African Journal of Business Management Vol. 5(12), pp. 5001-5009, 18 June, 2011
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM11.132
ISSN 1993-8233 ©2011 Academic Journals

Full Length Research Paper

A study of the intellectual capital's impact on listed banks' performance in China

Xiaopeng Zou[1] and Tzung-Cheng Huan[2]

[1]School of Economics, Zhejiang University, 38 Zheda Road, Hangzhou, 310027, China.
[2]College of Management, National Chiayi University, 580 Hsin-Ming Road, Chiayi, Taiwan 600, Taiwan.

Accepted 15 February, 2011

This paper uses Data Envelopment Analysis (DEA) and the intellectual capital measurement to study the impact of intellectual capital on the performance of China's banking industry and propose changes to improve the efficiency of the banking industry. The conclusions are as follows: capital employed efficiency (CEE) and structural capital efficiency (SCE) have a negative correlation with the technical efficiency from CRS DEA (TE), while human capital efficiency (HCE) has a positive correlation with TE. But the correlations between capital employed efficiency (CEE) and TE, human capital efficiency (HCE) and TE are not statistically significant.

Key words: Listed banks, intellectual capital, value added intellectual coefficient.

INTRODUCTION

The elements of knowledge economy are knowledge production and knowledge innovation, and the source of innovation is intellectual capital, also known as intellect capital and knowledge capital (Bontis, 2004). "If knowledge economy is a huge tree, innovation will be the flourishing branches and intellectual capital will be the indispensable nutrition provider - roots." Therefore, more and more theorists and practitioners have moved their attention from physical capital to intellectual capital; enterprisers also have increased their emphasis on knowledge economy management (Fu, 2003; Cheng and Xie, 2001). Along with the expansion of economic globalization, enhancing competitive power is the key to future market share. The effective management of intellectual capital will not only bring businesses value appreciation, but also improve their competitive power. Moreover, due to the continuous development of science and technological innovations, intellectual capital is irreplaceable as the source of knowledge innovation.

The global financial crisis has exposed the problems in China's economic system. Optimizing the economic system through a series of financial innovations, especially in the area of banking efficiency and risk management systems, has been increasingly vital to China (Xu, 2003). There are two perspectives from which this study can investigate the best use of intellectual capital to improve efficiency. One is studying the relationship between intellectual capital and the performance of Chinese banks. The other is exploring intellectual capital, as a resource contributing to the improvement of bank performance. The objective of this article is to explore the relationship between intellectual capital and bank performance. These perspectives are not only important to the development of China's banking industry, but they are also the objectives of this article.

LITERATURE REVIEW

Definition of intellectual capital

In 1969, Canadian economist Galbraith defined intellectual capital as: mental acts, but not mere knowledge or pure intelligence; the discrepancy between company's market value and book value is explained as intellectual capital (Edvinsson, 1999). Itami (1987) defines it as intangible assets, including particular technologies, customer information, brand, reputation and corporate culture. These intangible assets are important measurements to a company's compatibility. Stewart (1997) offers

*Corresponding author. E-mail: tchuan@mail.ncyu.edu.tw Tel: 886-(0)5-2732801.

the opinion that “intellectual capital stands for knowledge, information, intellectual property and experience that can be adopted to create wealth”. Edvinsson (1999) describes intellectual capital as “the experience, organizational technology, customer relationship management and professional skills that makes a company more competitive in the market”. Bontis (2004) claims in his thesis that, intellectual capital refers to the organizational or individual knowledge that contributes to sustainable competitive advantage. Pulic (2004a) includes in his definition all employees’ and organizations’ ability to create value under a market assessment.

Chen and Huang (1998) study on intangible assets is not confined to the traditional accounting sense of intangible assets, but identifies four categories: 1) intellectual-property-right intangible assets, 2) contract-right intangible assets, 3) relationship intangible assets and 4) integrated intangible assets. As to the definition generated from the classification, Dang and Li (1999) hold the position that intellectual capital is a kind of high value-added capitalized knowledge elements take part in social reproduction cycle, while its main body was still knowledge. Tan (2001) puts more emphasis on human capital in his definition of intellectual capital. However, Yuan (2001) sees intellectual capital as an important component that reflects organizational capacity. Yuan (2001) defines intellectual capital as a potential ability of the organization and a carrier for knowledge application and skills innovation. Wang and Xu (2002) propose that intellectual capital is wealth-creating ability and all kinds of knowledge elements were actually cited from intellectual capital.

The measurement of intellectual capital

In May of 1995, Skandia, the top insurance and finance enterprise in Sweden, issued the world’s first public intellectual capital annual report, where previously, only traditional annual reports were compiled for reference (Edvinsson, 1997). This study resulted in the Skandia intellectual capital navigation, which not only measures intellectual capital, but also provides a framework for classification and a standard for measurement. Pulic (2004b) adopted an innovative intellectual capital measurement, Value Added Intellectual Capital (VAIC). Several other intellectual capital measurements emerged around the same time, including Tobin’s Q Ratio and Direct Assessment Approach (DIC). Research in the field of intellectual capital was also expanding accordingly.

This article adopts VAIC to evaluate positive analysis in the performance of China’s listed banks. This method concentrates on three indexes: 1) Capital Employed Efficiency (CEE), 2) Human Capital Efficiency (HCE) and 3) Structural Capital Efficiency (SCE). VAIC=CEE+HCE+SCE, where higher VAIC indicates higher performance. The Value Added Intellectual Capital method essentially means that capital, human capital and structural capital together constitute a company’s intellectual capital; while the interactions between them finally generate the added value – the benefits finally received by business, government and employees. In the banking industry, the external manifestation of this added value is net income, interest expense, taxes and wage costs. Pulic (2004b) adopted the notion of efficiency to companies’ size difference.

The study on intellectual capital

Pulic (2004b) was the first to study the impact of intellectual capital on the banking industry. He measured Australian banks’ intellectual capital performance (1993 to 1995) and Croatian banks’ capital performance (1996 to 2000) with the VAICTM model. His findings show that, performance rank and classic accounting rank give banks significantly different positions. Bontis (2004) identify the three essential components of intellectual capital in Malaysia’s service and non-service industries: human resource, capital structure and customer capital. This study reveals that capital structure has great influence on the performance of these two industries. Although human resource is vital to both industries, it has greater influence on service industries than on non-service industries. Mavridis (2004) studied on Japanese banks using the same method and found that, the intellectual capital performances among different banks show significant discrepancies.

Williams (2004) studied the relationship between intellectual capital performance and intellectual capital exposure method. The results did not show a systematic correlation except that intellectual capital exposure decreases significantly when intellectual capital performs at a very high level. A study measuring the intellectual capital of 98 Indian banks with the VAIC^{TM} model indicates that, different types of banks performed differently (Kamath, 2007). According to the final results of the model, foreign banks that make the best use of the intellectual capital and financial capital out-perform those that fail to reach the effective operant level. A study of the British banking industry and the relationships among the three parts of intellectual capital using multiple regression indicates that, technological investment, banking efficiency, entrance barrier of banking industry and investment efficiency significantly influence intellectual capital efficiency (El-Bannany, 2008). Deol (2009) studied the use of intellectual capital and its effect on strategic development and the results show that after reformation, governmental banks, private banks and foreign banks use intellectual capital in different ways to deal with the changes in strategic environment.

In China, fewer scholars have expanded intellectual capital studies to the specific field of banking. Instead, researchers have applied intellectual capital generally to

human capital studies and enterprise efficiency studies. Cheng and Xie (2001) and Feng and Li (2001) discuss the impact of human capital, a component of intellectual capital, on performance, from different perspectives. Feng and Li (2001) emphasize the human capital of the senior managers who control the core technology. Both studies indicate that, human capital has a special impact on performance. Fang et al. (2002) concentrate on how changes in human capital affect performance. Based on the discovery that loss of human capital property rights results in low efficiency, Liu and Zhang (2003) point out that, incentives on human capital property rights could improve national enterprises' performance. Xu (2003) examines the effect of human capital operation on improved competitive power and proposes that, businesses should implement incentive mechanisms in order to maximize the power of human capital. On the other hand, Zhu (2003) subdivides human capital and examines the impact of human capital performance. Fu (2003) studies the multiplier effect of human capital on performance and calls for a complete definition of human capital property rights. Li and Guo (2005) prove that, human capital has a positive correlation with performance, which strongly supports the resource-based enterprise theory. Liu (2009) applies intellectual capital to the banking industry and with exploratory research on the relationship between intellectual capital and performance among China's listed commercial banks in 2008. The results show that the human capital value added coefficient and structural capital value added coefficient both had positive correlation with profitability.

However, this study does not directly link intellectual capital to the banks' performance, while selected annual profit as the substitute variable. Examination of research on intellectual capital leads to the following conclusion: International research on intellectual capital began at the end of the 20th century and has been applied to a very wide variety of industries, especially knowledge-intensive industries such as information technology. Domestically, however, intellectual capital is a relatively new research area with huge potential. At this time, such intellectual capital studies in China concentrate on knowledge-intensive industries. Studies on the banking industry, which has drawn little attention, are limited in adopting Data Envelopment Analysis (DEA) to study banks' efficiency.

The importance of this study

As a result of the fact that, research on intellectual capital began in other countries, the currently mainstream theories were all established by foreign scholars. Chinese researchers are still in the stage of quoting foreign studies, and most current researches in China are not at all systematic, although they have combined with our national conditions. Possible reasons for this phenomenon are as follows. The origination of intellectual capital was based on technology innovation. Developed technologies first emerged in the Occident, and the industrial revolutions intensified Western countries' pursuit for advanced technologies. These factors led to the Occident's early start and comprehensive theoretical accumulations in this area.

Intellectual capital, which is not a new topic in the West, appears to be relatively unexplored in China. There are three reasons for this. First, China lacks the comprehensive theoretical accumulation of Western researchers; second, the knowledge and technology investments in Chinese enterprises are lacking; and finally, there is no clear definition of intellectual capital in China, so research data is difficult to grasp. However, the rapid growth of China's economy will lead to increased research on intellectual capital so as to improve the country's corporate efficiency. This article makes extensive use of existing research to examine the effect of intellectual capital on the performance of listed banks in China. Offering new insight on a relatively unexplored topic, this paper also opens the possibilities of further discussion.

METHODOLOGY

The methodology of this article includes two major parts: theoretical analysis and positive analysis. Theoretical analysis is the use of relative intellectual capital theories to analyze the effect of intellectual capital on the performance of listed banks, while positive analysis does not study the banking industry in a classic way, but links the measurement of intellectual capital to the DEA (Data Envelopment Analysis) measurement of business performance. This article uses efficiency as calculated by DEA as the proxy variable, CPA (natural logarithm of the tradable capital stock) and LEV (leverage ratio) as control variables, and three indexes in VAIC method as dependent variables. Using theoretical analysis and databases, this article presents a quantitative analysis combined with econometric models to explore potential changes to improve the banking industry's performance from a perspective of intellectual capital. Based on the results, this article provides proposals for the banking industry.

This article uses Data Envelopment Analysis (DEA) to study the efficiency of China's listed banks, and derives each bank's technological efficiency (TE) from annual reports and DEAP calculation. Measurement of intellectual capital is based on Pulic's (2004b) Value Added Intellectual Coefficient (VAIC) and uses three indexes – Capital Employed Efficiency (CEE), Human Capital Efficiency (HCE) and Structural Capital Efficiency (SCE). In the positive analysis, Technological Efficiency (TE) calculated from DEA are the proxy variable of enterprise's performance; CPA (natural logarithm of the tradable capital stock) and LEV (leverage ratio) are the control variables; the three indexes in VAIC are the dependent variables. Based on theoretical analysis and the database, this study adopts univariate analysis and stepwise variable regression method to explore the link between TE and the other three indexes – Capital Employed Efficiency (CEE), Human Capital Efficiency (HCE) and Structural Capital Efficiency (SCE).

Data envelopment analysis

Data Envelopment Analysis is a non-parametric method of X-efficiency measurement, consisting of three component indexes: 1) Comprehensive Efficiency (CE), 2) Technological Efficiency (TE) and 3) Allocative Efficiency (AE). Comprehensive Efficiency (CE) refers to the ratio of ideal minimum cost to real cost at current

output. CE=1, in which a company is operating at the minimum cost, indicates comprehensive efficiency; while CE<1 indicates for comprehensive inefficiency. Technological Efficiency (TE) refers to the technology efficiency under invariant returns to scale. TE=1, in which a company is operating at equal product curve and is making full use of current technology, indicates technological efficiency; while TE<1 indicates technological inefficiency.

Allocative Efficiency (AE) reflects whether a company has chosen the best investment portfolio to minimize cost at current price. AE=1, in which a company has already adopted the best investment portfolio to operate, stands for allocative efficiency; while AE<1 stands for allocative inefficiency. TE represents the technology efficiency under invariant returns to scale, while PTE represents the technology efficiency under variant returns to scale. TE=PTE reflects that, technological efficiency is not influenced by returns to scale; while TE≠PTE reflects that technological inefficiency is partially caused by scale inefficiency. These indexes have the following correlations: CE=TE*AE, TE=SE*PTE (SE stands for scale efficiency).

Index measurement methodology

Due to the specialty of the banking industry, the efficiency measurement depends mainly on the selections of input and output variables. Existing research uses three primary approaches: 1) production approach, 2) intermediate approach and 3) assets approach. When using the production approach, a bank is treated as the supplier of financial services. Therefore, the transactions and accounts settled in a period of time are regarded as bank's output. As those factors are hard to measure, we may use the static scale of deposits and loans as output indexes instead, and choose employee number and fixed assets as input indexes. This approach is usually adopted to measure the relative efficiency between different branches.

When using the intermediate approach, a bank is treated as an intermediary between the capital investor and the capital raiser. In contrast to the previous approach, output here represents the whole deposit and debt scale that is applied into real use, while input indexes are labor, fixed assets and loanable funds. When using the assets approach, a bank is an intermediary, as in the intermediate approach. Nevertheless, this approach uses balance sheet assets (primarily liabilities and security investments) in the as the output index, and uses various deposits as the input index. This approach is relatively more accurate than the previous two.

RESULTS

Positive analyses of china's current listed banks

Basic hypotheses

In this study, intellectual capital is defined as capital, human capital and structural capital according to VAIC^{TM}. Capital refers to the physical capital in an enterprise; human capital refers to employee knowledge, skills and experience; structural capital refers to the resources that employees bring to the enterprise such as the relationship with suppliers, customer loyalty and social networks. Based on these three components and the aforestated analysis, the hypotheses are established as follows:

H_1: Capital has a positive impact on bank performance.

H_2: Human capital has a positive impact on bank performance.

H_3: Structural capital has a positive impact on bank performance.

Data sources and research sample selection

Pulic's Value Added Intellectual Coefficient (VAIC) adopts three indices to measure intellectual capital: 1) Capital Employed Efficiency (CEE), 2) Human Capital Efficiency (HCE) and 3) Structural Capital Efficiency (SCE), where

CEE=VA/CE,
HCE=VA/HC,
SCE=(VA-HC)/VA, and
VAICTM=CEE+HCE+SCE.

In the equations, VA represents a bank's value added; CE represents the book value of a bank's net assets; HC represents a bank's overall payroll and wage investment. Value Added (VA) = Profit before Taxation + Payroll Expenses + Interest Expenses. Payroll Expenses is the payroll item in the cash flow statement; Interest Expenses means net interest income.

This article adopts Technological Efficiency (TE) calculated from DEA as the dependent variable and uses the natural logarithm of A share tradable stock value and leverage ratio as control variables. The chosen variables can be seen in Table 1. The original data (except CPA) comes from each bank's 2007 to 2009 annual reports. CPA comes from 14 banks, A share tradable stock values on three particular days: 28/12/2007, 31/12/2008, and 31/12/2009, as collected from 10jqka stock market software. All the data in the Data Envelopment Analysis came from each bank's annual reports. However, since China CITIC Bank and Bank of Beijing had not released their 2009 reports prior to the data collection, only 40 annual reports are represented in the database.

Measurement analysis of China's bank performance

The measurement analysis of China's listed banks' performance mainly uses Data Envelopment Analysis. Considering the indices used by domestic scholars to synthesize bank performance, combining three kinds of approaches (production approach, intermediate approach and assets approach) depending on the availability of various databases, this article uses the following indices:

Output Indices

Securities Investment, Total Loans, Net Profit.

Input indices

Employee Number, Fixed Assets, Business and Administrative Expenses, Total Deposit.

Table 1. Variable definition.

Variable type	Variable name	Variable definition
Dependent Variable	Technological Efficiency (TE)	DEA Relative efficiency
Independent Variables	Capital Employed Efficiency (CEE)	CEE=VA/HC
	Human Capital Efficiency (HCE)	HEC=VA/HC
	Structural Capital Efficiency (SCE)	SCE=SC/VA
Control Variables	Natural Logarithm of the Tradable Capital Stock (CPA)	LN (A Share Tradable Stock*Stock Price)
	Leverage Ratio (LEV)	Gross Liabilities/Gross Assets

Table 2. Listed banks' efficiency evaluation results – 2007.

Listed bank	Technological efficiency (TE)	Pure technological efficiency (PTE)	Scale efficiency (SE)	Returns to scale
Bank of China	1.000	1.000	1.000	Invariant
China CITIC Bank	1.000	1.000	1.000	Invariant
Shenzhen Development Bank A	1.000	1.000	1.000	Invariant
Shanghai Pudong Development Bank	1.000	1.000	1.000	Invariant
Industrial Bank	1.000	1.000	1.000	Invariant
China Minsheng Banking	1.000	1.000	1.000	Invariant
Bank of Nanjing	1.000	1.000	1.000	Invariant
Bank of Beijing	1.000	1.000	1.000	Invariant
Bank of Ningbo	0.979	1.000	0.979	Increasing
Bank of Communications	0.977	1.000	0.977	Decreasing
China Merchants Bank	0.941	1.000	0.941	Decreasing
Huaxia Bank	0.935	0.940	0.995	Increasing
Industrial and Commercial Bank of China	0.876	1.000	0.876	Decreasing
China Construction Bank	0.873	1.000	0.873	Decreasing

Using of DEAP 2.1 to evaluate 14 listed banks' input and output indices from 2007 to 2009, calculates the measurement results presented in Tables 2, 3 and 4 were obtained. According to the aforestated analysis, Bank of China has relatively higher technological efficiency among national banks. Shenzhen Development Bank, Shanghai Pudong Development Bank, Industrial Bank, China Minsheng Banking, and Bank of Nanjing have relatively higher technological efficiency among all non-state-owned banks.

China's listed banks' intellectual capital measurement analysis

In this article, China's listed banks' intellectual capital is measured primarily using Pulic's Value Added Intellectual Coefficient model. On the basis of the selected indices earlier stated, the Value Added Intellectual Coefficient and the Value Added (VA) were calculated. The details are listed in Table 5. As shown in Table 5, Shanghai Pudong Development Bank, Industrial Bank, Bank of Nanjing, Bank of China, China Construction Bank, and Shenzhen Development Bank have relatively high intellectual capital efficiency. We can therefore theoretically deduce that, intellectual capital is somehow relevant to bank performance. This article will continue to examine this issue from a positive analysis perspective.

Positive analysis on performance and intellectual capital

Correlation analysis

Based on each bank's 2007 to 2009 annual reports and the data collected from 10jqka stock market software, the correlation analysis of the variables are outlined (Table 6). Table 6 shows that Capital Employed efficiency (CEE) and Structural Capital Efficiency (SCE) both have a negative correlation with Technological Efficiency; while the correlation between Structural Capital Efficiency (SCE) and TE is relatively more significant than that between CEE and TE. Human Capital Efficiency (HEC)

Table 3. Listed banks' efficiency evaluation results – 2008.

Listed banks	Technological efficiency (TE)	Pure technological efficiency (PTE)	Scale efficiency (SE)	Returns to scale
Bank of China	1.000	1.000	1.000	Invariant
Shenzhen Development Bank A	1.000	1.000	1.000	Invariant
Shanghai Pudong Development Bank	1.000	1.000	1.000	Invariant
Industrial Bank	1.000	1.000	1.000	Invariant
China Minsheng Banking	1.000	1.000	1.000	Invariant
Bank of Nanjing	1.000	1.000	1.000	Invariant
Bank of Beijing	1.000	1.000	1.000	Invariant
Bank of Communications	0.999	1.000	0.999	Decreasing
China Merchants Bank	0.948	1.000	0.948	Decreasing
China CITIC Bank	0.943	0.970	0.972	Decreasing
Huaxia Bank	0.941	0.948	0.992	Increasing
Bank of Ningbo	0.878	1.000	0.878	Increasing
Industrial and Commercial Bank of China	0.877	1.000	0.877	Decreasing
China Construction Bank	0.864	1.000	0.864	Decreasing

Table 4. Listed banks' efficiency evaluation results – 2009.

Listed banks	Technological efficiency (TE)	Pure technological efficiency (PTE)	Scale efficiency (SE)	Returns to scale
Bank of China	1.000	1.000	1.000	Invariant
Industrial and Commercial Bank of China	1.000	1.000	1.000	Invariant
Bank of Communications	1.000	1.000	1.000	Invariant
Shenzhen Development Bank A	1.000	1.000	1.000	Invariant
Shanghai Pudong Development Bank	1.000	1.000	1.000	Invariant
Industrial Bank	1.000	1.000	1.000	Invariant
China Minsheng Banking	1.000	1.000	1.000	Invariant
Bank of Nanjing	1.000	1.000	1.000	Invariant
Bank of Ningbo	1.000	1.000	1.000	Invariant
China Merchants Bank	0.980	1.000	0.980	Decreasing
Huaxia Bank	0.965	0.965	1.000	Invariant
China Construction Bank	0.934	1.000	0.934	Decreasing

has a positive correlation with Technological Efficiency, but the correlation is not significant. Both A share tradable stock value and financial leverage (LEV) have insignificant negative correlations with TEs.

Regression analysis

To determine the effects of different variables on technological efficiency, two control variables, CPA and LEV, were fixed to isolate each factor's impact on technological efficiency. Finally, a stepwise regression was applied to determine which variables significantly affect technological efficiency. CEE, HEC, SCE and TE are regressed as follows according to each bank's 2007 to 2009 annual report and the 10jqka software database. Tables 7 and 8 show that, SCE and TE have the most significant negative correlation, followed by the negative correlation between CEE and TE. The least significant is the positive correlation between HEC and TE. However, under the significance level 0.05, *t* statistic which has 38 degrees of freedom, is 1.68, therefore CEE and HCE are not significantly correlated.

In order to indicate the impact of different elements on technological efficiency, stepwise regression was conducted with the following results. Table 9 demonstrates that, LEV has been eliminated, while *F* statistic of the whole model has increased. Also, structural capital efficiency has the biggest impact on TE, followed by HEC and CEE.

Table 5. Listed banks' VAIC^{TM} and VA ranks – 2007 to 2009.

Bank's name	VAICTM	VA (¥millions)	VA rank
2007			
Shanghai Pudong Development Bank	8.305	38440	7
Industrial Bank	12.761	34172	9
China CITIC Bank	15.606	42458	6
China Construction Bank	16.530	333172	2
Bank of Nanjing	17.352	3304	14
Bank of China	18.181	252117	3
Shenzhen Development Bank A	18.537	15197	11
China Merchants Bank	19.128	62158	5
Industrial and Commercial Bank of China	21.401	376384	1
Huaxia Bank	24.597	17380	10
Bank of Communications	30.791	92040	4
Bank of Ningbo	31.130	3617	13
China Minsheng Banking	36.665	37874	8
Bank of Beijing	54.268	12570	12
2008			
Shanghai Pudong Development Bank	10.014	54278	7
China CITIC Bank	12.961	59066	6
Shenzhen Development Bank A	14.515	15754	12
Industrial Bank	14.780	44931	9
Bank of China	16.987	272639	3
China Construction Bank	17.308	385518	2
Bank of Nanjing	18.877	4727	14
Industrial and Commercial Bank of China	24.717	455497	1
Huaxia Bank	26.173	23763	10
China Merchants Bank	29.890	81355	5
Bank of Communications	30.807	111925	4
Bank of Ningbo	42.547	4962	13
Bank of Beijing	51.536	19245	11
China Minsheng Banking	51.914	48629	8
2009			
Shanghai Pudong Development Bank	10.252	58713	6
Industrial Bank	13.445	48912	8
Shenzhen Development Bank A	15.136	22089	10
Bank of China	15.473	271081	3
China Construction Bank	16.424	394631	2
Bank of Nanjing	16.719	5547	12
Huaxia Bank	22.905	23912	9
Industrial and Commercial Bank of China	24.318	465478	1
China Merchants Bank	24.787	72875	5
Bank of Communications	26.703	114710	4
China Minsheng Banking	29.473	55231	7
Bank of Ningbo	52.765	6189	11

Positive results analysis

Though the aforestated model does not pass overall tests and the linear relationship is insignificant, the main purpose of the model is to judge whether the impact of the three intellectual capital coefficients on operation efficiency is positive or negative. Thus, the non-significant results of the overall tests do affect the usefulness of the

Table 6. Correlation analysis.

Variable	TE	CEE	HEC	SCE	CPA	LEV
TE						
CEE	-0.032652					
HEC	0.012810	-0.310781				
SCE	-0.155402	-0.469912	0.813265			
CPA	0.008870	0.037877	-0.191298	-0.088908		
LEV	0.008147	0.832982	-0.158629	-0.264185	0.198588	

Table 7. Single-factor regression results under invariant control variable.

Independent variable	Coefficient	Std. Error	t-Statistic	Prob.
CEE	-0.023628	0.054898	-0.430389	0.6695
HCE	0.000575	0.000610	0.094342	0.9254
SEC	-0.236098	0.244749	-0.964655	0.3412

Table 8. Multiple regression results for all variables.

Variable	Coefficient	Std. error	t-Statistic	Prob.
C	1.493298	0.540640	2.762092	0.0092
CEE	-0.068806	0.061012	-1.127743	0.2673
HEC	0.001629	0.001017	1.601292	0.1186
SCE	-0.928278	0.438806	-2.115463	0.0418
CPA	0.000276	0.006372	0.043270	0.9657
LEV	0.387550	0.537119	0.721535	0.4755

Dependent variable: TE; Sample: 140; Included observations: 40; R^2: 0.12.

Table 9. Regression results of all variables.

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	1.491455	0.531220	2.807602	0.0081
SCE	-0.927187	0.431790	-2.147311	0.0388
HEC	0.001620	0.000980	1.652067	0.1075
CEE	-0.069524	0.057863	-1.201546	0.2376
LEV	0.395390	0.498375	0.793358	0.4329

Dependent variable: TE; Sample: 140; Included observations: 40; R^2: 0.12.

results since the model was not designed to demonstrate significant linear relationship between intellectual capital and performance. Positive analysis conclusions can be drawn as follows: CEE and SCE are negatively correlated with TE, while HCE and TE are positively correlated. But CEE and HCE are not significantly correlated with TE.

Although banks have a large amount of human capital, its influence on technological efficiency is not significant for the following reasons: first, banks fail to fully employ their human capital. Banks are usually very large organizations because of the number of branches necessary to serve consumers across China's geographical span. Thus, the institution is typically too large to make best use of employee talents. Second, the operational mode of Chinese commercial banks is problematic. National banks typically count on their reputations and relationships with the government, and often neglect customer loyalty and satisfaction. Employee training in this field is limited. Although some banks do emphasize customer service, they often do not invest

sufficiently in employee training and development.

As to why capital efficiency of banks has no significant impact on their technological efficiency, the reasons are as follows: first, a bank's main financial source is deposits, and its capital can only be poured into low-risk capital investments. Therefore, its main income is from the interest spread. This will affect the banks' capital efficiency, and the low capital efficiency weakens their correlation in the positive analysis. Second, financial management products in China are far behind other countries' in innovation. Innovation in financial products will not only attract more funds to investment, but also increase performance. The positive analysis indicates that SCE and TE are negatively correlated, mainly because structural capital requires additional employees. As a result, costs will increase while technological efficiency will decrease.

CONCLUSION AND SUGGESTION

Capital Employed Efficiency (CEE) and Human Capital Efficiency (HCE) do not have a significant linear correlation with Technological Efficiency (TE). However, they may have non-linear correlations such as a logarithmic correlation. Capital Employed Efficiency (CEE) may have a negative correlation with TE; while Human Capital Efficiency may have a positive correlation with TE. Structural Capital Efficiency (SCE) has a relatively significant negative linear correlation with TE. Analysis of the data shows that, the descending order of these three variables according to their influence on TE is: Structural Capital Efficiency (SCE), Human Capital Efficiency (HCE), and Capital Employed Efficiency (CEE).

The following proposals are provided due to CEE and HCE's non-significant impact on TE: First, improve staff recruitment strategies and establish reasonable employee incentive programs. Effective staff recruitment strategies reduce redundancy, improves employee quality; while employee incentives inspire employees to reach their potential capacity, encourage inter-staff competition and cooperation, and improve staff quality. Second, improve staff responsibility awareness. Employees do not typically give customer satisfaction and loyalty top priority. Businesses should therefore invest in customer service training and awareness for employees, which will ultimately improve performance. Third, optimize financial product input and output. Banks should not focus only on the innovation of financial products, but also on input and output optimization. Only the rational use of capital will improve management efficiency.

REFERENCES

Bontis N (2004). Assessing knowledge assets: a review of the models used to measure intellectual capital, available at: www.business.mcmaster.ca.

Chen JG, Huang QH (1998). The significance of intangible assets management to our nation's reform and development. Manage. World, 6: 129-137.

Cheng CP, Xie KF 2001. The relationship between enterpriser' human capital and corporate performance. Nankai Manage. Rev., 5: 30-34.

Dang XH, Li XM (1999). The measurement of intellectual capital and comments on western industrial intellectual capital. J. Xi'an Univ. Technol., 2: 7-11.

Deol HS (2009). Strategic environment and intellectual capital of Indian banks. J. Intel. Capital, 10(1): 109-120.

Edvinsson L (1999). Global knowledge Nomad, universal networking intellectual capital. J. Human Resour. Cost. Account., 4(1): 21-33.

El-Bannany M (2008). A study of determinants of intellectual capital performance in banks: The UK case. J. Intel. Capital, 9(3): 487-498.

Fang RS, Li Y, Feng JL (2002). How change in management structure affect corporate performance. Sci. Res. Manage., 6: 93-99.

Feng T, Li QJ (2001). How high technology company's human capital privatization affect property rights system and performance. Modern Econ. Sci., 7: 24-29.

Fu WN 2003. Enterpriser's human capital and performance: a theoretical model. J. Capital Univ. Econ. Bus., 5: 54-59.

Itami H 1987. Mobilizing Invisible Assets, London: Harvard University Press.

Li JM, Guo FB (2005). Positive analysis on corporate human capital and corporate performance. Mark. Popul. Anal., 11(3): 29-36.

Liu DL (2009). Listed Commercial Banks' Intellectual Capital Performance Positive Analysis. Modern Corp. Culture, 26: 169-171.

Liu LL, Zhang GL 2003. Corporate human capital performance and property right incentive. Shandong Univ. Finan. J., 2: 59-64.

Mavridis DG. 2004. The intellectual capital performance of the Japanese banking sector. J. Intel. Capital, 5(1): 92-115.

Pulic A (2004a). Value creation efficiency analysis of Croatian banks 1996-2000, available online at www.vaic-on.net

Pulic A (2004b). Measuring the performance of intellectual potential in knowledge economy, available at: www.vaic-on.net.

Stewart TA (1997). Intellectual capital- the economic impact of the patent system: a study of the British experience. London: Cambridge University Press.

Tan JS 2001. Intellectual capital accounting study. Beijing: China Financial and Economic Publishing House.

Wang Y, Xu QR 2002, Intellectual capital and its measurement, Res. Dev. Manage., 14: 11-16.

Williams SM 2004. Downsizing – Intellectual capital performance anorexia or enhancement. Learn. Organ., 11(4/5): 368-379.

Xu XL (2003). Study on Chinese enterprisers' performance evaluation and pay system design, Northeast Normal University Master Thesis.

Yuan QH (2001). Corporate intellectual capital management. Beijing: Economic and Management Publishing House.

Zhu XZ (2003). Human capital and corporate performance, Guangxi Soc. Sci., 1: 75-77.