulating effect of foreign capital entry on short-term fluctuation in aspect of long-term effect of banking system stability through vector error correction model, and measures dynamic effect of entry impact of foreign capital on banking system stability simultaneously through impulse response function.

2. Measurement model and variable setting

2.1. Measurement model setting

This paper will measure the long-term and short-term interactive relationship between variables through vector error correction model (VEC) and the model can provide relatively rigorous and scientific explanation for dynamic relationship between variables.

When effect of entry of foreign capital on banking system stability is investigated from perspective of greenfield investment, if macro economy trend is relatively good, banking system stability will also be improved because level of banking system stability of a country is not only concerned with greenfield investment degree of foreign capital but also concerned with economic growth level. Therefore, when existing research analyzes effect of greenfield investment of foreign capital on banking system stability through time series data, explaining variable basically contains: greenfield entry degree of foreign capital and actual GDP. In addition to above explaining variables, this model also considers introducing bank concentration ratio variable representing banking industry market structure. Whether relationship between bank concentration ratio and financial stability is positive or negative is a problem widely discussed in theoretical cycle. Under the condition of greenfield investment of foreign capital, whether "dispersive" or "centralized" banking system contributes to improvement of banking system stability of our country more will be verified by this paper through construction of VEC model.

2.2. Variable selection

Therefore, model variable is set as: variable explained is banking system stability (stab), explaining variable is greenfield entry degree of foreign capital, and control variable includes: actual GDP growth rate (gdpz) and bank concentration ratio (conce). The reason why this paper chooses 3 explaining variables for VEC model lies in limitation by sample period of time series data, and therefore, in addition to entry degree of foreign capital, 2 control variables are chosen: actual GDP growth rate and bank concentration ratio. Economically speaking, 2 core control variables with the most obvious effect are introduced to co-integration equation and error correction model, and the purpose of introducing actual GDP growth rate in exogenous control variable is to measure effect of macro economy growth on banking system stability, and the purpose of introducing bank concentration ratio is to measure effect of banking industry market structure on banking system stability in greenfield investment of foreign capital.

1) Actual GDP growth rate. To realize comparability of data, this paper converts all GDP values according to GDP index on the basis of price in 2000, and ratio of balance between GDP in former and latter year and GDP of former year shall be considered as GDP growth rate. The variable index is used to reflect increase level of national macro economy.

2) Bank concentration ratio. Bank concentration ratio index reflects banking

system competition condition and banking industry market structure. Traditional CRn (industry concentration ratio) index is used for calculation of the index, and specific value of total assets of five banks ranking top five with the biggest asset scale (Industrial and Commercial Bank of China, The Agricultural Bank of China, Bank of China, China Construction Bank and Bank of Communications) in banking system and total assets of banking financial institutions shall be used for measurement.

3) Banking system stability. For index calculation of banking system stability, this paper chooses 8 relevant indexes from 4 aspects of banking system, i.e. profitability, mobility, market risk and credit risk, and this paper chooses 8 indexes to measure banking system stability of our country, i.e. return on assets, return on capital, non-performing loan ratio, provision coverage of main commercial banks, medium and long term loan/credit volume, foreign net asset growth rate of banking system, loan-to-deposit ratio and credit amount of Central Bank to commercial bank/domestic credit amount etc., establishes measurement index system for banking system stability, and measures banking system stability of our country through principal component analysis, and gains corresponding index values.

4) Greenfield entry degree of foreign capital. Foreign capital entering in the way of greenfield investment includes 4 types specifically, i.e. representative office, branch, wholly foreign-owned bank and joint Chinese-foreign bank, and therefore, greenfield entry degree of foreign capital actually represents penetration degree of foreign banks to banking system of our country, generally expressed in share. Some literatures have adopted different calculation methods and calibers to measure entry degree of foreign capital in greenfield investment way. They can be divided into 2 types roughly: firstly, measurement from institution asset proportion, and it shall be calculated through proportion of total asset of foreign banks in host country in total asset of banking system of host country; secondly, measurement from institution number proportion, and it shall be calculated through proportion of number of foreign banks in host country in total number of banking system institution of host country. Because bank concentration ratio of our country is relatively high and few banks hold comparatively great market share, this paper considers that entry degree of foreign capital in greenfield way can be measured more correctly through measurement way of institution asset proportion, and ratio between total asset of foreign banks of our country and total assets of banking financial institutions shall be chosen as proxy variable for entry of foreign capital in greenfield way into banking system of our country. According to computational formula chosen finally, see Table 1 (calculated to three decimal places) for computational result data of entry degree of foreign capital in greenfield way in this paper.

Table 1 reflects change condition of entry degree of foreign capital in greenfield investment way with time. Because admission limitation on foreign capital is released gradually after access to WTO, greenfield entry degree of foreign capital was 1.504% in 2003, and has increased gradually since 2003, and especially between 2005 to 2006, rise amplitude is relatively obvious, and compared with entry degree in 2003, it increased by 26.93% and 40.36% respectively. In 2007, peak value of the stage appeared: 2.358%, and greenfield entry degree of foreign capital decreased relatively obviously in 2008 and 2009, and the reason lied in financial crisis of 2008 that

caused decrease of stability of the entire financial system, and attraction to entry of foreign capital was also weakened, and foreign banks that have entered would also choose to reduce investment proportion or withdraw gradually because of fear of risk. From 2010, because effect of financial crisis has been weakened gradually, greenfield entry degree of foreign capital rose again, but from 2012, it decreased to a certain degree, and the decrease tendency has been maintained until 2014, which shows the condition that partial foreign banks have started to withdraw from China gradually from 2012. The reason may be as follows: on the one hand, the purpose for entry of many foreign banks into China is to gain short-term yield initially, they will withdraw from China naturally once the purpose is realized with excessive profit; on the other hand, their expectation on economy of China in the future is not bright and clear, and decrease tendency exists in partial banks, and because capital item is not opened completely, existing banking institutions have occupied all present shares of Chinese market, and entry cost of new foreign capital has improved, so compared with greenfield entry degree of foreign capital in former years, the degree in 2012-2014 decreased to some extent.

Table 1. Entry degree of greenfield investment of foreign capital

Year	Entry degree of foreign capital (%)	Year	Entry degree of foreign capital (%)
2003	1.504	2009	1.697
2004	1.843	2010	1.828
2005	1.909	2011	1.901
2006	2.111	2012	1.782
2007	2.358	2013	1.693
2008	2.129	2014	1.633

Data sources: calculation on the basis of Chinese Financial Yearbook of each year.

2.3. Data sources and variable processing

Original data in this paper is sourced from Chinese Statistical Yearbook, Chinese Financial Yearbook, Chinese Trade and Foreign Economic Statistical Yearbook, Statement of International Income and Expenditure, Annual Report of State Administration of Foreign Exchange, website of People's Bank of China, website of China Banking Regulatory Commission, annual reports of various commercial banks and WIND database.

2004-2014 are chosen as sample period of this paper, and the reason is that admission on foreign banks has been opened gradually after China joined the WTO in the end of 2001. Until in 2004, total asset of foreign banks in China and its proportion in banking financial institutions of our country were improved greatly, and in addition, officially published data for partial control variables were provided from 2004, and therefore sample period starts from 2004 and ends at 2014.

Because dimension of original data is different, standard processing shall be made to guarantee data conformance and comparability. In addition, this paper makes logarithmic transformation to all variables of which all numerical values are positive in sample period, and the purpose is: firstly, logarithmic transformation decreases

absolute observed value of variable, lowers difference between variables, and lowers appearance probability of heteroscedasticity; secondly, logarithmic transformation can convert regression residual error to relative error from absolute error and therefore lowers residual error difference. Because logarithmic transformation can only be made to positive number, processing step is to take the logarithm firstly and standardize later. Variable symbols after logarithmic transformation and standardization shall be named successively as: lnfdie, lngdpz, and lnconce, and because banking system stability degree may be negative number, and logarithmic transformation is impossible, so standardized symbols shall be still named as: stab.

Based on above reasons, logarithmic transformation shall be made to all variables proposed to be incorporated in this model firstly and all variables shall be standardized later except for banking system stability degree. Because it is impossible to make logarithmic transformation to partial variables, model constructed in this paper is semilogarithm model. Slope coefficient β represents that once independent variable increases by 1%, variable explained, i.e. banking system stability will increase by β unit averagely.

3. Model construction and analysis

3.1. Pearson correlation test

Judge relationship among variables preliminarily before model construction through Pearson correlation coefficient, calculate correlation coefficient through SPSS and result is as shown in Table 2:

Table 2. Correlation coefficient test of sequence

Variable sequence group	Correlation coefficient	Accompanying probability
(1)stab, fdie	0.796	0.003
(2)stab, gdpz	0.861	0.000
(3)stab, conce	-0.762	0.001

Seen from table of correlation coefficient, correlation coefficients among 3 groups of variable respectively are: 0.796, 0.861 and -0.762, of which the absolute values are greater than 0.75, and the accompanying probabilities of 0.003, 0.000 and 0.001, are lower than significance level 0.01. Because null hypothesis of Pearson test is unconcerned, it is considered that null hypothesis can be refused under 99% confidence level. It is judged that variable sequence group (1) and (2) belong to positive strong correlation while variable sequence group (3) belongs to negative strong correlation according to correlation coefficient symbol and size, which shows that relatively obvious positive correlation exists between banking system stability of our country and greenfield investment degree of foreign capital and macro economy growth rate while relatively obvious negative correlation exists between banking system stability and bank concentration ratio. Test result here is just preliminary judgment to relationship among variables, and the purpose is to provide reference for further model

construction research, and precise relationship among variables can only be determined through further research by constructing co-integration equation and vector error correction model in following content.

3.2. ADF unit root test

Because effective co-integration model can only be constructed when all variable sequence is smooth and steady or same-order integrated, unit root test shall be made to each variable sequence firstly, and it is found that original sequence is not smooth and steady, and therefore first-order difference is made to original sequence and ADF unit root test shall be made later, test result is as shown in Table 3 (except for accompanying probability, three decimal places behind decimal point shall be calculated for ADF test value and critical value):

Table 3. Unit root test of sequence

Variable	Test form	ADF test value	Critical value	Accompanying probability
Δstab	(n,n,1)	-2.195	-1.988(5%)	0.0341
Δlnfdie	(n,n,1)	-3.282	-2.886(1%)	0.0050
Δlngdpz	(c,t,1)	-7.414	-5.835(1%)	0.0028
Δlnconce	(c,t,2)	-4.476	-4.450(5%)	0.0486

Result in Table 3 is sourced from ADF test for smoothness test, test form (c, t, k) adopted respectively represents intercept term, trend term and lag order in test equation, and Δ represents that first-order difference transformation has been made to variable sequence. In the test form column, n at corresponding locations in bracket respectively represents that intercept term or trend term is not contained, and the purpose of adding lag term is to make residual error of test equation be white noise. In critical value column, 1% or 5% in the bracket behind data respectively represents the condition when 0.01 or 0.05 is respectively taken as significance level. Selection of lag phase k is determined according to the principle that values of AIC and SIC shall be the minimum, and test form is chosen according to variation tendency of variable sequence after first-order difference.

Seen from Table 3, after first-order difference is made to original sequence, its ADF test value is lower than critical value when significance level is 0.01 or 0.05 (-2.195<-1.988, -3.282<-2.886, -7.414<-5.835, -4.476<-4.450) and accompanying probability, 0.0341, 0.0050, 0.0028 and 0.0486, is lower than significance level 0.05, and therefore it is considered that null hypothesis can be refused under 95% confidence level, which means that above sequence will be smooth and steady sequence after first-order difference, unit root does not exist, and sequence is I (1) (first-order integrated) sequence, conforming to same-order integrated precondition for co-integration model construction, so co-integration test can be made. The purpose of smoothness test and co-integration test is to guarantee long-term steady relationship among variables, to guarantee effectiveness of model and avoid appearance of "spurious regression".

3.3. Granger causality test

Because endogenous variable and exogenous variable must be determined before construction of co-integration equation, Granger test shall be made to verify if causality exists among variables before co-integration test to avoid spurious regression and provide reference for determination of endogenous variable and exogenous variable simultaneously. Granger test requires that each variable sequence shall conform to smooth and steady or co-integration condition, and only in this way can test result be effective, of which co-integration condition has been verified later. On the basis of proper lag phase determination through AIC and SC information principle, test result gained is as shown in Table 4:

Table 4. Granger causality test of sequence

Null hypothesis	Accompanying probability p
(1) lnfdie is not the Granger cause of stab	0.0308
(2) stab is not the Granger cause of lnfdie	0.0424
(3) lngdpz is not the Granger cause of stab	0.0216
(4) stab is not the Granger cause of lngdpz	0.4229
(5) lnconce is not the Granger cause of stab	0.0284

Seen from Granger test result in Table 4, accompanying probability p of null hypothesis (1), (2), (3) and (5) respectively is 0.0308, 0.0424 and 0.0216, lower than significance level 0.05, so it is considered that null hypothesis can be refused under 95% confidence level, which means that lnfdie, lngdpz and lnconce are the Granger cause of stab, and in turn, stab is the Granger cause of lnfdie too; but accompanying probability p of null hypothesis (4) and (6) respectively is 0.4229 and 0.3808, greater than 0.05 (also greater than 0.1) and it is considered that null hypothesis is received, which means that stab is not the Granger cause of lngdpz and lnconce in turn.

Result shows that interactional Granger causality exists between greenfield investment of foreign capital and banking system stability degree (greenfield entry proportion of foreign banks will affect banking system stability, and in turn, banking system stability degree of our country will also affect greenfield entry degree of foreign banks), and macro economy growth rate and bank concentration ratio are the Granger cause of banking system stability, but effect in turn is not effective, and therefore relationship between the 2 pairs of variable is unidirectional. Therefore it is considered that in multivariable system constructed in this paper, greenfield entry degree of foreign capital lnfdie and banking system stability stab are endogenous variables while macro economy growth rate lngdpz and bank concentration ratio lnconce are exogenous variable, which also conforms to economic significance analysis to each variable in system.

3.4. Johansen co-integration test

Abovementioned unit root test has proved that all sequences proposed to be included to variable system of this Paper are I (1) sequences, which conform to precondition of co-integration test. Therefore, Vector Error Correct Model VECM can be established by taking lnfdie and stab as endogenous variable and lngdpz and lnconce as exogenous variable and lag phase can be selected according to AIC and SC minimum principle and it is found out that it conforms to minimum principle when lag phase is selected as 1 after comparison. After co-integration test to VECM model, the third kind of test form is selected: there is no determinacy trend in sequence and intercept equation in co-integration equation is estimated and steps are to judge whether co-integration vector exists and the number of vectors and to write long-term co-integration model.

1) Judge whether co-integration vector exists and the number of vectors

During judgment, verification is carried out by adopting characteristic root trace test and eigenvalue of maximum test to ensure robustness of judgment result and results are shown in the following Table 5 and Table 6 (r is co-integration sequence):

Table 5. Characteristic root trace test of co-integration sequence

Null hypothesis	Alternative hypothesis	Characteristic root	Statistical magnitude of trace	5% critical value	Accompanying probability
(1)r=0	(1)$r \geq 1$	0.913	23.349	15.495	0.0027
(2)$r \leq 1$	(2)$r \geq 2$	0.137	1.325	3.841	0.2497

Table 6. Eigenvalue of maximum test of co-integration sequence

Null hypothesis	Alternative hypothesis	Characteristic root	Statistical magnitude of trace	5% critical value	Accompanying probability
(1)r=0	(1)$r \geq 1$	0.913	22.025	14.265	0.0025
(2)$r \leq 1$	(2)$r \geq 2$	0.137	1.325	3.841	0.2497

It is observed from characteristic root trace test result that statistical magnitude of trace of null hypothesis (1): $r = 0$ is larger than 5% critical value of significant level (23.349>15.495) and accompanying probability is 0.0027, which is less than significant level 0.05 and therefore, null hypothesis (1) is rejected and alternative hypothesis (1) is accepted, namely, $r \geq 1$; however, statistical magnitude of trace of null hypothesis (2): $r \leq 1$ is less than 5% critical value of significant level (1.325<3.841) and accompanying probability is 0.2497, which is larger than significant level 0.05 and therefore, null hypothesis (2) is accepted, namely, $r \leq 1$ and it is thought that the number of co-integration vectors is $r = 1$ and there is a co-integration relation in sequence only by integrating above two results ($r \leq 1$ and $r \geq 1$).

It is observed from characteristic root trace test result that statistical magnitude λ-max of null hypothesis (1): $r = 0$ is larger than 5% critical value of significant level (22.025>14.265) and accompanying probability is 0.0025, which is less than significant level 0.05 and therefore, null hypothesis (1) is rejected and alternative hypothesis (1) is accepted, $r \geq 1$; however, statistical magnitude λ-max of null hypothesis (2): $r \leq 1$ is less than 5% critical value of significant level (1.325<3.841) accompanying probability is 0.2497, which is larger than significant level 0.05 and therefore, null hypothesis (2) is accepted, namely, $r \leq 1$ and it is thought that the number of co-integration vectors is $r = 1$ and there is a co-integration relation in sequence only by integrating above two results ($r \leq 1$ and $r \geq 1$).

It is observed that two kinds of different test methods are adopted to co-integration relation test and obtained results are consistent and therefore, it is thought that the conclusion "there is a co-integration relation in sequence only" is firm.

2) Long-term co-integration equation

After judging the number of co-integration relation, co-integration vectors can be obtained by adopting Eviews (remaining three decimal places).

Table 7. Estimation result of co-integration vector

Vector name	Stab (banking system stability)	Lnfdie (greenfield entry degree of foreign capital)	C (constant term)
Co-integration vector	1.000	-0.302 [-3.37]	-0.198

Note: numbers in brackets in table represent t statistics.

It can be observed from Table 7 that co-integration vector after normalization is (1, -0.302) and t statistical magnitude of slope coefficient of co-integration equation is -3.371, which is significant after t test (absolute value of t statistical magnitude is larger than 2).

Abovementioned co-integration relation can be written into mathematical expression and given that ecm_t, so mathematical expression is shown as formula (1):

$$ecm_t = stab_t - 0.302 \ln fdie_t - 0.198 \tag{1}$$

Unit root test can be carried out to residual error ecm_t as effective supplementary of co-integration test.

Table 8. Unit root test of co-integration residual item

Variable	Test form	ADF test value	Critical value	Accompanying probability
ecm_t (co-integration residual item)	(n,n,1)	-2.149	-1.982(5%)	0.0365

It can be observed from Table 7 that ADF test value of unit root test of residual error in co-integration ecm_t is less than critical value (-2.149<-1.982) under 0.05 significant level and accompanying probability is 0.0365, which is less than 0.05 and

therefore, it is thought that null hypothesis can be rejected under 95% confidence level and there is no unit root; namely, residual item of co-integration model is stable and effective existence of abovementioned co-integration relation is further tested and long-term stable and balanced relation between two endogenous variables of greenfield entry degree of foreign capital and banking system stability and it is illustrated that abovementioned Granger causality test is effective simultaneously.

Formula (1) is sorted and transformed into: $stab_t = 0.302 \ln fdie_t + 0.198 + ecm_t$, which is long-term co-integration equation. It can be observed from co-integration model that entry method of foreign capital greenfield is positive effect on promotion of banking system stability of our country analyzed from long-term angle and expressed as: if greenfield entry degree of foreign capital increases per 1%, stability degree of banking system of our country increases by 0.302 unit (percentage) on average in the long term, which has 0.302% of promotion function on banking system stability of our country. Positive slope coefficient represents that total effect is positive and influence on banking system stability of our country has positive effect (such as catfish effects, demonstration and spillover effects) and negative effect (such as impact effects, the loss of quality customers, input risk and so on) because of foreign capital greenfield investment and therefore, total effect is superposed result of positive and negative effect and total effect here is positive, which demonstrates that positive effect is larger than negative effect in general and total effect is still positive after mutual offset and therefore, foreign capital greenfield investment will be favorable to promote banking system stability of our country in long term.

3.5. Construct Vector Error Correction (VEC) Model and impulse response function

Establish Vector Error Correction (VEC) Model based on long-term co-integration equation to reflect short-term dynamic relation between variables. The third kind of test form is selected: there is no certainty trend in sequence and intercept equation of co-integration equation is estimated and VEC models, such as formula (2) and (3) can be obtained after eliminating insignificant explanation variable:

$$\begin{aligned} \Delta stab_t &= \underset{[-2.34]}{-0.417} ecm_{t-1} + \underset{[2.32]}{0.413} \Delta stab_{t-1} + \underset{[2.12]}{0.227} \Delta \ln fdie_{t-1}\,, \\ &+ \underset{[2.29]}{1.538} \ln gdpz_t - \underset{[-2.01]}{0.285} \ln conce_t + v_{1t} \\ R^2 &= 0.78; AIC = -2.74; SC = -2.25\,, \end{aligned} \tag{2}$$

$$\begin{aligned} \Delta \ln fdie_t &= \underset{[-2.86]}{-0.361} ecm_{t-1} + \underset{[3.35]}{0.343} \Delta stab_{t-1} + \underset{[2.17]}{0.033} \Delta \ln fdie_{t-1}\,, \\ &+ \underset{[2.09]}{1.827} \ln gdpz_t - \underset{[-2.11]}{0.132} \ln conce_t + v_{2t} \\ R^2 &= 0.75; AIC = -2.43; SC = -2.36\,. \end{aligned} \tag{3}$$

It can be observed that two error correction models can be estimated in general

and goodness of fit of model is higher and they are both significant when t test of coefficient in existing variable when significant level is 0.05 and whole estimation effect is favorable.

Impulse response function can reflect dynamic influence of model on system when model suffers from certain kind of compact. Therefore, see Fig. 1 and Fig. 2 for impulse response function figure made to VEC Model:

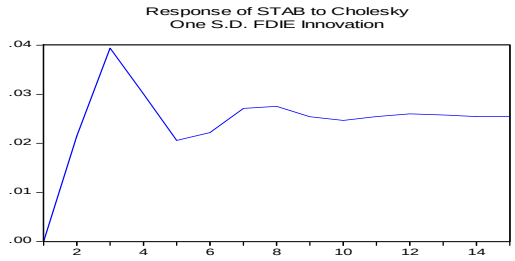

Fig. 1. Response function for impact of foreign capital entry on banking system stability

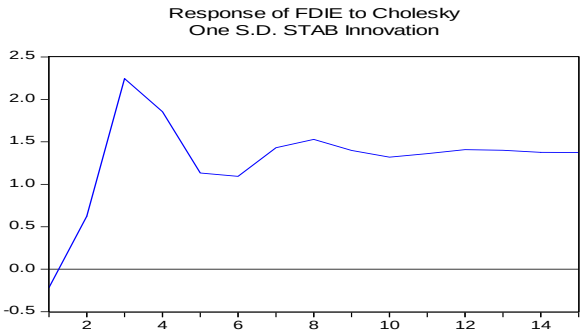

Fig. 2. Response function for change impact of banking system stability on foreign capital entry degree

Seen from Fig.1, response of banking system stability rises from 0 in the 1st phase and reaches peak (0.039) in the 3rd phase and then decreases gradually and tends to be stable regardless of slight fluctuation in the fifth phase and the trend lasts to the around 15th phase after the first positive impact of foreign capital. It can be observed that impulse responses brought by foreign capital entry impact to banking system stability are all positive and impulse response functions all fluctuate on upward horizontal axis.

Seen from Fig.1, response of foreign capital entry degree decreases significantly in the 1st phase and increases rapidly after decreasing to negative value (-0.22) and reaches peak (2.25) in the 3rd phase and then decreases gradually and tends to be stable regardless of slight fluctuation in the fifth phase and the trend lasts to the around 15th phase after the first positive impact of foreign capital. It can be observed that impulse responses brought by impact of banking stability change to foreign capital entry degree are all positive except for the 1st phase and impulse response

functions mostly fluctuate on upward horizontal axis. It can also be observed that trends of impulse response functions in the two figures are basically the same.

4. Model analysis

It can be analyzed and obtained from VEC model:

Firstly, influence of foreign capital greenfield investment and banking system stability is mutual, which is consistent with conclusion obtained from VEC model of Granger causality test and VEC model that reflects short term change. Seen from specific coefficient, in formula (2), short-term effect of foreign capital entry degree on banking system stability of our country is 0.227; namely, foreign capital greenfield investment increases per 1%, banking system stability will promote 0.227 unit in next period; in formula (3), short-term effect of banking system stability on foreign capital entry degree is 0.343; namely, banking system stability of our country promotes per unit, proportion of foreign capital investment greenfield will increase 0.343% in proportion of next phase. At the same time, it can be seen that its influence on banking system stability has lag to certain degree because it has certain construction period when foreign capital is invested in greenfield method.

Secondly, balanced adjustment coefficient in formula (2) (also referred to as error correction coefficient) is -0.417 and balanced adjustment coefficient in formula (3) is -0.361, which illustrates that adjustment speed (or strength that pulls system to balanced state) that adjusts it to balanced state is respectively -0.417 and -0.361 when system deviates from long-term balanced state within short period for two models. Adjustment coefficients estimated here are all negative values and conform to reverse correction mechanism, which illustrates that long-term effect has adjustment function on short-term fluctuation in influence effect.

Thirdly, direction of slope coefficient of foreign capital entry degree in short-term change model is the same with direction of slope coefficient in long-term co-integration equations, which are all positive effects and illustrate that positive effect of foreign capital greenfield investment on banking system stability is larger than its negative effect and it is positive effect in general seen from short term.

Besides, long-term effect (slope coefficient 0.302 in co-integration model) is larger than (>) short-term effect (slope coefficient 0.127 in VEC model), which also illustrates that influence has accumulative effect and conforms to practical economic realism. Because foreign capital greenfield entry has accumulative effect, the longer the time when a country introduces foreign bank in greenfield method, the greater the cumulative effect on the stability of the country's banking system and the more obvious the improvement and promotion effect on the banking system stability.

Fourthly, it can be seen from analysis on influence of exogenesis control variable:

Firstly, in formula (2) and (3), influence of macro economic growth rate gdpz on explained variable of two models: banking system stability stab is all positive influence, which also conforms to practical economic reality. If macro economic increase is favorable, the whole finance system including banking system will be stable, willing of foreign bank to invest greenfield in China will be strong and foreign-capital entry proportion will promote.

Secondly, in formula (2), general influence of bank concentration ratio conce on explained variable, banking system stability is negative.

Because influence of bank concentration ratio conce on banking system stability includes positive and negative influences, positive effect shows that if bank concentration ratio is too low, too many numbers of bank organizations will lead to excessive internal competition of banking system and risk undertaken by banks can be increased to reduce banking system stability by shortening "franchise value" of bank; negative effect shows that if bank concentration ratio is too high, large-scale bank will bear excessive risks under condition of long-term invisible subsidy of government and supervision and regulation difficulty of large-scale is larger than small-scale banks simultaneously, which will reduce banking system stability.

Under condition where positive and negative effects coexists, it is thought by demonstration results of this Paper that negative effect of bank concentration ratio on banking system stability is larger than positive effect in general and therefore, after superposition and mutual offset of positive and negative effects, final general effect is negative effect. Namely, during foreign capital greenfield investment, if bank concentration ratio of our country is too high, banking system stability will be more fragile.

Thirdly, in formula (3), general influence of bank concentration ratio conce on explained variable: foreign capital entry degree fdie is negative, which illustrates that too high bank concentration ratio will lead to larger obstacle for entry of foreign bank and it is more difficult to obtain market share and benefit and therefore, willing of foreign capital greenfield investment will be reduced and greenfield entry degree of foreign bank will be reduced.

Fifthly, current period value of two endogenous variables: banking system stability stab and foreign capital entry degree fdie will be influenced by previous period value and slope coefficients influenced by previous period are respectively 0.413 and 0.343 in formula (2) and (3), which are all positive obviously. It shows that: if stability of banking system in previous period is relatively high, it means that operation condition of banking system in all aspects is in favorable circulation and banking system stability in next period will continue favorable trace and maintain in relatively high level; however, if foreign capital greenfield entry proportion is relatively large, it illustrates that environment factors, such as policy, system and macro economy of our country are favorable and foreign capital greenfield investment is different from strategic investment and therefore, once banks are established, it has continuity and existing market share will not be abandoned to withdraw easily and foreign capital entered banking system of our country has certain leading and driving function to newly-entered foreign capital and therefore, foreign capital greenfield investment proportion in next period will improve further.

5. Conclusion and policy suggestion

5.1. Conclusion

This Paper has analyzed influence of foreign capital greenfield investment on banking system stability of our country by demonstration by adopting Johansenco-integration and VEC model and it is shown by the results that: (1) foreign capital greenfield investment is the Granger cause of banking system stability. (2) They both have long-term stable balanced relationship and long-term effect has regulation function to short-term fluctuation. Whether from a long or short term, positive effects of influence of foreign capital greenfield investment on banking system stability of our country are all larger than negative effects and influence has "hysteresis effect" and "accumulative effect". (3) If increase of macro economy is favorable, it will promote improvement of banking system stability and foreign capital entry proportion; if concentration ratio of bank is too high, it will make banking system stability more fragile and reduce foreign capital greenfield entry degree. If banking system stability in previous period is relatively high, it will continue favorable track and continue to maintain in relatively high stability level in next period; however, if foreign capital entry proportion in previous period is relatively large, foreign capital greenfield investment proportion in next period will rise further.

5.2. Policy suggestion

Based on conclusion in this Paper, this Paper puts forward policy suggestion from two levels to promote stable improvement of banking system stability of our country and healthy development of banking system. Based on regulation and supervision level, it is required that: firstly, foreign capital admittance limit shall be loosened and positive function of it on banking system stability of our country shall be fully exploited; secondly, balanced distribution of foreign capital in areas and countries shall be guided and adjusted reasonably; thirdly, foreign capital shall be introduced orderly to ensure Chinese capital control right of banking system of our country. Fourthly, dynamic monitoring shall be executed to foreign capital entry risk and bank risk pre-warning and response mechanism shall be established. Based on Chinese-capital commercial bank level, it is required that: firstly, assimilation and re-innovation shall be carried out to foreign capital and financing innovation capability of Chinese capital bank; Secondly, advanced management experience and mechanism brought by foreign capital shall be learned and internal treatment structure of Chinese capital bank shall be improved actively; thirdly, talents cultivation and utilization mechanism of foreign capital shall be referred to and scientific human resource management system shall be established; fourthly, cooperation with foreign capital shall be strengthened and "mutual win-win" situation shall be created.

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