BANKING SYSTEM EFFICIENCY AND CHINESE REGIONAL ECONOMIC GROWTH: AN EMPIRICAL ANALYSIS BASED ON BANKS' MICRO-EFFICIENCY

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ABSTRACT

Based on the cost efficiency of individual banks, this paper constructs an indicator to clarify Chinese regional banking system's credit allocation efficiency in accordance with the panel data of the provinces and central-government-administered cities of China. When applying this variable into the growth equation and estimating the regression, the results demonstrate a strong positive relationship between the regional banking systems' efficiency and regional growth rate. This paper presupposes that the indicator of the banking system's efficiency bears a direct relationship with the banking system's capability of identifying promising entrepreneurs and optimizing credit allocation. Thus, it could be concluded that the banking system can exert their influences on the process of economic growth not only through capital accumulation effects but also through credit allocation effects.

JEL: G11, G14, G15

INTRODUCTION

The research in the relationship between economic growth and banking sector development can be dated back as early as Schumpeter (1934), and Goldsmith (1969). Since then, this subject has received extensive attention by economic researches. The empirical relationship between these two variables has been well documented. Most regression outcomes show that the banking system plays an important role in promoting the development of regional economies. For instance, based on cross-nation data, Rajan & Zingales (1998) conclude that in a foreign-investment-dependent nation, the higher the banking system's efficiency, the faster firms develop. King & Levine (1993a), employing historical data of nearly 80 countries, argued that a highly positive relationships between bank's development and economic growth did exist. They further inferred that bank's development could facilitate economic growth by increasing the rate of capital accumulation and economy efficiency. Referring to current domestic literature, Tan Ruyong(1999), Wang Guosong(2001) & Rao Huacun(2001) all identified the causal relationship between banking and economic growth through empirical analysis.

In most of the relevant empirical literature, the banking system's development is usually measured by the size of the banking system or the amount of bank-arranged capital. To be specific, the indicators used to depict the development of the banking system include the ratio between liquid liabilities of the banking system and GDP (King & Levine, 1993b), the proportion of bank branches to the regional resident population (Ferri & Mattesini, 1997), the ratio between domestic credit and GDP (Rajan & Zingales, 1998). However, these measurements have some inherent flaws in capturing the relationship between the banking system development and economic growth, that is, they mainly focus on the effect of banks on stimulating capital accumulation. Meanwhile, the financial intermediary theory developed since the 1980's shows that another important function of a commercial bank lies in its ability to identify optimal borrowers, alleviate the information asymmetry in the financial market, optimize capital allocation and thus promote economic growth (Diamond, 1984; Stiglitz & Weiss, 1988). However, empirical researches in this respect can hardly be found in relevant academic literature. Levine (1997) points out that, the only indicator measuring financial development in previous studies is the ratio of the loans granted to private business against the total loans. This approach is based on the premise that the private sector is more efficient than the public one. Obviously, the hypothesis itself is subject to be question on various grounds. Besides, it should be noted that, for many developing countries, the share of credit granted to the public sector is mainly the outcome of government intervention rather than the banks' discretionary decisions. In that case, this measurement is unable to effectively reflect the banks' ability to improving the efficiency of credit allocation, if political factors are considered.

In this paper, we construct an indicator that is able to reflect the allocative efficiency of banking systems based on micro-efficiency of individual banks, and then investigate the relationship between this indicator and the rate of Chinese economic growth. In general, the higher individual banks' ability to identify the quality borrowers and optimize the allocation of financial resources, the more efficient the regional banking system is. Hence, by analyzing the relationship between this indicator and regional economic growth rates, we can substantiate that the bank's ability to identify quality borrowers indeed plays a role in facilitating economic growth. Utilizing this logic, we first calculate the cost efficiency of the 14 biggest commercial banks of China, and then we construct the banking system's efficiency index based on the weighted average of the bank's individual cost efficiency in each region. After putting this index into the growth regression model, we find that, in China, the banking system's efficiency indeed exerts a salient positive influence upon the regional growth rate; and therefore the empirical results demonstrate that the bank's economy-facilitating role can also be realized though their screening ability.

LITERATURE REVIEW

<u>Research Method</u>

The general model used in empirical analyses of economic growth is presented as the following (Mankiw et al, 1992):

$$y_t - y_{t-1} = \varphi y_{t-1} + \chi k_{t-1} + \psi S_{t-1} + \varepsilon_t \tag{1}$$

Where y_t denotes logarithm of GDP per capita over period t in one country (region); k_{t-1} is the logarithm of the ratio of banking credit granted to the country (region) and its GDP over the period t-1; S_{t-1}, considered as long-term potential determinants of economic growth, is a vector containing other financial and control variables in logarithmic form. ε_t is the random error term. With regard to the explanation of coefficients in formula (1), if $\varphi < 0$, then it shows the existence of conditional convergence. χ describes the effect of bank's credit supply on the economic growth, if the estimation result is $\chi > 0$, it shows that banking system could promote economic growth through the channel of capital accumulation.

K_t is defined as the ratio between bank system's credit scale and GDP in one country (region). An important hypothesis in this paper is that, for a given credit size, varied efficiency of the banking system may lead to different contributions to the economic growth. Therefore, we construct an effective credit size index $\hat{K}_t$ to depict the impact of banking system's efficiency on economic growth, the specification of $\hat{K}_t$ can be formulated as the following:

$$\hat{K}_t = K_t (1 - \mu_t)^{\rho} \tag{2}$$

Here, we use parameter μ_t ($0 \le \mu_t \le 1$) to quantify the inefficiency of the banking system. The bigger the value of μ_t , the lower the efficiency of the banking system in one country (region), and the lower the ability the bank system has in that country(region) to screen borrowers and optimally allocate capital. Under this situation, a given capital size, K_t, can only parallel to the smaller size of effective credit, $\hat{K}_t$, considering their contributions to economic growth. Therefore, in this paper, both the efficiency of banking system and the whole credit scale issued by it have the joint influence upon the growth rate of a country (region). Specifically, when the bank system's efficiency is extremely low, i.e. μ_t is close to one, the contribution of loans to economic growth will come close to zero. Finally, ρ depicts the extent to which this inefficiency exerts on economic growth.

In the following, we substitute K_t for $\hat{K}_t$, yielding the regression equation as below:

$$y_t - y_{t-1} = \varphi y_{t-1} + \chi k_{t-1} + \hat{\rho}\ln(1-\mu_{t-1}) + \psi S_{t-1} + \varepsilon_t \tag{3}$$

Herein, $\hat{\rho} = \rho\chi$. If the diagnostic result shows that χ is positive, and $\hat{\rho} = 0$, it means that the role of banking system on economic growth is mainly capital accumulative and the effect of credit allocation is not significant. Nevertheless, if both χ and $\hat{\rho}$ are significantly non-zero, we then conclude that the effect of credit allocation on economic growth could not be excluded.

METHODOLOGY: A NEW INDEX MEASURING BANKING SYSTEM'S EFFICIENCY

The Estimation of Technical Efficiency of Commercial Banks

Two technical micro-efficiency concepts exist in current literature: cost efficiency and profit efficiency. In this paper, we choose the concept of cost efficiency to measure technical efficiency of individual bank for the facts that a bank's profitability may not be in line with its ability to screen quality borrowers. In some cases, banks can even make admirable profits through the manipulation of prices, which is particularly true in the Chinese banking sector for its less competitive market structure.

When the entity's technical efficiency is estimated, the following two techniques are usually applied: DEA technique (or non-parametric techniques) and stochastic frontier technique (one of the techniques of parametric estimation) (Kalirajan & Shand, 1999). The parametric technique is preferred here because the hypothesis test can be conducted under this technique and the estimation of micro-efficiency is unbiased. In this paper, stochastic frontier technique will be chosen to estimate technical efficiency of individual banks.

Berger (1993) gives the general formula for cost efficiency estimation under parametric techniques:

$$RC = C(Q, W) \cdot U \tag{4}$$

Here, RC represents real cost; $C(Q, W)$ is the theoretical minimal cost. $U \in [1, \infty)$ reflects the degree of cost ineffectiveness of commercial banks, while its reciprocal denotes the value of cost efficiency. $Q = (Q_1, Q_2 \cdots)$ is a vector of quantities for various outputs. And $W = (W_1, W_2, \cdots)$ is a vector for prices of inputs.

Taking the logarithm of equation (4), yields:

$$rc = c(Q, W) + \varepsilon + \mu \tag{5}$$

In this equation, ε random error term; and other variables in lowercase are logarithmic form of the corresponding variables in equation (4).

The inputs and the outputs of the equation (4) should be accurately defined prior to conducting the regression estimation. In equation (4), price vector takes average cost of loanable funds and average price of operation inputs as its components. As to average cost of loanable funds, it is defined as the ratio of the sum of commission and interest expenditure against average quantity of loanable funds, while the average price of operation inputs is taken as the ratio of operation expenses against average total assets. In addition, bank's outputs include three items, namely, total loans, total investment and non-interest proceeds. Finally, for limited availability of data, we only include three typical items as components of total real cost of a bank, which are commission, interest expenditure and operation expenses respectively.

Next, we begin estimating the cost efficiency of China's main commercial banks. Due to the difficulty of data collection, the sample herein just consists of 4 major state-owned banks, (three of them have recently been converted to public-listed commercial banks through the introducing of new non-government investors), and 10 middle-sized commercial banks. These 14 banks constitute the main force of Chinese banking sector, whose assets amount to nearly 75% of total assets of the whole banking industry. Taking account of data availability, banks' size or other reasons, we exclude from the sample policy banks, city commercial banks, urban and rural cooperative credit banks and branches of foreign banks in China. The time scale ranges from 1998 to 2004-a critical period for commercial banks' reform in China. Therefore, the outcome of the reform can be evaluated through assessing the change of banks' micro-efficiency. The data is mainly extracted from "Year Book of Chinese finance" and official information published in each bank's website. Since the financial data of Guangdong Development Bank in 2004 is still unavailable, we then extrapolate data for the year 2004 by adjusting each component of the sample for 2003 by the average change from 2001 to 2003. Table 1 below gives statistic description of the sample.

Table 1: Statistic Description of the Sample

Notation	Variable	Mean Value	Standard Error
RC	Real total cost	295.17	355.48
Q_1	Balance of loan	5812.32	8212.12
Q_2	Balance of investment	2205.21	3125.37
Q_3	Non-interest Proceeds	70.21	75.36
W_1	Average cost of loanable funds	0.019	0.01
W_2	Average price of operation inputs	0.018	0.007

Sources: "Year Book of Chinese Finance" (1999-2004) and official statistic data published in every bank's website. Note: Q_1 is the mean value of balance of loan in the observational year (deducted by non-performing loans). Q_2 is the mean value of balance of investment, here including short-term investment, security investment, long-term investment, deducted by reserve for loss of investment. Q_3 is calculated as yearly earning deducted by interest proceeds. W1, W2 are index having no dimension. Other variables are in hundreds of million RMB.

Giving the small size of sample , we specify $C(Q, W)$ in relatively simple form of Cobb-Douglas function for the feasibility of the estimation. Furthermore, due to insignificant differences between various inputs' price, it would easily give rise to the problem of over-identification, if more flexible forms of the cost function were applied (Berger, 1993). Then equation (5) turns into the following form:

$$rc_i = a_0 + a_1 q_{1i} + a_2 q_{2i} + a_3 q_{3i} + a_4 w_{1i} + a_5 w_{2i} + \varepsilon_i + u_i \tag{6}$$

The variables here in lowercase are the logarithmic form of the variables listed in table 1; ε_i is random error, subject to $N(0,\sigma_v^2)$ distribution. μ_t denotes the term of bank's inefficiency, which is subject to semi-normal distribution ($\left|N(0,\sigma_v^2)\right|$). Taking account the linear homogeneity of inputs, we impose a linear restriction on equation (6): $a_4 + a_5 = 1$, and reach the following form:

$$rc_i - w_{1i} = a_0 + a_1 q_{1i} + a_2 q_{2i} + a_3 q_{3i} + a_5(w_{2i} - w_{1i}) + \varepsilon_i + \mu_i \quad (7)$$

Next, we use Frontier 4.1 package to estimate (7) with maximum likelihood method. As a customary practice in the estimation of an entity's micro-efficiency, we estimate $\sigma^2 = \sigma_u^2 + \sigma_v^2$ and $\lambda = \sigma_v / \sigma_u$ respectively, instead of directly estimating σ_u^2 and σ_v^2. The estimation results of equation (7) are given in table 2.

Table 2: Estimation Results of Frontier Cost Function

	a_0	a_1	a_2	a_3	a_5	σ^2	λ
Parameter estimated	2.03	0.76	0.17	0.015	0.41	0.017	0.7
Standard error	0.16	0.049	0.06	0.028	0.065	0.0089	0.21
T statistics	12.7	15.6	2.88	0.53	6.32	2.00	3.25

From table 2, we find that a_1 is slightly less than one, which reveals slight economies of scale in more traditional operation (loans): when the amount of loan doubled, the real total cost does not increase accordingly. a_2 is far less than one indicating apparent economies of scale in investment. It should be noted that a_3 comes close to zero and remains insignificant, demonstrating that the intermediary business has no significant impact on individual banks' real cost, which could be expounded by the facts of under-development and insignificance of intermediary business for Chinese banking sector as a whole. In order to display the evolutionary pattern of banks' cost efficiency, we divide the whole sample into 6 sub-samples, namely, 1998-1999, 1999-2000, 2000-2001, 2001-2002, 2002-2003, and 2003-2004 respectively, and conduct separate estimation on equation (7) for each sub-sample. The estimated results, to our surprise, display substantial stability, implying the slow upgrading of banks' cost technology. Moreover, the estimated λ is increasing gradually after 2002, which could be understood through the fact that Chinese banking system has proved more efficient and competitive after reform and the gap of banks' cost efficiency has been widened ever since.

Then we estimate cost efficiency of individual banks with the following formula defined as equation (8) (Jondrow et al, 1982):

$$\hat{u}_i = E(u_i|\hat{e}_i) = \frac{\sigma\lambda}{1+\lambda^2}\left(\frac{\phi(\lambda\hat{e}_i)}{\Phi(\lambda\hat{e}_i)} + \lambda\hat{e}_i\right) \quad (8)$$

$\hat{u}_i$ denotes the inefficiency value of a bank, and $\hat{e}_i$ represents residual of regression; $\phi(\cdot)$ and $\Phi(\cdot)$ are, respectively, the density and distribution functions of a standardized normal random variable. Some descriptive statistics on the distribution of $\hat{u}_i$ across banks are given in Table 3.

Table 3: Descriptive Statistics on the Distribution of Inefficiency across Banks

	98-99	99-00	00-01	01-02	02-03	03-04
Mean value	0.088	0.070	0.081	0.072	0.068	0.077
Standard error	0.061	0.043	0.048	0.041	0.045	0.055
Median	0.083	0.055	0.062	0.056	0.050	0.066

As shown in Table 3, the variation of cost efficiency across banks has been increasing since 2001, revealing the ever-intense competition in the banking industry and keeping in line with the above-mentioned analysis. On average, during 2000-2003, cost efficiency of individual banks has gradually been improved (the value of inefficiency term decreases year by year). However, it should also be noticed that, for some unknown reason, the average cost efficiency is deteriorating after 2003.

Index for Inefficiency of Regional Banking System

We then use a weighted average to construct an index for the inefficiency of a regional banking system in which weights are the proportion of loans by a specific bank for a region to total loans issued in that region. The data for the loans of each bank at each region is mostly extracted from "Year Book of Chinese Finance". For some relatively small-sized commercial banks, the Year Book does not give regional data; we then create the regional data through multiplying total loans of that bank for one year by the proportion of regional GDP in the GDP of the whole nation.

The index we propose for the inefficiency of banking system for each region is therefore defined as follows:

$$\hat{\mu}_{jt} = \sum a_{ijt} \hat{u}_{it(t+1)} \tag{9}$$

$\hat{\mu}_{jt}$ denotes the value of the inefficiency for banking system of region j. And $\hat{u}_{it(t+1)}$ represents the value of inefficiency for bank i from year t to $t+1$; α_{ijt} is the ratio between loans of bank i issued in region j and total loans region j received in year t. Table 4 gives the results estimated for the value of inefficiency of banking system for each region in China.

From table 4, we conclude that: firstly, on average, during the former half period of 1998-2003, the efficiency of the banking system for every region is quite low, while in the latter half period the value of efficiency is high. This demonstrates that the recently launched series of reforms in the banking sector is beginning to have an effect. Secondly, in the fastest growing regions, such as Beijing, Shanghai, Guangdong Province, the efficiency of the banking system is higher, while in Hubei, Guangxi, Hunan Provinces, etc, whose growth rate is relatively lower, its banking system's efficiency is lower too.

Growth Regression-The Equation for Regression

The equation is established for the regression based on equation (3):

$$y_{it} = \alpha + \hat{\varphi} y_{i(t-1)} + \chi k_{i(t-1)} + \hat{\rho} \ln\left(1 - \hat{u}_{i(t-1)}\right) + \Psi S_{i(t-1)} + \eta_i + \varepsilon_{i,t} \tag{10}$$

Table 4: Value of Inefficiency of Banking System for Various Regions (Percentage)

	1998	1999	2000	2001	2002	2003
Beijing	6.80	5.47	6.00	5.01	4.33	4.23
Tianjing	6.45	6.60	7.80	5.91	5.93	6.53
Hebei	6.63	7.18	7.52	5.82	6.24	6.37
Shanxi	6.64	7.72	7.33	5.56	6.40	6.42
Inner Mongolia	6.37	7.39	6.77	4.96	5.89	5.77
Liaoling	6.71	7.37	7.41	6.01	6.27	6.53
Jiling	6.73	7.35	7.81	5.98	5.96	5.94
Heilongjiang	6.63	7.32	7.49	5.96	6.48	6.41
Shanghai	5.29	5.30	6.10	5.13	4.61	4.44
Jiangsu	5.93	5.53	6.56	5.38	5.16	5.21
Zhejiang	5.82	6.06	6.14	5.12	5.08	4.80
Anhui	6.46	7.42	7.43	5.95	6.34	6.97
Fujian	7.32	6.39	7.26	5.35	5.21	6.04
Jiangxi	7.66	7.49	7.53	5.66	6.04	5.95
Shandong	6.78	6.94	8.32	6.24	5.75	5.51
Henan	6.42	7.25	8.01	6.64	7.08	7.43
Hunan	6.66	6.94	8.52	6.53	6.14	6.48
Hubei	6.84	6.84	7.95	6.38	6.63	7.19
Guangdong	6.43	5.51	6.06	4.16	4.43	4.68
Guangxi	6.47	7.10	7.46	6.04	6.75	7.12
Hainan	6.96	6.32	10.67	8.95	7.39	7.51
Sichang	6.73	6.74	8.03	5.92	6.89	6.95
Guizhou	7.23	8.30	7.41	5.66	7.25	7.61
Yunnan	6.72	7.39	7.02	5.86	7.08	7.57
Tibet	7.57	7.49	6.53	5.12	8.06	8.44
Shaanxi	7.54	8.23	8.00	6.60	7.19	7.56
Gansu	7.01	7.73	6.88	5.55	6.83	7.52
Qinghai	7.12	8.02	7.05	5.37	6.70	6.88
Ningxia	7.05	7.73	7.27	5.58	6.53	6.46
Xinjiang	7.37	8.10	7.79	6.31	7.25	7.45
Chongqing	6.56	7.29	6.86	5.06	6.50	6.53

In this formula, $\overset{\wedge}{\varphi}$ is a key variable, and $\overset{\wedge}{\varphi} = \varphi + 1$. Only when the estimated value of $\overset{\wedge}{\varphi}$ is significantly less than one, does conditional convergence exist in the process of economic growth. χ and $\overset{\wedge}{\rho}$ are the same as the counterpart coefficients of equation (3). As it is mentioned in part 2, if $\overset{\wedge}{\rho}$ is significantly positive, then the banking system's effect of credit allocation on economic growth will occur. ε_{it} is residual term. y_{it} is the logarithm of GDP per capita of i th region in the t th year. k_{it} is the logarithm of ratio between total loans received by i th region and GDP of that region in t th year. $\overset{\wedge}{\mu}_{it}$ is the value of inefficiency of the banking system for the i th region and t th year. Table 4 lists the value of banking system's inefficiency for all the regions in China from 1998 to 2003. S_n is a vector containing various other variables, which have impacts on the steady state growth rate of a region. In this paper, $PRIV$, $CENT$, HUM, $TRADE$, and LAW are chosen as the components of vector S_n. $PRIV$ is used to denote the ratio of credit granted to the private sector in a region as a proportion of total loans issued by that region, in an attempt to understand the influence of private sector's development on regional growth rate. *CENT* is the proportion of non-state-owned commercial banks' issued loans in the total loans granted by the whole banking system in a specific region, which to some extent reflects the ownership structure of regional banking system. As a proxy for human capital, *HUM* is defined as the proportion of the population aged from 15 to 64 enrolled in middle schools and in higher education. *TRADE* is the proportion of total value of imports and exports in regional GDP, depicting the economic openness of that region. Finally yet importantly, *LAW* is the ratio of closed cases against total cases received by the regional courts to indicate the efficiency of the regional judicial system.

The data for the above-mentioned variables are all extracted from selective issues of "Chinese Year Book", "Year Book of Chinese Finance" and various regional statistic yearbooks. The data about judicial cases are obtained from regional court yearbooks. The time span of the sample ranges from 1998 to 2003. All the variables in the regression equation are logarithmic.

Due to the limitation of the small-sized sample, GMM method is used to estimate equation (10) (Gaselli et al, 1996), which is less demanding regarding sample size than the alternatives. All the computations reported in the following were carried out by using Easyreg International 2.0 package developed by State University of Pennsylvania.

Unit Root Test of Variables

For time-series empirical analysis, it is required that the series are stationary, otherwise, a co-integration test needs to be conducted. The sample in this paper is a sort of time series. Because the GMM method is applied and because the very nature of GMM is to conduct regression using the series in first differences, what we need in this paper is to ensure that the relevant series in first differences are stationary. The sample used here is panel data, so we employ LLC method developed by Levin and Lin (1993) to conduct unit root test. Table 5 gives the test results.

Table 5: Unit Root Test of Variables

variables	y	k	$Ln(1-\hat{\mu})$	Ln(PRIV)	Ln(CENT)	Ln(HUM)	Ln(TRADE)	Ln(LAW)
Level value	9.13	-30.66^{***}	2.61	6.52	5.85	10.56	3.14	-10.23^{***}
Value in first differences	-32.65^{***}	-42.53^{***}	-40.65^{***}	-10.28^{***}	-8.92^{***}	-20.35^{***}	-15.52^{***}	-35.73^{***}

*Note: ***(**、*) indicates that the results are significant at 1%、(5%、10%) level of confidence.*

Table 5 shows that the level value of all variables except k and $Ln(LAW)$ have a unit root; but only at the 1% level of confidence, the value in first differences of all variables does not have unit root, so it is not necessary to conduct co-integration test for all of these variables.

ESTIMATION RESULTS

Table 6 gives the results of estimation. In regression one, the coefficient of $y(-1)$ -the value of $\hat{\varphi}$- is significantly larger than one. This outcome indicates that, if only two variables, k and the inefficiency term of banking system, are included into equation (10), the variation of growth rate for all the regions will tend to increase and the phenomenon of so-called "absolute divergence" will occur. Besides, a significantly negative coefficient of k is achieved, which is inconsistent with theoretical supposition. However, the positive coefficient of $Ln(1-\hat{u})$ coincides with our prediction despite of the fact that it is not significant.

From regression two to eight, in most cases, the value of $\hat{\varphi}$ is significantly less than one. Therefore, when the relevant variables, which affect the steady state growth rate, are added into the growth equation, such as human capital, the economic growth of all the regions in China will show the salient feature of "conditional convergence". Besides, the coefficient of k is positive in all regressions except for regression four, indicating that for a specific region, keeping other variables constant, the larger the ratio of loans for that region and its GDP, the higher its growth rate is. In the central and western regions of China, whose growth rate is relatively lower, the economic growth is mainly impelled by investment. Consequently, compared with other regions, relatively larger ratio of banks' loans and regional GDP can be found. While in the fast growing eastern coastal areas, private business, joint ventures and foreign-funded companies are the main contributors to economic growth. In that case, the ratio of loans as a proportion of regional GDP is relatively low. Therefore, it seems that the ratio between the credit size and GDP is negatively correlated with growth rate. However, when controlling the effects of some variables, for instance, economic openness, human capital, etc, the real impact of the banking system's credit on economic growth is indeed positive. This may help explain the huge discrepancy between the estimated coefficient on k in regression one and coefficients of k in most other regressions. It is noteworthy that nearly all regressions achieve a statistically significant and positive coefficient of $Ln(1-\hat{u})$. It keeps in line with theoretical prediction in this paper: the efficiency of credit allocation of the banking system has positive impacts on regional economic growth. Therefore, our empirical evidence here demonstrates that, at least in China, not only does the widely recognized effect of capital accumulation of banking system exists, but the effect of credit allocation also exists.

Table 6: Main Results of Empirical Analysis

	One	**Two**	**Three**	**Four**	**Five**	**Six**	**Seven**	**Eight**
Constant	0.0612 (4.42)	0.0531 (3.93)	0.0814 (8.45)	0.0351 (3.75)	0.0695 (5.87)	0.0487 (4.29)	0.00981 (1.87)	0.0311 (2.64)
Y(-1)	1.105 (2.47)	0.941 (2.05)	0.968 (2.21)	0.934 (3.48)	0.897 (2.21)	0.355 (0.46)	0.937 (1.92)	0.940 (3.93)
K	-0.0311 (2.14)	0.0225 (2.68)	0.0317 (2.54)	-0.0154 (-0.312)	0.0519 (1.98)	0.0365 (3.75)	0.0213 (1.71)	0.0383 (4.18)
Ln(1- $\hat{\mu}$)	0.0109 (-0.54)	0.0651 (-4.67)		0.0515 (2.77)	0.0396 (5.65)	0.0387 (-1.51)	0.0525 (5.02)	0.0412 (-3.01)
Ln(PRIV)		0.0821 (7.77)	0.0781 (10.28)		0.117 (-4.45)	0.0891 (4.66)	0.0855 (7.02)	0.0799 (3.99)
Ln(CENT)		0.110 (3.06)	0.0796 (2.13)	0.109 (1.99)		0.0811 (2.41)	0.0981 (1.55)	0.0759 (2.95)
Ln(HUM)		0.0121 (6.20)	0.0237 (5.42)	0.0147 (6.18)	0.0176 (6.57)		0.0215 (5.97)	0.023 (6.53)
Ln(TRADE)		-0.0154 (1.98)	-0.0315 (2.17)	-0.0215 (2.88)	-0.0189 (2.07)	-0.0511 (3.19)		-0.0377 (3.09)
Ln(LAW)		0.00714 (1.25)	0.00915 (0.89)	0.00021 (0.173)	0.00355 (1.14)	0.0093 (1.08)	0.0102 (0.089)	
Adjusted R^2	0.237	0.551	0.364	0.417	0.501	0.492	0.355	0.587

Note : T-statistics in parenthesis

Comparing the results of regression two and three, we find that fitness of the regression is greatly improved, when the inefficiency term included into the growth equation. We conclude that the impact of banking system efficiency on regional economic growth cannot afford be neglected in this respect.

Finally, we look into the impact of other financial, control variables on economic growth. In light of Table 6, we find that, in China, human capital and private economy all exert strong, positive influence on regional growth, i.e. the bigger the stock of human capital in a region and the proportion of the loans granted to the private economy, the higher is the regional economic growth rate. Moreover, the coefficient of $Ln(CENT)$ is positive, showing that the structure of the banking system can also affect regional economic growth. More exactly, the bigger the proportion of loans issued by middle-sized non-state-owned banks to total loans for a region, the faster that region's economy grows. Recent research by Chi Guotai, Sun Xiufeng and Lu Dan (2005) shows that, in China, the average efficiency of non-state-owned banks outweighs that of four big state-owned banks. Therefore, the conclusions indirectly demonstrate that the higher efficiency of a banking system indeed facilitate economic growth. It is noteworthy that the efficiency of the judicial system barely affects regional growth, and the estimated coefficient of $Ln(LAW)$ is not significant in all the regressions. Indeed, the fitness or regression eight improves greatly after excluding this variable. This could mainly be expounded by the fact that, in China, the efficiency of the judicial system and its relevant arrangement are almost the same across regions. In addition, the estimated coefficient of $Ln(TRADE)$ is negative, in contrary to extant theories' prediction, and further explanations are needed, which are not included in this paper.

CONCLUSIONS

This paper constructs an index for the banking system's efficiency based on the micro-efficiency of individual banks, and analyzes panel data from 27 provinces and 4 cities directly under the jurisdiction of the Chinese central government. After that, we put this index into a growth equation and analyze the relationship between the banking system's efficiency and regional economic growth. The supposition in this paper is that there is some correspondence between the banking system's efficiency and its ability in screening quality borrowers and optimizing credit allocation for a region. Therefore, the research in this paper empirically investigates the impact of banks' ability in optimizing credit allocation on China's regional growth rate. The conclusion is that, in respect to the role of facilitating the economic growth, the banking system of China not only has the capital accumulation effect, but also demonstrates the credit allocation effect.

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