Scale Economies and Efficiencies for Chinese Rural Credit Cooperatives

Fengxia Dong
Ph.D candidate
342 Waters Hall
Department of Agricultural Economics
Kansas State University
Manhattan, KS 66506
e-mail: fdong@agecon.ksu.edu

and

Allen Featherstone
Professor
313 Waters Hall
Department of Agricultural Economics
Kansas State University
Manhattan, KS 66506
e-mail: afeather@agecon.ksu.ed

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Background

Like many developing countries, small enterprises and farmers in China suffer from a lack of access to capital. They can rarely get credit from banks. In China, there are over 800 million rural inhabitants who engage in farming, forestry, fishery, and livestock and poultry; and there are over 20 million township and village enterprises (TVEs), which account for about 30% of GDP, an important force in the growth of the national economy. Although there are many commercial banks in China, they don't operate in the below-county-level areas due to the operation cost, high financial risk, and low return. The rural sector is now served by a state bank (Agricultural Bank of China), a policy bank (Agricultural Development Bank of China), and thousands of Rural Credit Cooperatives (RCCs).

RCCs were initiated in the early 1950s to combat usury and since have been the core of the rural financial system. The principle of RCCs is to serve agriculture, rural areas, and farmers. RCCs are a main force in rural finance and play a most important role in mobilizing rural household savings, channeling a significant share into loans made to TVEs, and funneling capital to agricultural and other development projects in the rural areas.

The rural credit cooperatives in China are not "cooperative" financial institutions by nature. According to the definition by the International Labor Organization in 1994, a

cooperative is a voluntary organized and democratically managed organization. And The Management Rules of Rural Credit Cooperatives in China in 1997 defines the credit cooperatives as an organization that members could voluntarily buy shares, implement democratic management, and share risks and benefits. However, China's RCCs have never met the above standards. The members, who join mostly under governmental regulation, have never managed the organizations and have no freedom to withdraw membership. Before 1996, RCCs were managed by the Agricultural Bank of China and only afterwards were restructured as a separate set of institutions. The RCCs are still partly under the control of the local governments which tend to increase the supply of capital to agricultural production with little attention paid to institutional sustainability. With control and interference of local governments and local branches of the state banks as well as problems in self-operation, the RCCs have a problem with non-performing loans. As such the People's Bank of China, the central bank, reported, the RCCs had a combined negative net worth.

Currently, there are many controversies regarding the future of RCCs. Some suggest the bankruptcy of RCCs, but since this would cause substantial financial losses to rural depositors, especially low-income rural households, it is politically difficult. Some propose to change the RCCs to the real cooperatives, but as Xie Ping analyzes, there is no environment for the existence of real cooperative system in China. One feasible proposal is to continue the existence of the nominal cooperative institutions but restructure the RCCs to commercial banks, reform RCCs' operation, and restrict the intervention of the government.

To restructure and reform RCCs, it is necessary to know more about the current scale and efficiencies for RCCs. Efficiencies in the RCCs may not exist for several

reasons. Firstly, under the management of the Agricultural Bank, the RCCs incentive to make loans to clients to make profit is limited and mostly they just transfer the saving surplus to the Agricultural Bank after the politically forced loans to TVEs or farmers. As such, bankruptcy or decrease of employees' salary was not a consequence. They virtually worked as saving institutions in rural areas. Secondly, there were over 650 thousand employees working for the RCCs with average per capita assets 21,900 thousand Yuan and average per capita cost as high as 42 thousand Yuan in 1999. If the RCCs are becoming more efficient, then improved profitability, greater amounts of funds intermediated, and better service quality for rural customers are expected.

This article will provide empirical evidence on the non-existence or existence of economies of scale and scope, and efficiencies in RCCs in China. The empirical results provide the basis for research on the restructuring of RCCs.

Estimation Approaches

Both parametric and nonparametric methods are used to evaluated scale economies and efficiencies in RCCs in China. The parametric method captures and isolates statistical noise present in the data but is less flexible due to an assumed functional form, while the nonparametric method is less restrictive without imposing a specific functional form, but cannot effectively remove noise from the data.

Parametric Method

With the parametric method, the normalized quadratic cost function is used to assess scale and scope economies in RCCs in China. The normalized quadratic cost function is a flexible functional form based on the second order Taylor series approximation.

The normalized quadratic cost function with m+1 inputs and n outputs is

$$C' = a_0 + \sum_{i=1}^{m} a_i w_i' + \sum_{j=1}^{n} b_i Y_i + \frac{1}{2}\left(\sum_{i=1}^{m}\sum_{j=1}^{m} a_{ij} w_i' w_j' + \sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij} Y_i Y_j\right) + \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij} w_i' Y_j$$

where C' is the normalized cost (cost divided by the m+1th input price), w_i' is the *i*th normalized input price, and Y_i is the *i*th output quantity. The normalized quadratic cost function is linear homogeneous in input prices and twice continuously differentiable. Homogeneity is realized by the normalization process and symmetry is imposed by setting $a_{ij}=a_{ji}$ and $b_{ij}=b_{ji}$. To be consistent with economic theory, the cost function must be concave in input prices and convex in outputs.

Using Shephard's lemma, the compensated input demand function (X_i) can be found by differentiating the cost function with respect to input prices:

$$X_i = \frac{\partial C'}{\partial w_i'} = a_i + \sum_{j=1}^{m} a_{ij} w_j' + \sum_{j=1}^{n} c_{ij} Y_j$$

The cost function and input demand functions are estimated simultaneously using the method of Seemingly Unrelated Regressions (SUR).

In a multiproduct firm, economies of scale result from two sources: product-specific economies and/or economies of scope. Product-specific economies hold all other products constant and see how cost changes as one or a group of products vary. The product-specific economies of scale ($S_i(Y)$) are measured by the ratio of average incremental cost (AIC_i) over it's marginal cost. The product-specific economies of scale are expressed as following:

$$S_i(Y) = \frac{AIC_i(Y)}{\frac{\partial C'}{\partial Y_i}} = \frac{\frac{[C'(Y) - C'(Y_{N-i})]}{Y_i}}{\frac{\partial C'}{\partial Y}}$$

where C'(Y) is the cost of producing the entire multiproduct output bundle; $C'(Y_{N-i})$ is the cost of producing all of the outputs except the *i*th output. If $S_i(Y)$ is greater than one, the product-specific returns to scale is increasing; if $S_i(Y)$ is less than or equal to 1, then the product-specific returns to scale is decreasing or constant, respectively.

Economies of scope, which arise from diversification, result from cost savings obtained from the simultaneous production of several different outputs in a single enterprise. It measures the relative increase in cost that would occur from splintering production of output bundle into separate groups when a firm is facing a given set of prices and other exogenous factors. The degree of economies of scope relative to set i ($SC_i(Y)$) is defined as

$$SC_i(Y) = \frac{[C'(Y_i) + C'(Y_{N-i}) - C'(Y)]}{C'(Y)}$$

Economies of scope exist if $SC_i(Y)$ is greater than zero, which indicate that the cost of producing the optimal level of outputs in individual firms is greater than the cost of producing the same level of outputs in a single multiproduct firm.

The combination of product-specific economies of scale and economies of scope yields the measure of overall returns to scale. The degree of the scale economies defined over the entire product set ($S_N(Y)$ is

$$S_N(Y) = \frac{C'(Y)}{\sum_{i=1}^{n} Y_i \frac{\partial C'(Y)}{\partial Y_i}}$$

If $S_N(Y)$ is greater than 1, then the returns to scale is said to be increasing; if $S_N(Y)$ is less than 1, then the returns to scale is said to be decreasing; if $S_N(Y)$ is equal to 1, it indicates

that the firm is operating at its optimum size and hence that the productivity of inputs cannot be improved by increasing or decreasing the size of the firm.

Nonparametric Method

With the nonparametric approach, data envelopment analysis (DEA) is used to measure technical efficiency, alloctive efficiency, economic efficiency and overall efficiency as well as economies of scale. DEA involves the utilization of mathematical programming techniques to construct a best-performance benchmark from the observed data on inputs and outputs. Measuring performance against best practice, firms can identify and then improve their less efficient practices. When there are many firms each producing multiple outputs from multiple inputs included in a DEA analysis, the benchmark of a firm will be made up of more than one firm unless the firm is the best-performance in producing all outputs. A firm will not usually be the best-performance in producing all outputs and consequently, the best-performance benchmark of a firm may include a number of firms that are best-performance in producing one or more outputs.

Pure technical efficiency is a measurement of how far off the production function a firm is. It indicates the potential reduction in inputs a firm can achieve by adopting the best production and/or management practices of the best-performance firm. Allocative efficiency is a measurement of pricing efficiency. It examines whether a firm is using the optimal input mix to produce the observed output. Allocative inefficiency occurs when a firm does not equalize marginal returns with true factor market prices. Economic efficiency, or X-efficiency is the combination of pure technical and allocative efficiency. To be economically efficient, a firm needs to optimize some economic goal, such as cost minimization or profit maximization. Allocative efficiency is about doing things right, and economic efficiency is about doing the right things right (Barr, Killgo, Siems, and

Zimmel). The overall efficiency represents the minimum cost of producing a level of output, given input prices and a constant returns to scale technology. It is a combination of pure technical efficiency, allocative efficiency and scale efficiency.

RCCs allocate resources and control internal processes by effectively managing their sources, facilities, and employees. RCCs that do this best are the best performance banks and are on the efficient frontier and have a measure with unit value. RCCs can employ DEA model to benchmark their processes and find potential areas for improvement.

Data and Procedures

The normalized quadratic cost function in this study consists of 5 outputs and 3 inputs. The outputs for RCCs are flow capital loan to TVEs (Y1), fixed asset loans to TVEs (Y2), agricultural loans (Y3), other loans (Y4), and the deposit to other banks (Y5). The outputs are based on the balance sheet of credit funds of RCCs. Flow capital loans to TVEs means the loans restricted to be used as flow capital, such as operating cash, inventory and short-term investment; and fixed asset loans are the loans restricted to be used for buying or constructing fixed assets. Agricultural loans are loans to country communities or individual farmers, which are used for buying machinery, fertilizer, or other production materials. Other loans refer to non-agriculture related loans not in the first three categories and include loans to industry or business. Different loans may have different interest rates that are set by the government to support some specific production. The inputs for RCCs consist of total fixed deposits (X1), total current deposits (X2), and employees (X3). Total assets are mostly composed of loans with fixed assets typically accounting for less than 2%. For this reason, along with data issues, fixed assets were not

included as an input. This is easily understood when looking at the RCCs' simple office supplies and small operating space in rural country.

The sample ranges from 1980 to 1995, and includes 29 out of 31 provinces and regions in China. Among them, Hainan province was set up in 1986 and before that, it was a part of Guangdong province and data are not available. Since Chongqing became a Central Government-Administered Municipality in 1997, the estimation looks it as a part of Sichuan province. Tibet is not included due to unavailable data. There are 457 observations. The source of the data is China Rural Finance Almanac in respective years. The cost and input prices are normalized using the interest rate of current deposit. The summary of the data is shown in the table 1.

Considering some associations among the performance of rural credit unions and the development of the regions where they are located as well as the favorable government policies for certain regions, analysis is conducted for the whole country and for six regions, which are North region, including Beijing, Tianjin, Hebei, Shanxi, and Inner Mongolia; Northeast region, including Liaoning, Jilin, and Heilongjing; East region, including Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, and Shandong provinces; Middlesouth region, including Henan, Hubei, Hunan, Guangdong, Guangxi, and Hainan; Southwest region, including Sichuan, Guizhou, and Yunnan; and Northwest region, including Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang (Figure 1).

Figure 1


Map of China
HEILONGJIANG
Harbin
Urumqi
Changchun
JILIN
BEIJING
Shenyang
XINJIANG
LIAONING
GANSU
Hohhot
HEBEI
INNER MONGOLIA
TIANJIN
Yinchuan
Taiyuan
Shijiazhuang
Xining
NINGXIA
SHANXI
Jinan
QINGHAI
SHANDONG
Lanzhou
Xian
Zhengzhou
JIANGSU
TIBET
SHAANXI
HENAN
Hefei
Nanjing
SHANGHAI
SICHUAN
Lhasa
Chengdu
Wuhan
ANHUI
Hangzhou
HUBEI
ZHEJIANG
CHONGQING
Changsha
Nanchang
Guiyang
HUNAN
Fuzhou
JIANGXI
GUIZHOU
FUJIAN
Taipei
Kunming
GUANGXI
GUANGDONG
TAIWAN
YUNNAN
Nanning
HONG KONG
MACAU
GuangZhou
Haikou
HAINAN

Table 1. Summary Statistics of Sample RCCs (457) Observations

Variable	Minimum	Maximum	Average	Standard Deviation
Y1-Flow capital loan to TVEs (¥0,000)	64	5458000	219240	508130
Y2-Fixed asset loans to TVEs (¥0,000)	0	1108700	39734	100810
Y3-Agricultural loan (¥0,000)	1653	1413000	162140	212130
Y4-Other loan (¥0,000)	0	2940700	78385	263140
Y5-Deposit to other banks (¥0,000)	0	2097700	233960	296870
X1-Fixed deposits (¥0,000)	1426	7333700	477990	837400
X2-Curent deposits (¥0,000)	5998	4792200	255560	455210
X3-Number of employees	979	67185	19131	13885
W1-Interest rate of fixed deposits (%)	5.3213	12.132	8.3415	2.2177
W2-Interest rate of current deposits (%)	1.92	3.15	2.7407	0.3506
W3-Average salary (¥)	559.28	13041	2610.7	2500.6

Empirical Results

Results from Parametric Methods

The cost function and two input demand equations were estimated using Iterative Seemingly Unrelated Regression (ITSUR) with and without curvature imposed. The curvature was imposed using Cholesky decomposition, which is shown by Featherstone and Moss.

Table 2 presents the price elasticity estimates for fixed deposit, current deposit, and employees with and without curvature imposed for the whole country and six regions. They were calculated at the mean of the input prices and output quantities. Price elasticity estimate for current deposit was recovered by homogeneity. For the whole country, the own-price elasticities without curvature imposed for fixed deposits and current deposits are positive. This indicates that curvature doesn't hold. With curvature imposed, all own-price elasticities are negative, which indicates that the input demand curves are downward sloping[*]. All own price elasticities are inelastic. Except in Northeast and Middle South regions, fixed deposit is net complements for both employee and current deposit.

Table 3 shows the product-specific economies of scale and economies of scope for each output and the economies of scale over the entire product set with and without curvature imposed. For the whole country, both without and with curvature imposed, flow capital loan to TVEs, fixed assets loan to TVEs, and deposit to other banks are produced at the mean with increasing returns to scale. This indicates that the RCCs could improve cost efficiency by increasing their sizes. But since both measures for flow

[*] The forward analysis will be referred to with curvature imposed. The analysis for without curvature imposed will be similar.

Table 2. Input Demand Price Elasticities

Region	Input	Price			Price		
		Fixed Deposit	Current Deposit	Employee	Fixed Deposit	Current Deposit	Employee
		Curvature not imposed			Curvature imposed		
Country	Fixed Deposit	0.0835	-0.0831	-0.0003	-0.0001	0.0003	-0.0002
	Current Deposit	-0.4541	0.4506	0.0035	0.0017	-0.0044	0.0027
	Employee	-0.2834	0.5320	-0.2485	-0.1589	0.4051	-0.2462
North	Fixed Deposit	-0.0001	0.0007	-0.0006	-0.0051	0.0056	-0.0005
	Current Deposit	0.0052	-0.0096	0.0044	0.0444	-0.0048	0.0041
	Employee	-0.5792	0.5644	0.0129	-0.4893	0.5350	-0.0456
Northeast	Fixed Deposit	0.0097	-0.0099	0.0002	-0.0002	-0.4244E-04	0.0002
	Current Deposit	-0.0710	0.0706	0.0004	-0.0003	-0.0001	0.0004
	Employee	0.1949	0.0513	-0.2462	0.2054	0.0462	-0.2015
East	Fixed Deposit	0.0014	-0.0012	-0.0002	-0.0001	0.0004	-0.0002
	Current Deposit	-0.0077	0.0037	0.0040	0.0023	-0.0063	0.0040
	Employee	-0.2169	0.5754	-0.3585	-0.2112	0.5697	-0.3584
Middle South	Fixed Deposit	0.0390	-0.0390	0.3169E-04	-0.6774E-05	-0.4978E-04	0.5655E-04
	Current Deposit	-0.1661	0.1642	0.0018	-0.0002	-0.0015	0.0017
	Employee	0.0240	0.3246	-0.3487	0.0421	0.3093	-0.3514
Southwest	Fixed Deposit	0.0488	-0.0479	-0.0009	-0.0007	0.0014	-0.0006
	Current Deposit	-0.2004	0.1945	0.0059	0.0061	-0.0111	0.0050
	Employee	-0.5310	0.8212	-0.2901	-0.3459	0.6315	-0.2856
Northwest	Fixed Deposit	0.0705	-0.0686	-0.0019	-0.0017	0.0025	-0.0008
	Current Deposit	-0.4621	0.4476	0.0145	0.0169	-0.0254	0.0084
	Employee	-0.9404	1.0771	-0.1367	-0.3934	0.5896	-0.1961

capital loan to TVEs and deposit to other banks are almost one, the effect of increasing the size won't be significant for these two outputs. Agricultural loans and other loans are produced with decreasing returns to scale, but also very close to constant returns to scale, so we can say that slight diseconomies exist for those two outputs. The degree of economies of scope measures the relative increase in cost that would occur from splintering production into two groups: the product being produced alone and the other four being produced together. For the whole country, both with and without curvature imposed, all measures are slightly negative, indicating that scope economies do not exist. With curvature imposed, the splintering of production of those five outputs will reduce costs by 5.85% to 6.73%. The combination of both product-specific economies of scale and economies of scope yield the overall measure of the returns to scale. The RCCs are producing at a decreasing return to scale for the country as a whole, indicating slight diseconomies of scale exist.

For North region, flow capital loan, other loan, and deposit to other banks are produced at increasing return to scale while the production of fixed assets loan to TVEs and agricultural loan are produced at decreasing return to scale. Only flow capital loan to TVEs has scope economies, which indicates that the combination of flow capital loan to TVEs with other else could reduce cost by 17.84%. Although except the flow capital loan to TVEs, all other products have negative measure on economies of scope, the values are very close to zero, which indicates only very slight scope diseconomies. Overall economy of scale is less than 1, which implies that for North region, the outputs are being produced in a region of decreasing returns to scale.

In Northeast region, both fixed assets loan to TVEs and deposit to other banks have

Table 3. Product-Specific Economies of Scale, Economies of Scope and Economies of Scale

Region	Output	Product-Specific Economies of scale		Economies of Scope		Economies of Scale	
		Curvature not imposed	Curvature Imposed	Curvature not Imposed	Curvature Imposed	Curvature not imposed	Curvature Imposed
Country	Flow capital loan to TVEs	1.0029	1.0024	-0.0188	-0.0673		
	Fixed ssets loan to TVEs	1.5903	5.3093	-0.0097	-0.0585		
	Agricultural loan	0.9970	0.9912	-0.0093	-0.0587	0.9920	0.9445
	Other loan	0.9954	0.9959	-0.0111	-0.0604		
	Deposit to head bank	1.0075	1.0073	-0.0115	-0.0609		
North	Flow Capital Loan to TVEs	1.0464	1.0463	-0.0616	0.1784		
	Fixed assets loan to TVEs	0.8497	0.8561	-0.0257	-0.0349		
	Agricultural loan	0.8760	0.9876	-0.0225	-0.0277	0.9230	0.9566
	Other loan	1.0868	1.0870	-0.0793	-0.0614		
	Deposit to head bank	1.0754	1.0758	-0.0748	-0.0010		
Northeast	Flow Capital Loan to TVEs	0.9664	0.8853	-0.0982	-0.1112		
	Fixed assets loan to TVEs	1.4336	1.0187	-0.1234	-0.1245		
	Agricultural loan	1.0019	0.8238	-0.0369	-0.0480	0.8932	0.9261
	Other loan	0.9936	0.9854	-0.0645	-0.0654		
	Deposit to head bank	1.0400	1.0291	-0.1003	-0.0987		
East	Flow Capital Loan to TVEs	0.9948	0.9945	-0.0608	-0.0610		
	Fixed assets loan to TVEs	1.0662	1.0659	-0.0735	-0.0741		
	Agricultural loan	0.8735	1.0160	-0.0543	-0.0549	0.9150	0.9459
	Other loan	0.9962	0.9961	-0.0681	-0.0686		
	Deposit to head bank	0.9826	0.9825	-0.0509	-0.0514		
Middle South	Flow Capital Loan to TVEs	0.9486	0.9542	0.0411	0.0193		
	Fixed assets loan to TVEs	1.0044	1.0142	-0.0309	-0.0537		
	Agricultural loan	1.0376	1.0244	-0.0268	-0.0570	0.9913	0.9635
	Other loan	0.9634	0.9587	-0.0081	-0.0295		
	Deposit to head bank	0.9910	0.9889	-0.0167	-0.0371		
Southwest	Flow Capital Loan to TVEs	2.4884	3.0673	-0.5147	-0.5147		
	Fixed assets loan to TVEs	1.2145	-0.6782	-0.0903	-0.1311		
	Agricultural loan	0.8276	1.1067	-0.3707	-0.3932	0.7547	0.8748
	Other loan	1.0726	1.0254	-0.1953	-0.2025		
	Deposit to head bank	0.5915	0.5665	0.1892	0.2029		
Northwest	Flow Capital Loan to TVEs	1.3645	1.3118	-0.2273	-0.2072		
	Fixed assets loan to TVEs	1.1389	1.1305	0.0009	-0.0247	0.8518	0.9630
	Agricultural loan	0.5516	0.8540	0.0554	0.0634		
	Other loan	0.8217	0.7909	0.0150	-0.0049		
	Deposit to head bank	0.8883	0.9176	0.0663	0.0319		

slight product-specific scale economies but very close to constant returns to scale; no one has scope economies. Economies of scale is lower than that in both North region and the country, which implies that the RCCs in Northeast were operating at a scale that deviated more from efficient level than in the North region and the country.

For East region, flow capital loan to TVEs, other loan, and deposit to other banks have decreasing returns to scale, while fixed assets loan to TVEs and agricultural loan have increasing returns to scale. Economies of scope do not exist for all outputs and outputs were being produced in a region of decreasing return to scale.

For Middlesouth region, the product-specific economies of scale are very similar to those for east region. Only flow capital loans to TVEs has economies of scope. The RCCs were producing at a little decreasing returns to scale with relatively highest value of the measurement among all regions which implies the RCCs in middlesouth region were closest to the efficient scale among all regions.

The RCCs in Southwest had biggest product-specific scale economies on the output of fixed assets loan to TVEs with the measure value 3.0673 and smallest one on deposit to head bank with the measure value 0.5665. This indicates that the RCCs in Southwest needs to increase their flow capital loan and decrease their deposits to the head bank. Only deposit to head bank has a scope economies, which indicates that the splintering of production into the deposit to head bank and other outputs would increase the cost by 20.29%. The splintering of production of other loans seems able to decrease cost tremendously. For example, if flow capital loan to TVEs was produced alone and the other four products were produced, the cost would be reduced by 51.47%. The overall scale diseconomies exist in Southwest region with smallest value of measurement

which implies the RCCs in Southwest were operating at a scale much further from efficient scale.

In the Northwest region, only loans to TVEs including flow capital and fixed assets loan have scale economies. The economies of scope exist for agricultural loan and deposit to head bank. The splintering of production into agricultural loan to TVEs and other outputs could increase cost by 6.3%. Very slight overall scale diseconomies exist for RCCs in the Northwest region.

The imposition of curvature changes the estimates very little. In addition, the imposition of curvature doesn't substantially affect the input demand elasticities, which is consistent with the results found by Featherstone and Moss in a study of agricultural banking in U.S., in which the imposition of curvature did not materially affect most of the elasticity estimates.

Results from Nonparametric Method

Since the efficiency estimates from nonparametric method are relative to the most efficient RCC in the sample which has a value of one, they cannot be directly compared to the estimates from parametric approach. The efficiency estimates obtained from the nonparametric method are presented in table 4.

Surprisingly, all regions were very technically efficient with mean values above 0.99. This indicates that the RCCs in all regions adopted almost same practices. They were operating very close to the relative production frontier. All regions are allocative inefficient, which results from government control of factor markets such that the market can't determine the interest rates and the price of other input according to the relative scarcity of resources. Allocative inefficiency results in economic inefficiency. All regions didn't have economies of scale. And in terms of returns to scale, 13 out of 457

Table 4. Results from Nonparametric Method.

Country

	Pure Technical Efficiency	Allocative Efficiency	Economic Efficiency	Scale Efficiency	Overall Efficiency
Mean	0.99629	0.44913	0.44805	0.82092	0.35996
Standard error	0.00640	0.25618	0.25656	0.18814	0.22324
Minimum	0.97	0.08	0.08	0.14268	0.06

North

	Pure Technical Efficiency	Allocative Efficiency	Economic Efficiency	Scale Efficiency	Overall Efficiency
Mean	0.99788	0.48088	0.48026	0.82916	0.40875
Standard error	0.00469	0.25661	0.25698	0.16062	0.26237
Minimum	0.98	0.1	0.1	0.37180	0.09

Northeast

	Pure Technical Efficiency	Allocative Efficiency	Economic Efficiency	Scale Efficiency	Overall Efficiency
Mean	0.99542	0.37333	0.37192	0.87612	0.33333
Standard error	0.00651	0.15303	0.15348	0.10321	0.16178
Minimum	0.98	0.11	0.11	0.60361	0.1

Southeast

	Pure Technical Efficiency	Allocative Efficiency	Economic Efficiency	Scale Efficiency	Overall Efficiency
Mean	0.99723	0.42134	0.42049	0.87403	0.37063
Standard error	0.00506	0.25986	0.25997	0.11261	0.23076
Minimum	0.98	0.09	0.09	0.55712	0.06

Middle South

	Pure Technical Efficiency	Allocative Efficiency	Economic Efficiency	Scale Efficiency	Overall Efficiency
Mean	0.99455	0.43830	0.43697	0.90807	0.40250
Standard error	0.00772	0.27647	0.27717	0.09341	0.25912
Minimum	0.97	0.08	0.08	0.58301	0.06

Southwest

	Pure Technical Efficiency	Allocative Efficiency	Economic Efficiency	Scale Efficiency	Overall Efficiency
Mean	0.99735	0.36612	0.36518	0.86257	0.32102
Standard error	0.00531	0.15178	0.15163	0.12395	0.15118
Minimum	0.98	0.12	0.1188	0.48339	0.09

Northwest

	Pure Technical Efficiency	Allocative Efficiency	Economic Efficiency	Scale Efficiency	Overall Efficiency
Mean	0.99525	0.56450	0.56305	0.58382	0.28925
Standard error	0.00779	0.28723	0.28795	0.25108	0.17200
Minimum	0.98	0.09	0.0882	0.14268	0.06

RCCs faced decreasing returns to scale and all others faced increasing returns to scale. The overall efficiency is low, which ranged from 0.29 to 0.41. That implies that the same level of outputs for RCCs could have been produced with about 59% to 71% less cost if all RCCs had been producing on the minimum cost frontier under constant returns to scale. Most of overall inefficiencies are due to allocative inefficiencies for regions except the Northwest, which is also partly due to scale inefficiency.

Conclusions

In this study, we employ both parametric and nonparametric methods to evaluate the economies of scale and efficiencies of Chinese Rural Credit Cooperatives across 16-year period.

From the results of parametric approach, the RCCs in all regions did not have economies of scale and they were operating in a region of slightly decreasing returns to scale. Therefore RCCs in those regions need to decrease their size to get cost efficiency, but effect is not significant. RCCs in most regions did not have economies of scope. Thus, combining rural lending into an institution that currently does not have such loans will not lead to scope economies. That shows potentially that the five kinds of loans lent by RCCs need to be separated. However, the effect was small except in Southwest region. Therefore, restructuring of RCCs in Southwest seems more necessary. One suggestion is to transfer these loan services to other banks, e.g., local agricultural bank or other commercial bank, to achieve cost efficiency. In addition, the flow capital loans to TVEs in Northeast and Northwest and fixed assets loan to TVEs in Northeast also need to be transfered from RCCs to other banks based on economies of scope. RCCs in some regions do have economies of scope on some outputs. For example, combining flow

capital loan to TVEs into the RCCs in North region that currently do not have that lending leads to scope economies and could reduce costs.

The results of nonparametric approach show that RCCs in all regions are all pure technical efficiency. However, since the measurement is a relative comparison, it does not mean that all RCCs have adopted the best practices for financial services other than RCCs. They need to compare with more modern financial services like those in developed countries and learn from them to improve the efficiency. RCCs in all regions are not allocative efficient. This may indicate that the input market in China is still distorted by government policies, which needs efforts from the government to liberalize the financial market. Most RCCs are economicly inefficient and overall inefficient due to the lack of allocative efficiency.

The results could provide insight into guidelines for the current effort to reform and restructure RCCs in China. But in addition, the government needs to regulate the intervention from local governments and local branches of state banks. In the meantime, the RCCs need to increase the employees' professional skill to decrease and further eliminate non-performing loans.

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