An Empirical Research on the Relationship Between Non-Interest Income Business and Operation Performance of Commercial Banks

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Abstract   Based on the quarter data from 2002 to 2009 of China Merchants Bank, this paper does the empirical analysis between the ratio of non-interest income in the business income and return on equity (ROE). The test result shows that there exists cointegration relationship between them. Developing non-interest income business can enhance remarkably the operation performance of commercial banks. ECM shows that both short-term fluctuation of non-interest income and the equilibrium error of operation performance have striking effect on the short-term fluctuation of operation performance of commercial banks.
Key Words   Ratio of non-interest income business; ROE; Cointegration test; ECM

1   Introduction

During the past 20 years, with the rapid development of commercial banks and more and more fierce competition in the financial market, commercial banks have changing their structure of income. The ratio of non-interest income business in the business income of commercial banks is increasing continuously. For some large banks in Europe and the United States, above ratio has larger than 50%. For Chinese commercial banks, the non-interest income business has also developed rapidly in recent years, but the traditional interest income business is still in the leading position.

Foreign researchers began the research on the non-interest income business from 1980s. Diamond (1983,1984) and Williamson(1989) held that the diversification of the income structure results in some information advantages for commercial banks. Diversification of the income structure can bring comprehensive benefits to commercial bank. Clark (1988), Murder (1992) and Rorestoeri (1993) did empirical research on some Japanese, Israeli and European commercial banks. They concluded that diversification of the income structure leads to economies of scope for commercial banks. Saunders and Walters (1994) held that the expansion of banking business can reduce risks. Galloet al. (1996) held that increasing ratio of non-interest income business contributes to the increasing profitability and risk reduction. Ralf Elsas (2006) analyzed the panel data of nine countries from 1996 to 2003, tested the effect of revenue diversification on bank value. Vincenzo Chiorazzo (2008) researched on the relationship between revenue diversification and performance in some Italian banks. Their research showed that there exists a positive correlation between the two variables. Some researchers got different conclusions. De Young and Roland (1999) held that the revenue from commission is not as stable as that of traditional banking business. Behr (2005) concluded that the more diversified a commercial bank's business is, the less income it gains. Stiroh and Rumble (2006) held that the increasing of the non-interest income ratio of a commercial bank will not increase its profitability because the non-interest income is more volatile than the interest income and the profitability is less. Evelyn, Hayden (2007) did the empirical analysis about the relationship between revenue diversification and bank performance by using the credit data of 983 Germany bank from 1996-2002. Their research did not prove any obvious correlation between the change of the flow of such credit fund and bank performance. Lepetitet al (2008) held that the size of a commercial bank and the type of non-interest income have effect on the relationship between non-interest income and bank profitability.

Domestic researchers began the research on the diversification of the income structure of commercial banks only in recent years. Wang Ting (2007), Zou Jiang, Zhang Wei-Ran, Xu Ying-hong (2004) compared the income structure between Chinese and foreign commercial banks; He Yong (2006) put forward some countermeasures for Chinese commercial banks to optimize the income structure. Wang Zhi-jun (2004), Xue Hong-jian (2006), Wang Jia-Qiang (2007) reviewed the non-interest income of commercial banks in the United States, European Union and Asia-Pacific area. Cai Hong-yuan (2005) and Wang Yong (2006) analyzed the main sources of the non-interest income and the problems in the development of non-interest income business; Zhou Hao-Wen, Wang Jing (2008) held that non-interest

income is volatile. Zheng Rong-nian, Niu Mu-hong (2007) concluded that the commercial banks with high credit risk are liable to develop non-interest income business. Lou Ying-chun (2008) held that for Chinese commercial banks, non-interest income does not have a significant effect on bank assets and the profitability.

Taking into account the availability of data, this paper takes China Merchants Bank as an example. China Merchants Bank became a joint-equity bank from the first quarter of 2002. This paper aims at analyzing the relationship between the development of non-interest income business and the operation performance of China Merchants Bank. Firstly, it will do the stationary test for every time series and the cointegration test between two time series. Secondly, it will conclude whether there exists a long-term stabilized equilibrium relationship between the two variables. Finally, it will analyze the factors which explain the short-term fluctuation of the operation performance of the bank by ECM.

2 Indicator Selection Data Sources and Processing

Non-interest income refers to all the income of a commercial bank other than the interest income. In the paper, the ratio of non-interest income in the business income indicates the development level of the non-interest income business in China Merchants Bank, return on equity (ROE) indicates the operation performance of the bank.

All the data of above two variables, namely, the ratio of non-interest income in the business income (NONINT) and return on equity (ROE) come from the website of China Merchants Bank and is shown in Table 1.

Table 1   Variable Data

Quarter	NONINT	ROE	Quarter	NONINT	ROE
Q1 2002	3.3	2.17	Q1 2006	7.75	4.05
Q2 2002	3.7	5.68	Q2 2006	13.76	8.55
Q3 2002	4.3	8.08	Q3 2006	2.91	3.28
Q4 2002	6.9	9.52	Q4 2006	13.17	17.52
Q1 2003	5.55	3.35	Q1 2007	9.16	4.30
Q2 2003	5.56	6.46	Q2 2007	15.97	21.40
Q3 2003	4.2	3.27	Q3 2007	11.13	15.84
Q4 2003	5.29	12.21	Q4 2007	17.23	24.76
Q1 2004	5.47	4.37	Q1 2008	8.39	8.45
Q2 2004	5.5	8.69	Q2 2008	16.09	36.42
Q3 2004	5.33	4.17	Q3 2008	10.52	22.73
Q4 2004	7.07	15.06	Q4 2008	15.23	27.41
Q1 2005	5.78	4.81	Q1 2009	11.20	5.12
Q2 2005	9.31	9.59	Q2 2009	24.52	20.16
Q3 2005	6.88	13.67	Q3 2009	12.56	14.95
Q4 2005	8.46	15.93	Q4 2009	21.54	21.18

By Eviews6.0, we get 0.741909, the correlation coefficient between above two variables, which means that there exists relative strong positive correlation between the two variables.

3. Empirical Analysis
3.1 Stationary test to variables

To analyze the relationship between two time series, the first step need to be done is to test the stationary of the two time series respectively. In this paper, we adopt the Augmented Dickey-Fuller test, i.e., the ADF test to do the unit root test to the two variables. The test result is shown in table 2.

Table 2   Result of ADF Test

variable	Times of difference	（C, T, K）	Durbin-Watson statistic	ADF test statistic	5% critical value	1% critical value	test result
NONINT	1	（0, 0,0）	1.93	-20.60	-1.95	-2.64	I(1)*
ROE	1	（0, 0,0）	1.88	-14.78	-1.95	-2.64	I(1)*

Note: （C, T, K）indicates the constant, trend and lag length in ADF test;
* indicates that the difference of variable passes the ADF test under the 1% critical level.

The above test result shows that neither of the above two variables are stationary, and both of them are I (1).

3.2 Cointegration rank test between the variables

To test whether there exists a long term stabilized equilibrium relationship between the two variables, we need do the cointegration rank test to the variables. The test result is shown in table 3.

Table 3　Result of Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.326603	14.36440	12.32090	0.0224
At most 1	0.080011	2.501805	4.129906	0.1343

Trace statistic 14.36440 is less than 0.05 critical value 12.32090. Trace test indicates 1 cointegrating equation at the 0.01 level between the two variables. To do the further test, we do the OLS to the two variables. The residual series E of the above regression equation is illustrated in figure 1.
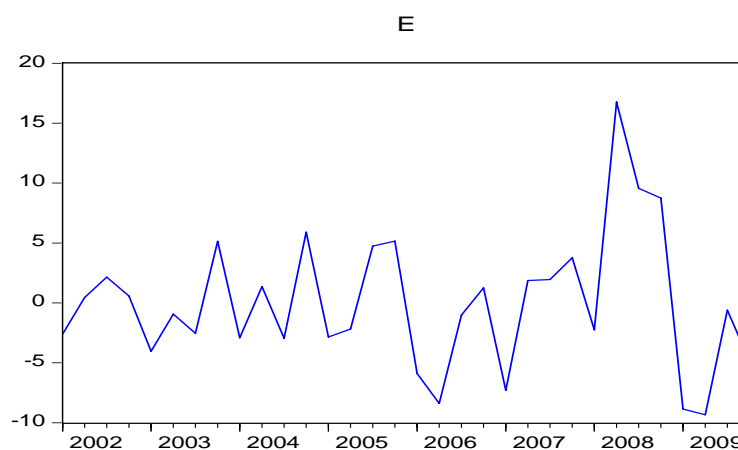

Figure 1　Line and Symbol of Residual Series E

Then we do the unit root test to the residual series E, the ADF test result is shown in table 5.

Table 4　Result of ADF Test to Residual Series E

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.332234	0.0089
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	
*MacKinnon (1996) one-sided p-values.			

The t-statistic -4.332234 is less than the test critical value -4.284580 under 1% level which proves that the residual series E is stationary. Trace test indicates 1 cointegrating equation at the 0.01 level between variables ROE and NONINT.

3.3 ECM analysis

Since trace test indicates 1 cointegrating equation at the 0.01 level between variables ROE and NONINT, according to Granger theory, there must be ECM between them. Firstly, we define the equilibrium error (ecm), ROE being the dependent variable, NONINT being the independent variable. Secondly, we do the OLS, the coefficient is 1.165417. Do the ECM analysis with Eviews6.0, we get table 6.

Table 5   Result of ECM Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.724781	1.076402	0.673336	0.5063
D(NONINT)	1.261006	0.185507	6.797603	0.0000
ECM	-0.799340	0.189167	-4.225572	0.0002
R-squared	0.729969	Mean dependent var		0.613226
Adjusted R-squared	0.710681	S.D. dependent var		10.84958
S.E. of regression	5.835819	Akaike info criterion		6.457672
Sum squared resid	953.5901	Schwarz criterion		6.596445
Log likelihood	-97.09392	Hannan-Quinn criter.		6.502909
F-statistic	37.84581	Durbin-Watson stat		1.897695
Prob(F-statistic)	0.000000			

From table 6, we get the ECM equation as follows:

$$ROE_t - ROE_{t-1} = 0.724781 + 1.261006(NONINT_t - NONINT_{t-1}) - 0.799340(ROE_{t-1} - 0.911807 - 1.165417NONINT_{t-1}) + \mu_t$$

4 Conclusions

There exists a cointegration relationship between the ratio of non-interest income in the business income and return on equity (ROE). Furthermore, there exists a significant positive correlation between the two variables. For the joint-equity commercial banks, developing non-interest income business can improve their business performance significantly which can result in higher rate of return for investors.

To optimize the income structure through developing the non-interest income business is the inevitable choice for commercial banks under the increasingly fierce competition, which has become a worldwide tendency for commercial banks. Chinese commercial banks should take measures to continuously improve the non-interest income business so as to enhance their operation performance, and to narrow the gap with the commercial banks in developed countries.

The short-term fluctuation of ROE results from two factors, one is the short-term fluctuation of NONINT, the other one is the equilibrium error which indicates the degree the variable ROE deviates from its long-run equilibrium. From ECM equation, the ratio of non-interest income in the business income increases by 1%, ROE, in short term, will increases by 1.26%. ROE deviates from its long-run equilibrium by 1%, its short-term fluctuation will bring ROE back to its equilibrium point by 0.8%. The short-term fluctuation of non-interest income business has a significant impact on the short-term fluctuation of the operation performance of commercial banks. Therefore, the commercial banks should maintain the stable development of the non-interest income business so as to avoid excessive fluctuations of the operation performance of the commercial banks due to the excessive fluctuation of non-interest income.

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