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**FIELDWORK REGARDING ECONOMICS
OF SCALE AND ECONOMIES OF DENSITY:
THE CASE OF A REGIONAL BANK**

Abstract

The objective of this research is to perform a comparative study regarding economics of scale and economies of density based on the case of a regional bank. In some researches regarding regional banks, the merger and expansion of service areas is suggested by reason of the economics of scale. In these researches, however the advantages of mergers and area expansion are not verified from the viewpoint of economies of density, nor do they consider the risks of mergers. In this research, the economic efficiency of a regional bank was simulated from the viewpoint of economics of scale and economies of density. The decision-making problem of the bank was to compare a narrow area that has high-density economic efficiency with the economic efficiency of a merger and area expansion. The real option of the bank was analysed by the Monte Carlo simulation method, and a desirable alternative plan was indicated accordingly.

Key words:

Economics of scale, economies of density, business value.

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1. The objective of the research

The objective of this research is to perform a comparative study regarding economics of scale and economies of density based on the case of a regional bank at a local level.

In some researches regarding the management of Japanese regional banks, the merger and expansion of service areas is suggested by reason of the economics of scale. In these researches, however the advantages of mergers and area expansion are not verified from the viewpoint of economies of density, nor do they consider the risks of mergers.

The business area of a Japanese regional bank is limited by financial law, so its scale and capital strength are inferior compared with a national-scale bank. Therefore, there are many cases in which a regional bank is reorganised by a major bank. In decision-making regarding the management of a regional bank, mergers and area expansion have become the mainstream today. However, there are some regional banks that are recognised as financial institutions taking on an important social mission by local users. These regional banks raise the density of corporate recourses, such as the branch, while narrowing a business area.

In this research, the economic efficiency of a regional bank was simulated from the viewpoint of economics of scale and economies of density. The decision-making problem of the bank was to compare a narrow area that has high-density economic efficiency with the economic efficiency of a merger and area expansion. The real option of the bank was analysed by the Monte Carlo simulation method. Through this research, a suggestion is given for the future of community-based financial institutions.

2. Survey of the precedent research and the derivation of hypotheses

The service area of a regional bank is regulated by financial law, and a loan business must be performed only within the determined area. In the area around which the economic growth hovers, it is particularly difficult for a regional bank to bear expected losses alone, such as a doubtful debt account expense or losses from bad debts. Therefore, many regional banks remove the limitation of the business area by merger with the aim of expanding the service area. This is survival plan is becoming the mainstream in the regional bank industry.

Miyamura (1992) measured a cost function between a factor price and a product. Like a national-scale bank, the economics of scale was recognised in a re-

gional bank. Inoue (2003) performed an analysis by the production function. Horie (2008) analysed a measurement formula regarding the size of a business and the ratio of general expenses to deposits. Both support the scale expansion of the regional bank by the merger. However, in these precedent researches, the effect of the merger is not verified by economies of density. In addition, the fruit of the merger is often emphasised, but the risks of the scale expansion are not evaluated.

The authors conducted a questionnaire-based survey for local medium and small-sized businesses in the service area of the case study bank in prior research (Matsuda & Isada, 2010). The questionnaires were distributed to groups of enterprises by the cooperation of the local economic organisation and employers' association. From a statistical analysis of the effective answers, the following conclusions were provided.

At first, many local medium and small-sized businesses accepted the validity of high lending rates by a certain condition. In other words, the customers of the regional banks accepted the setting of the lending rate as being balanced with the expected loss. However, there is disagreement as a result of the merger and area expansion of the regional bank regarding what the local medium and small-sized businesses pursued at the regional bank. The local medium and small-sized businesses expect the relationship with the regional bank to be reinforced. However, once the merger and area expansion is complete, communication with the regional bank and the local medium and small-sized business is apt to deteriorate, and the relationship can be easily weakened. When a relationship is rarefied, the validity of the interest rate is no longer accepted.

Based on these findings, the following hypotheses were derived in this research. Merger and area expansion has become the mainstream in the corporate strategy of regional banks. However, the local medium and small-sized businesses expect reinforcement of the relationship with the regional bank, and a corporate strategy to meet this expectation is desirable. The corporate strategy to concentrate corporate resources on certain areas can be superior to the continuation of the regional bank's acceptance in an area, thus raising the business value.

3. An approach

3.1. Decision-making problem

In this research, the following decision-making problem was simulated based on the case of an actual regional bank. To represent the choices the regional bank could make, the three following alternative plans were compared. For each alternative plan, the expected business value of the credit risk section of the bank five years later was estimated using a spreadsheet. The business

risk that made the expected business value criterion variables was simulated, and from those results, the risk-return was analysed.

1) Status quo (routine rationalisation)

This plan maintains the present conditions to provide a basis of comparison with the other plans. Here, the current branch area is maintained, and the abolition of an unprofitable branch is considered.

2) Merger and area expansion

This plan is concerned with the economics of scale. A merger with other regional banks in the neighbouring areas is assumed while conforming to financial law.

3) Narrow area and densification

This plan is concerned with the economies of density. At first, a faraway branch is transferred to the other regional banks. The clerical workforce, which had become abundant, is reduced. The aim of this plan is to strengthen communication with the user in a loan business. Therefore, the financing representative simply moves to another branch.

3.2. Real option analyses

First, various factors that influences the business value of the credit risk section of the regional bank were clarified. The spreadsheet documented each factorial influence, and the expected business value was estimated. Finally, various parameters regarding each factor along with the risk-return were simulated by the Monte Carlo method, and a trial option was analysed.

As a supplementary note, there is a credit risk section, a market risk section and an operational risk section in the profit section of the regional bank. The analysis in this research focused on the credit risk section because the necessary condition for a community-based financial institution to continue in an area is the continuation of the credit supplied to the area. In addition, the profit of the market risk section (employed funds gain) and of the operation risk section (sales commissions of financial products such as investment funds) are not as large now in either medium or small regional banks in Japan.

3.3. Various premises for risk-return analyses

3.3.1. Initial values

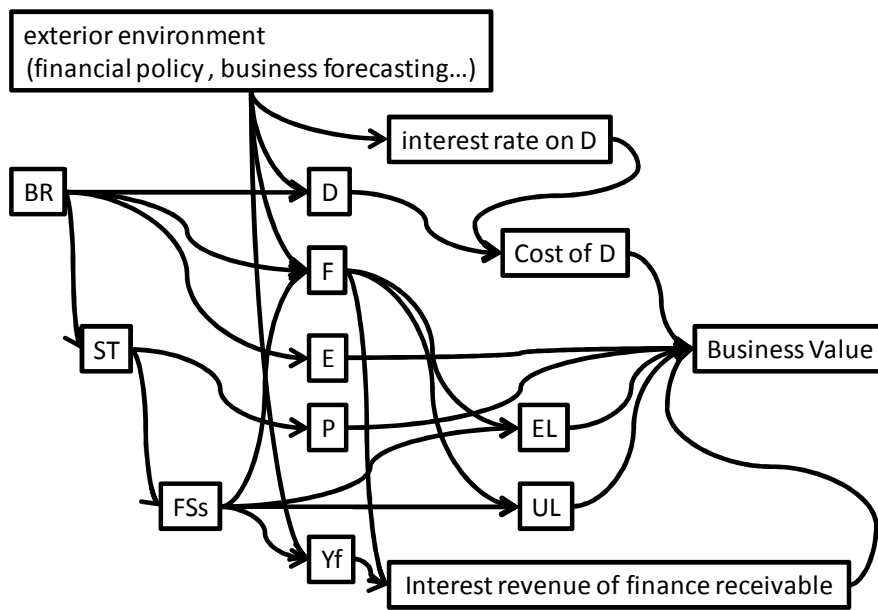
At first, various kinds of initial values in the expected business value simulation of each alternative plan were set. The most recent actual results were processed. Each initial value of expected loss, unexpected loss and credit risk limit are given below.

3.3.2. Explanatory variables (risk factors)

Various factors and the confluent relations influencing the business value of the credit risk section are indicated by Figure 1.

Figure 1

Various factors and the confluent relations influencing the business value



According to the premise of each alternative plan, the «number of the branch» (BR), the «number of staff» (ST) and the «financing staff ratios» (FSs) are fixed. Each confluent relation indicated by Figure 1 assumes the following formula (the dash) of the variable expresses an initial value):

- Cost of equipment (E) =E'(BR/BR')
- Personnel expenses (P) =P'(ST/ST')
- Financing staff per 1 branch (FS/BR) =ST {1+ (FSs-FS's)}
- Cost of equipment of the credit risk section (Ec)=E{(BR/BR'+FS/ST)/2}
- Personnel expenses of the credit risk section (Pc)=P(FS/ST)
- Yield rate of finances receivable (Yf) = Yf'{1+ (FS/BR-FS'/BR')}
- Expected loss (EL) =EL' {1+ (FS/BR-FS'/BR')}
- Financing average balance (F) =F'{1+ (BR-BR')/BR'}
- Daily average bank deposits (D) =D'{1+ (BR-BR')/BR'}
- Risk limit (RL) =RL'(F/F')
- Unexpected loss (UL) =UL' {1+(BR-BR')/BR'}
- Weighted average capital cost (WACC) =Yd (1-tax) {(F-CA)/F} +div (CA/F)

3.3.3. Probability distribution

The probability distribution of the variable in each alternative plan is assumed as follows. First, it should be noted that it is desirable to examine the adaptability of the probability distribution by Kolmogorov-Smirnov tests. However, a normal distribution is presumed except for some variables because there is little observed data in this research.

- (1) Finance receivable average balance, daily-average bank deposits

The rate of change of the average balance of the regional bank in the past decade was adopted as the standard deviation.

- (2) Yield rate of finance receivable, the rate of return of the interest on deposits

The yield of the regional bank in the past decade was adopted as the standard deviation.

- (3) Expected and unexpected losses

In the regional bank, the credit risk is measured by a value at risk method (VaR) to calculate the amount of the expected largest loss with a statistical tech-

nique. In this research, an initial value of unexpected loss (UL) was estimated from the most recent risk disclosure information of the regional bank. A normal distribution was assumed for the probability distribution. The initial value of expected loss (EL) (i. e., loan loss reserve) adopted the mean of the amount of doubtful debt accounts of the most recent decade. Finally, a uniform distribution was assumed for the probability distribution when reduction was expected by an alternative plan.

(4) Credit risk limit

The risk limit is applied to the credit risk section upon allocating the risk capital. In this research, a certain buffer in the present conditions was adopted in an initial value.

(5) Personnel expenses / cost of equipment

The rate of change of the actual results in the regional bank in the most recent decade was adopted as the standard deviation.

3.4. Criterion variables of simulation

The criterion variables of the simulation are expected business value. The net present value (NPV) is generally used as the business value. However, for the simulation in this research, market value added (MVA) was used for criterion variables in view of the specialty of the credit risk section in the finance business. MVA is a way of considering the return on investment after risk adjustment to divide the value that deducts EL from profit by UL. MVA is the accumulated total of the discounted value of economic added value (EVA) after a risk coordinated.

3.5 Risk simulation

First, an income and expenditure spreadsheet of the credit risk section for each alternative plan was made based on the presumption of the above-mentioned variables, and the MVA five years later was estimated. The results of the probability distribution of MVA estimated by various factors to influence business value were obtained by the Monte Carlo method (each trial was run 100,000 times).

The validity of each alternative plan was evaluated from this result, and the hypotheses were verified.

4. Verification of hypotheses by the simulation result

The estimated value of MVA in each alternative plan and the results of the Monte Carlo simulation are shown in table 1.

Table 1

The estimated value of MVA and the results of the simulation

Item	status quo	merger and area expansion	narrow area and densification
Estimated value (million yen)	525	721	884
Mean (million yen)	315	680	832
Standard deviation (million yen)	774	1,150	705
Coefficient of variation	2.46	1.69	0.85
Maximum (million yen)	2,484	3,901	2,807
Minimum (million yen)	-1,853	-2,540	-1,129
Largest loss / risk capital	142.54%	137.30%	107.32%
Reliability	99.42%	99.42%	99.47%
Standard error of the mean (million yen)	2	4	2

The MVA of «merger and area expansion» and the MVA of «narrow area and densification» considerably exceeded the MVA of «status quo». For the mean of the MVA provided by the Monte Carlo method, the values of «merger and area expansion» became more than double the value of «status quo», and the values of «narrow area and densification» also became more than double the value of «status quo». For the coefficient of variation, which divided the standard deviation of the MVA by the mean, the coefficient of variation of «merger and area expansion» was lower than that of «status quo». However, the variation exceeds the mean, which is not a favourable tendency. The coefficient of variation of «narrow area and densification» was less than 1, and the variation was less than the mean. It may be said that the risk of «narrow area and densification» is less than that of «status quo» or «merger and area expansion». For a difference with the maximum and minimum by reliability greater than 99%, «merger and area expansion» was the largest, «status quo» was

second, and «narrow area and densification» was the smallest. For the largest negative value in MVA, both «status quo» and «merger and area expansion» considerably exceeded the risk limit, which indicates that an owned capital is damaged and that the capital-asset ratio may be less than the minimum standard value in Japan. However, for «narrow area and densification», the largest loss in MVA was nearly covered by risk capital. If other buffers are considered, there is little possibility that a capital-asset ratio would be less than the minimum standard value in Japan.

From these results, «merger and area expansion» and «narrow area and densification» can expect improved business value compared with «status quo». Also, «merger and area expansion» is comparatively high risk and high return, and «narrow area and densification» is comparatively low risk and low returns turns.

The MVA rises in «narrow area and densification», and the risk is small; thus, it may be said that it is a more desirable alternative plan. In other words, for the estimated expected business value, the coefficient of variation based on the standard deviation of MVA, the possibility of damage of the minimum owned capital by the greatest loss of MVA, and the difference of the maximum and minimum of MVA, the «narrow area and densification» plan is superior to the other two plans. It may be said that the hypotheses of this research were verified.

5. Conclusion and discussion

The objective of this research is to weigh the economic efficiency of business from the viewpoint of economics of scale and economies of density. These viewpoints were applied to a regional bank as a study case, and a desirable alternative plan was indicated accordingly.

As a limit of this research, the hypotheses were verified with a simulation technique. A plurality of premises was set for the future regarding various kinds of uncertainty factors. For a future task, the influence of real various phenomena should be observed, and it is necessary to confirm the results of this research.

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