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## **Competition among Regional Banks in Japan: Evidence from the Boone Indicator**

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## Abstract

In this study, we use the method of Boone et al. (2007, How (not) to measure competition, TILEC Discussion Paper, No. 2007 - 014), known as the Boone indicator, to estimate competition in the banking industry in Japan. Classical methods, for example, market share, price-cost margin, and the Herfindahl-Hirschman Index, are not monotonically related to competition, so they are inappropriate. On the other hand, as many studies by Boone suggest, the Boone indicator can capture precisely the degree of competition. Our results show that the banking industry in Japan has been more competitive in recent years.

Keywords: Degree of competition, Boone indicator, Japanese regional banks

JEL Classification: G21, L13

## 1. Introduction

Since 1980, financial markets around the world have changed surprisingly because of globalization and deregulation. In Japan too, deregulation and mergers and acquisitions have occurred in the banking, securities, and insurance industries, and have led to the formation of huge banks and financial conglomerates. Furthermore, for some decades, the Japanese economy has undergone big changes: the bubble economy in the late 1980s, long-term recession in the 1990s, the financial "bigbang" between 1996 and 2001, and the sub-prime mortgage crisis in 2008. These shifts in the financial environment have provided changes in the financial structure as well as the state of competition.

Recently, researchers have argued about whether deregulation makes the banking industry more competitive. Berger et al. (2004) insist that banks' concentration and competition affect financial stability and economic growth. This has revealed the importance of investigating the state of bank competition. Moreover, Claessens and Laeven (2004) and Boone (2008a, 2008b) suggest that some classical competition indexes, for instance, the Herndahl-Hirschman Index (HHI), cannot capture the state of competition precisely. From this result, Claessens and Laeven (2004) emphasize an approach that considers firms' entry to the market, that is, contestability.

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There are many studies on the state of competition in the Japanese banking industry. Uchida and Tsutsui (2005) extend the methodology of Bresnahan (1982) and Lau (1982) to investigate panel data for Japanese banks from 1974 to 2000. They show that the banking industry had become more competitive by the mid-1980s, and that regional banks were more competitive than major city banks. On the other hand, Tsutsui (2009) estimates the price-cost margin (PCM) and the *H*-statistic to investigate the state of competition among Japan's regional banks. His result suggests that the lending market among Shinkin banks, relatively small regional banks, became competitive gradually. Furthermore, Molyneux et al. (1996) estimate the *H*-statistic and conclude that in 1986 and 1988, the state of competitiveness among Japanese city and regional banks was rather less competitive. Niimi (1998) uses the *H*-statistic to investigate competitiveness among the city banks and long-term credit banks before and after the bubble economy in the late 1980s. He finds that the state changed from "monopoly/coalition" to "monopolistic competition."

Besides the banking industry, other financial institutions in Japan have been investigated from a competition viewpoint by researchers. Tsutsui and Kamesaka (2005) investigate the competitive condition of the Japanese securities industry over the period 1983-2002 using the *H*-statistic and find that the industry was monopolistic between 1991 and 1996. Kubota and Tsutsui (2009) use a questionnaire survey in 2006-2007 to demonstrate from the results of the *H*-statistic and the PCM that the market for consumer credit is monopolistic. Souma and Tsutsui (2010) examine the change in the degree of competition in the Japanese life insurance industry during the period 1986-2002. In order to obtain the degree of noncompetition and collusion, they estimate the first-order condition for profit-maximizing insurance oligopolies. Their result suggests that competition has increased since 1995 in the industry.

On the other hand, Claessens and Laeven (2004) and Delis (2012) study the factors that trigger bank competition. Claessens and Laeven (2004) regress the *H*-statistic on the variables for banking system structures and contestability. They find that those variables are correlated with banks' competitiveness. Using the Boone indicator, Delis (2012) shows that the variables for financial reform, law quality, and bureaucratic quality make banks competitive. In addition, Uchida and Tsutsui (2005) regress their index of bank competition on a variety of variables. Their result suggests that the trading amount of government bonds affects the degree of bank competition.

In this study, we estimate the Boone indicator, for the Japanese regional banking industry from 1989 to 2009. The Boone indicator, introduced by Boone et al. (2007) and Boone (2008a), is an index that outperforms other competitive measures. We investigate the competitiveness for regional banks, second-tier regional banks, Shinkin banks, and credit unions in each year.

The main results are as follows. Whereas the estimated Boone indicator differs across categories, it tends to increase gradually, that is, the Japanese regional banking industry has become more competitive. For comparative purposes, we estimate the HHI, PCM, and *H*-statistic. Surprisingly, these measures suggest a decrease in the competitiveness of the regional banking industry. Our sample is in the period when a variety of deregulations were promoted, and thus, our results of the Boone estimator are intuitive relative to the other indexes.

The remainder of this paper is as follows. Section 2 introduces the Boone indicator and explains the methodology of estimation and our data. Section 3 demonstrates the estimated Boone indicator. Section 4 compares the results with other measures of competition. Section 5 concludes.

## 2 The method

#### 2.1 The Boone indicator

Boone et al. (2005, 2007) and Boone (2008a, 2008b) present some measures for competitiveness.

Their common feature is that in a competitive market, more efficient firms obtain higher profits. These measures are called the "Boone indicator."<sup>1</sup> In this subsection, we explain the Boone indicator in the context of banking.

Bank i (i = 1, ..., N) maximizes profit

$$\pi_i = r_L L_i - C(D_i, L_i), \tag{1}$$

where  $L_i$  denotes loans,  $D_i$  is deposits,  $r_L > 0$  is the interest rate of the loans, and  $C(\cdot, \cdot)$  is the cost function. The balance sheet of bank *i* is  $L_i = D_i$ . For simplicity, we assume that each bank faces demand for bank lending,

$$r_L = a - bL_i - d\sum_{j \neq i} L_j,$$
<sup>(2)</sup>

and the cost function,  $C(D_i, L_i) = c_{Di} D_i + c_{Li} L_i$ . In addition, we assume there is an entry cost  $\gamma$ , so bank *i* enters the loan market when  $\pi_i \ge \gamma$ .

From these assumptions, we obtain

$$\pi_i = \left(a - bL_i - d\sum_{j \neq i} L_j\right) L_i - c_i L_i,\tag{3}$$

where  $c_i = c_{Li} + c_{Di}$ . The first-order condition is

$$a - 2bL_i - d\sum_{j \neq i} L_j - c_i = 0.$$
 (4)

Using Eq. (4) for all banks, we solve for  $L_i$  as

$$L(c_i) = \frac{\left(\frac{2b}{d} - 1\right)a - \left(\frac{2b}{d} + N - 1\right)c_i + \sum_{j=1}^N c_j}{[2b + d(N-1)]\left(\frac{2b}{d} - 1\right)}.$$
(5)

From Eqs. (3), (4), and (5), we obtain

$$\pi_i = bL(c_i)^2. \tag{6}$$

So far, we have specified the functions. Generally, the profit function is written as a function of  $c_i$ ,  $\pi$  ( $c_i$ ). In addition, higher marginal cost leads to lower profit,  $\pi'(c_i) < 0$ . Put differently, if we denote  $z \equiv \partial \pi_i / \partial c_i$ , then

$$z_i \equiv \frac{\partial \pi_i}{\partial c_i} < 0. \tag{7}$$

 $z_i$  is greater as the market becomes competitive. If we denote the parameters that ease the state of competition as  $\theta = a$ , b,  $\gamma$  and the parameters that tighten the state of competition as  $\phi = d$ , N, we obtain

<sup>&</sup>lt;sup>1</sup> To our knowledge, the first study that named these measures the Boone indicator is Van Leuvensteijn et al. (2011).

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$$\frac{\partial z_i}{\partial \theta} = \frac{\partial^2 \pi_i}{\partial c_i \partial \theta} > 0, \qquad \frac{\partial z_i}{\partial \phi} = \frac{\partial^2 \pi_i}{\partial c_i \partial \phi} < 0.$$
(8)

These inequalities suggest that in a more competitive market, profits negatively react with marginal cost much more. Intuitively, in a competitive market, more effective firms outperform others, and thus, they should earn more profit. On the other hand, if firms are less effective, they should earn less profit.

Boone et al. (2007) propose a method to estimate the impact of marginal cost  $c_i$  on profit  $\pi_i$ . They estimate the marginal cost elasticity of profit

$$PE \equiv -\frac{c_i}{\pi_i} \frac{d\pi_i}{dc_i}.$$
(9)

Boone et al. (2007) call this profit elasticity (PE). Since firms with less costs have more profits, other things equal, PE is greater than zero. Competition makes efficient firms more profitable, and thus, the more competitive the sector is, the greater is PE. The earlier measures for competitiveness are criticized for several reasons. Suppose that there is a competitive market and that one of the firms came to be managed more efficiently. In other words, all firms in this market attempt as much as possible to earn more profit. Then, the firm that becomes effective earns more profit than others do. In this case, the Boone indicator indicates the more effective firm is more profitable, whereas the other measures do not. For instance, the HHI suggests that the market share of that firm is greater than before, and thus, the HHI indicates the firm is less competitive. For problems with the other measures, see Boone et al. (2005, 2007) and Boone (2008a).

There is criticism that the estimation of PE needs data for profits, which often comprises significant errors and that is why the PCM tends to be preferred. However, since the numerator of the PCM is price minus marginal cost, we obtain

$$PCM = \frac{p-c}{p} = \frac{(p-c)q}{pq} = \frac{\pi}{pq}.$$
 (10)

That is, Eq. (10) is rewritten as the ratio of profit to income. Therefore, the PCM substantively uses data for profits, and thus, the problem of some errors is inevitable. On the other hand, the estimation of PE contains an error term, which alleviates the problem of profit errors.

Moreover, Boone (2008a, 2008b) proves that under a moderate condition, a more competitive market brings a stronger effect of firms' efficiency on their profits, and the authors propose two indicators: relative profits (RP) and relative profit differences (RPD).<sup>2</sup> Any types of the Boone indicator monotonically change against a change in competitiveness.

#### 2.2 The estimation method

Following Boone et al. (2007), we estimate PE as follows. First, from the problem of firms' profit maximization, we obtain a profit function of marginal cost,  $\pi$  ( $c_i$ ). We take ln  $\pi$  ( $c_i$ ) as a first-order Taylor approximation with respect to ln  $c_i$ ,

$$\ln \pi_i = \alpha + \beta \ln c_i. \tag{11}$$

<sup>&</sup>lt;sup>2</sup> Boone et al. (2005) conduct a simulation, in which RP outperforms the other measures for competitiveness.

To estimate this equation, we add a vector of control variables,  $X'_i$ , and an error term with mean zero,  $\varepsilon_i$ ,

$$\ln \pi_i = \alpha + \beta \ln \hat{c}_i + X_i \zeta + \varepsilon_i. \tag{12}$$

Since the marginal cost is unobservable, we estimate the translog cost function to obtain the estimate of marginal cost,  $\hat{c_i}^3$ . Then, we obtain the estimate of the coefficient,  $\hat{\beta}$ , so that

$$\widehat{PE} = -\widehat{\beta},\tag{13}$$

is the estimate of PE. For the estimation, we use the ordinary least squares (OLS) estimator. While we estimate marginal costs by the translog cost function, the estimates can contain a measurement error, which could lead to endogeneity in the PE regression. To solve the errors-in-variable problem, we apply the two-stage least squares (2SLS) estimator.

It is important to note that the Boone indicator implicitly assumes that firms' profit is nonnegative. Boone (2008b, p. 1248, Definition 1) assumes firms' profit is greater than the entry cost  $\gamma_i$ , that is,  $\pi_i \ge \gamma_i$ . Since  $\gamma_i > 0$ , profit should be positive.

#### 2.3 Other estimation methods

Several researchers propose methods to estimate the Boone indicator. There are two methods to estimate PE. Schaeck and Cihak (2010) use the model,

$$\frac{\pi_i}{TA_i} = \alpha + \beta \ln c_i + \varepsilon_i, \tag{14}$$

where  $TA_i$  is total assets and  $\pi_i / TA_i$  is return on assets (ROA). However, the authors do not clearly explain the reason why the dependent variable is ROA instead of profit. ROA consists of total assets, and thus,  $\beta$  presents the effect of marginal cost not only on profit, but also on TA. This leads to estimation bias.

Next, Van Leuvensteijn et al. (2011) estimate the model,

$$\ln s_i = \alpha + \beta \ln c_i + \varepsilon_i, \tag{15}$$

where  $s_i$  is the share of products. Originally, Boone et al. (2007) criticize the share measures, and thus, the estimate of  $\beta$  is not the Boone indicator. In fact, Boone et al. (2005) compare the share measure with the Boone indicator, and conclude that the share measure can fail to capture the change in competitiveness. Therefore, the estimation by Van Leuvensteijn et al. (2011) is not reliable.

On the other hand, CPB Netherlands Bureau for Economic Policy Analysis (2000) presents an estimate of  $\beta$  in the model,

$$\frac{\pi_i}{\pi_0} = \alpha + \beta \frac{c_i}{c_0} + \varepsilon_i,\tag{16}$$

to obtain RP. Eq. (16) is assumed a linear relation between relative profit and relative cost. Taking the logarithms for these variables yields

$$\ln\frac{\pi_i}{\pi_0} = \alpha + \beta \ln\frac{c_i}{c_0} + \varepsilon_i.$$
(17)

In this case, as Boone et al. (2005) suggest, the estimate of  $\beta$  is equivalent to that in Eq. (12).

<sup>&</sup>lt;sup>3</sup> For the detailed estimation, see the Appendix.

## **3** Results

## 3.1 Data

We use the Boone (2007) competition indicator approach to assess the degree of competition in the Japanese regional banking industry. The Boone indicator, that is, PE, is calculated by the marginal cost elasticity of bank profit. We estimate the impact of marginal cost on profit of banks, where the coefficient  $\hat{\beta}$  is obtained, so that  $\hat{\beta}$  is the estimate of PE. The larger is PE, the more intense is competition. This indicator monotonically changes with a change in competitiveness. We use the two estimators, OLS and 2SLS. Furthermore, to compare the results, we present results using three alternative measures of competition: HHI, PCM, and Panzar and Rosse's (1987) *H*-statistic.

We select regional banks, including second-tier regional banks, Shinkin banks, and credit unions. We use bank-level data from the Nikkei NEEDS Financial Quest, the Zenkoku Shinyo Kinko Zaimu Syohyo, and the Zenkoku Shinyo Kumiai Zaimu Syohyo, databases containing bank financial statements. The estimation period is from fiscal year 1989 to 2009. We use data from unconsolidated accounts to avoid double counting. The actual estimated Eq. (12) requires data on profit  $\pi_i$  and marginal cost  $\hat{c}_i$ .  $\pi_i$ , which is the profit obtained by the bank from its lending operations, is defined as interest income minus interest expenses, personnel expenses, and equipment expenses. Since we study the lending market, our definition of bank profits should incorporate the costs of lending operations, that is, we subtract the lending losses from the profits. However, our dataset has few observations of lending losses.<sup>4</sup> As marginal cost cannot be observed, the estimation  $\hat{c}_i$ , obtained by estimating the translog cost function, was used (see the appendix for an explanation of the estimations). The variable used to estimate the translog cost function is as follows. Cost C is defined as the sum of interest on deposits, personnel expenses, and equipment expenses. The input factor  $w_1$  is the interest rate for fundraising, defined as the ratio of interest on deposits to total amount of deposits.  $w_2$  is the wage rate, defined as the ratio of personnel expenses to the number of employees. The share of input factor  $s_i$  is the ratio of interest on deposits to cost C. The output factor q is the total financial assets, defined as the total amount of loans. We use the 2SLS approach with the instrumental variable being the deposit-cost rate of the explanatory variable, marginal costs.<sup>5</sup>

 $X_i$  is the control variable vector. We use the capital adequacy ratios to control for differences in the soundness of the bank management, the ratio of securities to total assets to control for the differences in the amounts of securities held, the number of employees per branch to control for differences in the size of financial institutions, and the loan-to-deposit ratio to control for economies of scope. After considering that there is heterogeneity in the behavior between the business categories, we use a Shinkin banks dummy, credit unions dummy, share-listing dummy, and second-tier regional banks dummy. However, for estimates using only Shinkin banks and credit unions, the number of members is added.

At the stage prior to the analysis, to exclude the influence of outliers, values outside of the range of the mean value of profit and marginal  $\cot \pm \pm$  the standard deviation × 2.58, are excluded in each fiscal year for each business category. Moreover, the data set used for the estimates excludes banks that cannot be used for the necessary variables. In addition, financial institutions are excluded where data on profit and marginal cost cannot be used.

<sup>&</sup>lt;sup>4</sup> In Japan, moreover, during our sample period, a number of banks lent to bad firms, which is called "zombie lending." This implies that even if we could utilize lending losses, the results would not necessarily reflect the actual profits of banks.

<sup>&</sup>lt;sup>5</sup> The deposit-cost rate is defined as (interest paid for deposit) / (total amount of deposits) + (personnel expenses + equipment expenses) / (ordinary income).

	All fina	ncial institu	tions			Regiona	l banks			
	Mean	Std. Dev.	Median	Min.	Max.	Mean	Std. Dev.	Median	Min.	Max.
$\pi$ (log)	6.503	1.644	6.467	-1.580	10.722	8,808	0.949	8,906	5.024	10.722
$c (\log)$	-3.314	0.530	-3.432	-4.978	-1.738	-3.651	0.598	-3.854	-4.735	-2.412
$w_1$ (log)	-0.008	0.294	-0.017	-1.693	4.526	-0.007	0.280	-0.012	-1.159	1.312
$w_2$ (log)	-0.003	0.166	-0.004	-4.039	2.414	-0.004	0.152	0.003	-0.696	0.394
The total amount of loans (log)	11.295	1.703	11.211	5.076	15.642	13.837	0.814	13.955	11.358	15.642
The total amount of deposits (log)	11.733	1.601	11.627	5.829	15.839	14.099	0.837	14.211	11.590	15.839
Interest on loans (log)	8.054	1.616	7.982	2.187	12.930	10.401	0.798	10.430	8.074	12.930
Interest on deposits (log)	6.758	1.881	6.717	0.388	12.799	8.854	1.584	8.872	4.466	12.799
Bank loan interest rate (%)	4.266	1.806	3.617	-0.082	36.099	3.560	1.713	2.798	1.494	8.341
Bank deposit interest rate (%)	1.546	1.645	0.603	0.018	30.253	1.307	1.543	0.449	0.018	5.750
Total assets (log)	11.857	1.589	11.746	6.021	16.018	14.212	0.846	14.327	11.684	16.018
Ordinary income (log)	8.496	1.555	8.381	2.750	13.377	10.827	0.847	10.873	8.382	13.377
Capital ratio (%)	5.089	2.886	4.720	-58.535	161.124	4.012	2.366	3.937	-48.015	8.840
Ratio of securities (log)	16.612	11.650	15.144	0.000	173.877	19.042	6.440	17.896	0.517	46.129
Employees per branch (log)	2.627	0.345	2.639	0.100	6.879	2.768	0.238	2.775	1.382	3.562
Loan-to-deposit ratio (%)	67.019	52.585	68.319	7.252	6177.899	77.346	8.000	77.478	53.652	170.241
Ratio of non-performing loans (%)	7.830	6.731	6.533	0.000	81.228	4.700	4.023	4.017	0.038	53.191
Deposit-cost rate (%)	4.275	1.886	3.586	0.676	32.486	3.350	1.654	2.596	1.311	7.825
Average cost (log)	-3.140	0.515	-3.263	-4.998	-1.294	-3.462	0.518	-3.647	-4.375	-2.345
Debt ratio (log)	2.996	0.436	3.003	-0.653	7.320	3.187	0.325	3.193	2.333	6.632
Branches	29	36	15	1	284	97	42	91	20	284
Employees	469	704	203	2	24296	1647	912	1484	285	5110
Members	17341	18251	12037	45	361219					
N	14701					2352				
	Shinkin	banks				Credit 1	inions			
	Shinkin Mean	banks Std. Dev.	Median	Min.	Max.	Credit u Mean	mions Std. Dev.	Median	Min.	Max.
$\pi$ (log)	Shinkin Mean 6.626	banks Std. Dev. 1.079	Median 6.667	Min. -1.580	Max. 9.026	Credit v Mean 5.281	nions Std. Dev. 1.316	Median 5.440	Min. -1.339	Max. 8.044
$\pi$ (log) c (log)	Shinkin Mean 6.626 -3.300	banks Std. Dev. 1.079 0.500	Median 6.667 -3.481	Min. -1.580 -4.341	Max. 9.026 -2.079	Credit v Mean 5.281 -3.180	1110005 Std. Dev. 1.316 0.469	Median 5.440 -3.240	Min. -1.339 -4.978	Max. 8.044 -1.738
$\pi$ (log) c (log) $w_1$ (log)	Shinkin Mean 6.626 -3.300 -0.005	banks Std. Dev. 1.079 0.500 0.205	Median 6.667 -3.481 -0.012	Min. -1.580 -4.341 -0.865	Max. 9.026 -2.079 4.526	Credit v Mean 5.281 -3.180 -0.013	Std. Dev.           1.316           0.469           0.390	Median 5.440 -3.240 -0.031	Min. -1.339 -4.978 -1.693	Max. 8.044 -1.738 2.192
$\pi (\log)$ $c (\log)$ $w_1 (\log)$ $w_2 (\log)$	Mean 6.626 -3.300 -0.005 -0.003	banks Std. Dev. 1.079 0.500 0.205 0.136	Median 6.667 -3.481 -0.012 -0.003	Min. -1.580 -4.341 -0.865 -4.039	Max. 9.026 -2.079 4.526 2.414	Credit v Mean 5.281 -3.180 -0.013 -0.002	Inions           Std. Dev.           1.316           0.469           0.390           0.206	Median 5.440 -3.240 -0.031 -0.009	Min. -1.339 -4.978 -1.693 -2.944	Max. 8.044 -1.738 2.192 2.380
$ \frac{\pi \text{ (log)}}{c \text{ (log)}} \\ \frac{w_1 \text{ (log)}}{w_2 \text{ (log)}} \\ \text{The total amount of loans (log)} $	Shinkin 6.626 -3.300 -0.005 -0.003 11.453	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971	Median 6.667 -3.481 -0.012 -0.003 11.420	Min. -1.580 -4.341 -0.865 -4.039 8.166	Max. 9.026 -2.079 4.526 2.414 14.531	Credit o Mean 5.281 -3.180 -0.013 -0.002 9.916	tunions Std. Dev. 1.316 0.469 0.390 0.206 1.331	Median 5.440 -3.240 -0.031 -0.009 10.089	Min. -1.339 -4.978 -1.693 -2.944 5.076	Max. 8.044 -1.738 2.192 2.380 13.453
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ The total amount of deposits \ (\log) \\ \end{array} $	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.911	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888	Max. 9.026 -2.079 4.526 2.414 14.531 14.982	Credit o <u>Mean</u> 5.281 -3.180 -0.013 -0.002 9.916 10.407	thions Std. Dev. 1.316 0.469 0.390 0.206 1.331 1.167	Median 5.440 -3.240 -0.031 -0.009 10.089 10.523	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829	Max. 8.044 -1.738 2.192 2.380 13.453 13.493
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ The total amount of deposits \ (log) \\ Interest on loans \ (log) \\ \end{array} $	Shinkin           Mean           6.626           -3.300           -0.005           -0.003           11.453           11.911           8.188	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589	Credit o Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798	Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348	Median 5.440 -3.240 -0.031 -0.009 10.089 10.523 6.982	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187	Max. 8.044 -1.738 2.192 2.380 13.453 13.493 10.563
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ The total amount of deposits \ (log) \\ Interest on loans \ (log) \\ Interest on deposits \ (log) \\ \end{array} $	Shinkin           Mean           6.626           -3.300           -0.005           -0.003           11.453           11.911           8.188           6.834	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421	Credit o Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696	Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605	Median 5.440 -3.240 -0.031 -0.009 10.089 10.523 6.982 5.710	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388	Max. 8.044 -1.738 2.192 2.380 13.453 13.493 10.563 10.225
$ \begin{array}{l} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ \text{The total amount of loans (log)} \\ \text{The total amount of deposits (log)} \\ \text{Interest on loans (log)} \\ \text{Interest on deposits (log)} \\ \text{Bank loan interest rate (\%)} \end{array} $	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185	Credit of Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780	Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866	Median 5.440 -3.240 -0.031 -0.009 10.089 10.523 6.982 5.710 4.515	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082	Max. 8.044 -1.738 2.192 2.380 13.453 13.493 10.563 10.225 36.099
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ The total amount of deposits \ (\log) \\ Interest on loans \ (log) \\ Interest on deposits \ (log) \\ Bank \ loan interest rate \ (\%) \\ Bank \ deposit interest rate \ (\%) \\ \end{array} $	Shinkin 6.626 -3.300 -0.005 -0.003 11.451 8.188 6.834 4.129 1.463	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253	Mean           5.281           -3.180           -0.013           -0.002           9.916           10.407           6.798           5.696           4.780           1.771	Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666	Median 5.440 -0.031 -0.009 10.089 10.523 6.982 5.710 4.515 0.929	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020	Max. 8.044 -1.738 2.192 2.380 13.453 13.493 10.563 10.225 36.099 10.273
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ Interest on loans \ (\log) \\ Interest on deposits \ (log) \\ Bank \ loan interest rate \ (\%) \\ Bank \ deposit interest rate \ (\%) \\ Total assets \ (log) \\ \end{array} $	Shinkin 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129 1.463 12.031	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041	Credit u Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666           1.159	Median 5.440 -3.240 -0.031 -0.009 10.523 6.982 5.710 4.515 0.929 10.650	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021	Max. 8.044 -1.738 2.192 2.380 13.453 13.493 10.263 10.263 36.099 10.273 13.766
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ The total amount of deposits \ (log) \\ Interest on loans \ (log) \\ Interest on deposits \ (log) \\ Bank \ loan interest rate \ (\%) \\ Bank \ deposit \ interest rate \ (\%) \\ Total assets \ (log) \\ Ordinary \ income(log) \\ \end{array} $	Shinkin <u>Mean</u> 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129 1.463 12.031 8.636	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986 8.596	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877	Credit of Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541 7.238	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666           1.159           1.153	Median 5.440 -3.240 -0.031 -0.009 10.523 6.982 5.710 4.515 0.929 10.650 7.312	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021 2.750	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_2 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ The total amount of deposits \ (log) \\ Interest on loans \ (log) \\ Interest on deposits \ (log) \\ Bank \ loan interest rate \ (\%) \\ Bank \ deposit interest rate \ (\%) \\ Total assets \ (log) \\ Ordinary \ income(log) \\ Capital \ ratio \ (\%) \\ \end{array} $	Shinkin <u>Mean</u> 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129 1.463 12.031 8.636 5.391	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986 8.596 5.220	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142	Credit of Mean 5.281 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541 7.238 5.159	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.67           1.348           1.605           1.866           1.656           1.159           1.153           3.766	Median 5.440 -0.031 -0.009 10.089 10.523 6.982 5.710 4.515 0.929 10.650 7.312 4.435	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021 2.750 -58.535	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124
$ \begin{aligned} \pi & (\log) \\ c & (\log) \\ w_1 & (\log) \\ w_2 & (\log) \\ \text{The total amount of loans (log)} \\ \text{The total amount of deposits (log)} \\ \text{Interest on loans (log)} \\ \text{Interest on deposits (log)} \\ \text{Bank loan interest rate (\%)} \\ \text{Bank deposit interest rate (\%)} \\ \text{Total assets (log)} \\ \text{Ordinary income(log)} \\ \text{Capital ratio (\%)} \\ \text{Ratio of securities (log)} \end{aligned} $	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.453 11.453 8.684 4.129 1.463 12.031 8.634 5.391 18.295	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399	Median 6.667 -3.481 -0.012 -0.003 11.862 8.132 6.853 3.380 0.502 11.986 8.596 8.596 5.220 16.792	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927 0.122	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142 173.877	Mean           5.281           -3.180           -0.013           -0.02           9.916           10.407           6.798           5.696           4.780           1.771           10.517           7.238           5.159           13.160	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.659           1.153           3.766           15.037	Median 5.440 -0.031 -0.009 10.523 6.982 5.710 4.515 0.929 10.650 7.312 4.435 8.114	Min. -1.339 -4.978 -1.693 -2.944 5.879 2.187 0.388 -0.082 0.020 6.021 2.750 -58.535 0.000	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124 76.697
$\pi \text{ (log)}$ $c \text{ (log)}$ $w_1 \text{ (log)}$ $w_2 \text{ (log)}$ The total amount of loans (log) The total amount of deposits (log) Interest on loans (log) Interest on deposits (log) Bank loan interest rate (%) Bank deposit interest rate (%) Total assets (log) Ordinary income(log) Capital ratio (%) Ratio of securities (log) Employees per branch (log)	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.453 11.453 11.453 11.453 11.453 11.453 11.463 12.031 8.634 5.391 18.295 2.690	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399 0.285 0.285 0.285 0.285 0.285 0.285 0.285 0.966 0.976 0.976 0.976 0.976 0.976 0.977 0.956 0.977 0.956 0.976 0.976 0.976 0.977 0.956 0.976 0.936 0.936 0.9399 0.909 0.906 0.906 0.976 0.976 0.976 0.976 0.936 0.936 0.937 0.936 0.937 0.936 0.937 0.936 0.936 0.937 0.936 0.937 0.936 0.937 0.936 0.936 0.937 0.936 0.936 0.936 0.937 0.996 0.936 0.235 0.255 0.25	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986 8.596 5.220 16.792 2.671	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927 0.122 0.201	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142 173.877 6.879	Mean           5.281           -3.180           -0.013           -0.02           9.916           10.407           6.798           5.696           4.780           1.771           10.541           7.238           5.159           13.160           2.475	Inions           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666           1.153           3.766           15.037           0.403	Median 5.440 -3.240 -0.031 -0.009 10.089 10.523 6.982 5.710 4.515 0.929 10.650 7.312 4.435 8.114 2.485	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021 2.750 -58.535 0.000 0.100	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.255 36.099 10.273 13.766 10.806 161.124 76.697 5.354
$ \begin{aligned} \pi & (\log) \\ c & (\log) \\ w_1 & (\log) \\ w_2 & (\log) \\ The total amount of loans (log) \\ The total amount of deposits (log) \\ Interest on loans (log) \\ Interest on deposits (log) \\ Bank loan interest rate (%) \\ Bank deposit interest rate (%) \\ Total assets (log) \\ Ordinary income(log) \\ Capital ratio (%) \\ Ratio of securities (log) \\ Employees per branch (log) \\ Loan-to-deposit ratio (%) \end{aligned} $	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129 1.463 12.031 8.636 5.391 18.295 2.690 65.083	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399 0.285 72.962 2.962	Median 6.667 -3.481 -0.012 -0.003 11.420 8.132 6.853 3.380 0.502 11.986 8.596 5.220 16.792 2.671 64.483	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927 0.122 0.201 19.982 0.201	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142 173.877 6.879 6177.899	Credit of Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541 7.238 5.159 13.160 2.475 65.009	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666           1.159           1.153           3.766           15.037           0.403           19.392	Median 5.440 -3.240 -0.031 -0.009 10.523 6.982 5.710 4.515 0.929 10.650 7.312 4.435 8.114 2.485 68.290	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021 2.750 -58.535 0.000 0.100 7.252	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124 76.697 5.354 369.939
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ The total amount of deposits \ (log) \\ Interest on loans \ (log) \\ Interest on deposits \ (log) \\ Bank \ loan interest rate \ (\%) \\ Bank \ deposit interest rate \ (\%) \\ Total assets \ (log) \\ Ordinary \ income(log) \\ Capital \ ratio \ (\%) \\ Ratio \ of \ non-performing \ loans \ (\%) \\ Ratio \ of \ non-performing \ loans \ (\%) \\ \end{array} $	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129 1.463 12.031 8.636 5.391 18.295 2.690 65.083 7.956	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399 0.285 72.962 5.301 	Median 6.667 -3.481 -0.012 -0.003 11.420 8.132 6.853 3.380 0.502 11.986 8.596 5.220 16.792 2.671 64.483 7.258	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927 0.122 0.201 19.982 0.000	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142 173.877 6.879 6177.899 81.228	Credit of Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541 7.238 5.159 13.160 2.475 65.009 9.944	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666           1.153           3.766           15.037           0.403           19.392           9.258	Median 5.440 -0.031 -0.009 10.089 10.523 6.982 5.710 4.515 0.929 10.650 7.312 4.435 8.114 2.485 68.290 8.513	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021 2.750 -58.535 0.000 0.100 7.252 0.000	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124 76.657 5.354 369.939 67.310
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ The total amount of deposits \ (log) \\ Interest on loans \ (log) \\ Interest on deposits \ (log) \\ Bank \ loan interest rate \ (\%) \\ Bank \ deposit interest rate \ (\%) \\ Total assets \ (log) \\ Ordinary \ income(log) \\ Capital \ ratio \ (\%) \\ Ratio \ of securities \ (log) \\ Employees \ per \ branch \ (log) \\ Loan-to-deposit \ ratio \ (\%) \\ Ratio \ of \ non-performing \ loans \ (\%) \\ Deposit-cost \ rate \ (\%) \\ \end{array} $	Shinkin 6.626 -3.300 -0.005 -0.003 11.911 8.188 6.834 4.129 1.463 12.031 8.636 5.391 18.295 2.690 65.083 7.956 4.228	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399 0.285 72.962 5.301 1.767 0.455	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986 8.596 5.220 16.792 2.671 64.483 7.258 3.462	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927 0.122 0.201 19.982 0.000 1.452 4.262	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142 173.877 6.879 6177.899 81.228 32.486	Credit of Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541 7.238 5.159 13.160 2.475 65.009 9.944 4.763	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666           1.153           3.766           15.037           0.403           19.392           9.258           1.977	Median 5.440 -0.031 -0.009 10.523 6.982 5.710 4.515 0.929 10.650 7.312 4.435 8.114 2.485 68.290 8.513 4.265	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021 2.750 -58.535 0.000 0.100 0.7252 0.000 0.676 -676	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124 76.697 5.354 369.939 67.310 17.594
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans \ (\log) \\ The total amount of deposits \ (log) \\ Interest on loans \ (log) \\ Interest on deposits \ (log) \\ Bank \ loan interest rate \ (\%) \\ Bank \ deposit \ interest rate \ (\%) \\ Total assets \ (log) \\ Ordinary \ income(log) \\ Capital \ ratio \ (\%) \\ Ratio \ of \ non-performing \ loans \ (\%) \\ Deposit-cost \ rate \ (\%) \\ Average \ cost \ (log) \\ Duble \ (log) \\ Dubl$	Shinkin           Mean           6.626           -3.300           -0.005           -0.003           11.453           11.911           8.188           6.834           4.129           1.463           12.031           8.636           5.391           18.295           2.690           65.083           7.956           4.228           -3.138	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399 0.285 72.962 5.301 1.767 0.477 0.477	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986 8.596 5.220 16.792 2.671 64.483 3.462 -3.308	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927 0.122 0.201 19.982 0.000 1.452 -4.192 0.000	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142 173.877 6.879 6177.899 81.228 32.486 -1.918	Credit of Mean 5.281 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541 7.238 5.159 13.160 2.475 65.009 9.944 4.763 -2.995	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666           1.153           3.766           15.037           0.403           19.392           9.258           1.977           0.500	Median 5.440 -3.240 -0.031 -0.009 10.523 6.982 5.710 4.515 0.929 10.650 7.312 4.435 8.114 2.485 68.290 8.513 4.263 -3.042 -3.042	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021 2.750 -58.535 0.000 0.100 7.252 0.000 0.676 -4.998	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124 76.697 5.354 369.939 67.310 17.594 -1.294 2.294
$ \begin{array}{c} \pi \ (\log) \\ c \ (\log) \\ w_1 \ (\log) \\ w_2 \ (\log) \\ The total amount of loans (log) \\ The total amount of deposits (log) \\ Interest on loans (log) \\ Interest on deposits (log) \\ Bank loan interest rate (\%) \\ Bank deposit interest rate (\%) \\ Total assets (log) \\ Ordinary income(log) \\ Capital ratio (\%) \\ Ratio of securities (log) \\ Employees per branch (log) \\ Loan-to-deposit ratio (\%) \\ Ratio of non-performing loans (\%) \\ Deposit-cost rate (\%) \\ Average cost (log) \\ Deb ratio (log) \\ \end{array} $	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129 1.463 12.031 8.636 5.391 18.295 2.690 65.083 7.956 4.228 -3.138 2.918	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399 0.285 72.962 5.301 1.767 0.477 0.373	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986 8.596 5.220 16.792 2.671 64.483 7.258 3.462 -3.308 2.898	$\begin{array}{c} {\rm Min.} \\ -1.580 \\ -4.341 \\ -0.865 \\ -4.039 \\ 8.166 \\ 7.888 \\ 4.873 \\ 2.357 \\ 1.432 \\ 0.025 \\ 8.784 \\ 5.465 \\ -55.927 \\ 0.122 \\ 0.201 \\ 19.982 \\ 0.000 \\ 1.452 \\ -4.192 \\ 0.687 \end{array}$	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142 173.877 6.879 6177.899 81.228 32.486 -1.918 5.426	Credit of Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541 7.238 5.159 13.160 2.475 65.009 9.944 4.763 -2.995 3.017	$\begin{array}{c} \text{Inions} \\ \hline \\ \text{Std. Dev.} \\ 1.316 \\ 0.469 \\ 0.390 \\ 0.206 \\ 1.331 \\ 1.167 \\ 1.348 \\ 1.605 \\ 1.866 \\ 1.666 \\ 1.159 \\ 1.153 \\ 3.766 \\ 15.037 \\ 0.403 \\ 19.392 \\ 9.258 \\ 1.977 \\ 0.500 \\ 0.523 \end{array}$	Median 5.440 -3.240 -0.031 -0.009 10.523 6.982 5.710 4.515 0.929 10.650 7.312 4.435 8.114 2.485 68.290 8.513 4.263 -3.042 3.068	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021 2.750 0.000 0.100 7.252 0.000 0.100 7.252 0.000 0.676 -4.998 -0.653 -0.653	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124 76.697 5.354 369.939 67.310 17.594 -1.294 7.320
$\pi$ (log) c (log) $w_1$ (log) $w_2$ (log) The total amount of loans (log) The total amount of deposits (log) Interest on loans (log) Interest on deposits (log) Bank loan interest rate (%) Bank deposit interest rate (%) Total assets (log) Ordinary income(log) Capital ratio (%) Ratio of securities (log) Employees per branch (log) Loan-to-deposit ratio (%) Ratio of non-performing loans (%) Deposit-cost rate (%) Average cost (log) Debt ratio (log) Branches	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129 1.463 12.031 8.636 5.391 18.295 2.690 65.083 7.956 4.228 -3.138 2.918 2.138	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399 0.285 72.962 5.301 1.767 0.477 0.373 15 1.51	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986 8.596 5.220 16.792 2.671 64.483 7.258 3.462 -3.308 2.898 17	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927 0.122 0.201 19.982 0.000 1.452 -4.192 0.687 1 	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142 173.877 6.879 6177.899 81.228 32.486 -1.918 5.426 113	Credit of Mean 5.281 -3.180 -0.013 -0.002 9.916 4.780 5.696 4.780 1.771 10.541 7.238 5.159 13.160 2.475 65.009 9.944 4.765 -2.995 3.017 8	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666           1.159           1.153           3.766           15.037           0.403           19.392           9.258           1.977           0.500           0.523           8	$\begin{array}{c} \text{Median} \\ \hline 5.440 \\ -3.240 \\ -0.031 \\ -0.009 \\ 10.523 \\ 6.982 \\ 5.710 \\ 4.515 \\ 0.929 \\ 10.650 \\ 7.312 \\ 4.435 \\ 8.114 \\ 2.485 \\ 68.290 \\ 8.513 \\ 4.265 \\ -3.042 \\ 3.068 \\ 6 \\ -5.75 $	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 0.020 6.021 2.750 0.000 0.100 7.252 0.000 0.100 7.252 0.000 0.653 -4.998 -0.653 1 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.553 0.555	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124 76.697 5.354 369.939 67.310 17.594 -1.294 7.320 78
$\pi \text{ (log)}$ $c \text{ (log)}$ $w_1 \text{ (log)}$ $w_2 \text{ (log)}$ The total amount of loans (log) Interest on loans (log) Interest on deposits (log) Bank loan interest rate (%) Bank deposit interest rate (%) Total assets (log) Ordinary income(log) Capital ratio (%) Ratio of securities (log) Employees per branch (log) Loan-to-deposit ratio (%) Ratio of non-performing loans (%) Deposit-cost rate (%) Average cost (log) Betratio (log) Branches Employees	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129 1.463 12.031 8.636 5.391 18.295 2.690 65.083 7.956 4.228 -3.138 2.918 2.918 2.918	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399 0.285 72.962 5.301 1.767 0.477 0.477 0.373 15 411 10702	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986 8.596 5.220 16.792 2.671 64.483 7.258 3.462 -3.308 2.898 17 2455	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927 0.122 0.201 19.982 0.000 1.452 -4.192 0.687 1 11 277 277 1	Max. 9.026 -2.079 4.526 2.414 14.531 14.982 11.589 11.421 10.185 30.253 15.041 11.877 48.142 173.877 6.879 6177.899 81.228 32.486 -1.918 5.426 113 24296	Credit of Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541 7.238 5.159 13.160 2.475 65.009 9.944 4.763 -2.995 3.017 8 108	Inions           Std. Dev.           1.316           0.469           0.390           0.206           1.331           1.167           1.348           1.605           1.866           1.666           1.59           1.153           3.766           15.037           0.403           19.392           9.258           1.977           0.500           0.523           8           117	$\begin{array}{c} \text{Median} \\ 5.440 \\ -3.240 \\ -0.031 \\ -0.009 \\ 10.089 \\ 5.710 \\ 4.515 \\ 0.929 \\ 10.650 \\ 7.312 \\ 4.435 \\ 8.114 \\ 2.485 \\ 68.290 \\ 8.513 \\ 4.263 \\ -3.042 \\ 3.068 \\ 6 \\ 74 \\ 7890 \end{array}$	Min. -1.339 -4.978 -1.693 -2.944 5.076 5.829 2.187 0.388 -0.082 0.020 6.021 2.750 -58.535 0.000 0.100 7.252 0.000 0.676 -4.998 -0.653 1 2 -2.974 -2.9755 -2.9755 -2.	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124 76.697 5.354 369.939 67.310 17.594 -1.294 7.320 78 8.846
π (log) c (log) $w_1$ (log) $w_2$ (log) The total amount of loans (log) The total amount of deposits (log) Interest on loans (log) Interest on deposits (log) Bank loan interest rate (%) Bank deposit interest rate (%) Total assets (log) Ordinary income(log) Capital ratio (%) Ratio of securities (log) Employees per branch (log) Loan-to-deposit ratio (%) Ratio of non-performing loans (%) Deposit-cost rate (%) Average cost (log) Debt ratio (log) Branches Employees Members N	Shinkin Mean 6.626 -3.300 -0.005 -0.003 11.453 11.911 8.188 6.834 4.129 1.463 12.031 12.031 18.636 5.391 18.295 2.690 65.083 7.956 4.228 -3.138 2.138 211 343 20790 7190	banks Std. Dev. 1.079 0.500 0.205 0.136 0.971 0.956 0.936 1.520 1.685 1.644 0.937 0.906 2.133 9.399 0.285 72.962 5.301 1.767 0.477 0.477 0.373 15 411 19703	Median 6.667 -3.481 -0.012 -0.003 11.420 11.862 8.132 6.853 3.380 0.502 11.986 8.596 5.220 16.792 2.671 64.483 7.258 3.462 -3.308 2.898 17 245 14927	Min. -1.580 -4.341 -0.865 -4.039 8.166 7.888 4.873 2.357 1.432 0.025 8.784 5.465 -55.927 0.122 0.201 19.982 0.000 1.452 -4.192 0.600 1.452 -4.192 0.789 11 1379	$\begin{array}{r} {\rm Max.} \\ 9.026 \\ -2.079 \\ 4.526 \\ 2.414 \\ 14.531 \\ 14.982 \\ 11.589 \\ 11.421 \\ 10.185 \\ 30.253 \\ 15.041 \\ 11.877 \\ 48.142 \\ 173.877 \\ 48.142 \\ 173.877 \\ 6.879 \\ 6177.899 \\ 81.228 \\ 32.486 \\ -1.918 \\ 5.426 \\ 113 \\ 24296 \\ 361219 \end{array}$	Credit of Mean 5.281 -3.180 -0.013 -0.002 9.916 10.407 6.798 5.696 4.780 1.771 10.541 7.238 5.159 13.160 2.475 65.009 9.944 4.763 -2.995 3.017 8 108 12537	$\begin{array}{c} \mbox{inions} \\ \hline Std. Dev. \\ 1.316 \\ 0.469 \\ 0.390 \\ 0.206 \\ 1.331 \\ 1.167 \\ 1.348 \\ 1.605 \\ 1.866 \\ 1.666 \\ 1.159 \\ 1.153 \\ 3.766 \\ 15.037 \\ 0.403 \\ 19.392 \\ 9.258 \\ 1.977 \\ 0.500 \\ 0.523 \\ 8 \\ 117 \\ 14721 \end{array}$	$\begin{array}{c} \mbox{Median} \\ 5.440 \\ -3.240 \\ -0.031 \\ -0.009 \\ 10.523 \\ 6.982 \\ 5.710 \\ 4.515 \\ 0.929 \\ 10.650 \\ 7.312 \\ 4.435 \\ 8.114 \\ 2.485 \\ 68.290 \\ 8.513 \\ 4.263 \\ -3.042 \\ 3.068 \\ 6 \\ 74 \\ 7829 \end{array}$	$\begin{array}{c} {\rm Min.} \\ -1.339 \\ -4.978 \\ -1.693 \\ -2.944 \\ 5.076 \\ 5.829 \\ 2.187 \\ 0.388 \\ -0.082 \\ 0.020 \\ 6.021 \\ 2.750 \\ -58.535 \\ 0.000 \\ 0.100 \\ -58.535 \\ 0.000 \\ 0.100 \\ 0.100 \\ -2.52 \\ 0.000 \\ 0.676 \\ -4.998 \\ -0.653 \\ 1 \\ 2 \\ 45 \end{array}$	Max. 8.044 -1.738 2.192 2.380 13.453 10.563 10.225 36.099 10.273 13.766 10.806 161.124 76.697 5.354 369.939 67.310 17.594 -1.294 7.8247 7.82477 7.82477 7.82477 7.824777777777777

## Table 1. Descriptive statistics of the variables

The descriptive statistics in Table 1 show the sample averages of the main variables over the entire period by business category. Table 2 shows the profit and marginal costs during the period. The sample size for the entire period is largest for Shinkin banks, at 7,188; followed by credit unions, at 5,161; and then regional banks, at 2,352.

	All fina	ancial instit	utions	Region				
	Profit Marginal N		Profit	Profit Marginal		Listing	Second	
1000	C 10C	0.705	010	0 500	COSt	109	71	-tier
1989	0.180	-2.795	918	8.500	-2.891	123	(1	24
1990	0.057	-2.550	880	8.102	-2.585	114	05	24
1991	0.190	-2.499	800	8.420	-2.568	123	(1	25
1992	6.229	-2.655	864	8.671	-2.808	120	71	25
1993	6.106	-2.799	844	8.499	-2.993	121	72	25
1994	6.668	-3.013	845	9.079	-3.213	119	71	24
1995	6.632	-3.211	840	9.030	-3.454	124	74	25
1996	6.691	-3.431	824	8.985	-3.689	120	71	25
1997	6.603	-3.525	793	8.903	-3.782	119	71	25
1998	6.558	-3.585	760	8.887	-3.860	116	71	25
1999	6.625	-3.638	724	8.988	-3.951	118	72	24
2000	6.474	-3.632	679	8.937	-3.989	109	71	23
2001	6.447	-3.701	599	8.895	-4.087	108	71	24
2002	6.520	-3.769	587	8.893	-4.183	110	73	25
2003	6.638	-3.819	554	8.969	-4.228	106	74	25
2004	6.749	-3.841	540	9.016	-4.252	103	74	25
2005	6.854	-3.874	539	9.007	-4.274	103	74	25
2006	6.937	-3.833	530	9.030	-4.210	100	73	24
2007	6.797	-3.714	516	8.884	-4.080	102	74	25
2008	6.644	-3.713	504	8.723	-4.104	98	72	25
2009	6.692	-3.761	501	8.633	-4.182	96	72	25
Mean	6.503	-3.314		8.808	-3.651			
Sum			14701			2352	1508	517

Table 2. Profit and marginal co	st
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	Shinkin	n banks		Credit	unions		 	
	Profit	Marginal	N	Profit	Marginal	N		
		$\cos t$			$\cos t$			
1989	6.505	-2.762	428	5.038	-2.800	367	 	
1990	6.421	-2.523	413	4.972	-2.586	353		
1991	6.512	-2.462	403	4.995	-2.518	334		
1992	6.417	-2.604	406	5.137	-2.661	338		
1993	6.257	-2.747	392	5.052	-2.790	331		
1994	6.922	-2.970	392	5.512	-2.994	334		
1995	6.878	-3.179	391	5.420	-3.156	325		
1996	6.947	-3.404	385	5.520	-3.367	319		
1997	6.849	-3.512	379	5.359	-3.439	295		
1998	6.759	-3.581	369	5.307	-3.473	275		
1999	6.697	-3.620	362	5.375	-3.514	244		
2000	6.532	-3.628	345	5.192	-3.465	225		
2001	6.347	-3.665	312	5.145	-3.531	179		
2002	6.405	-3.733	306	5.200	-3.568	171		
2003	6.466	-3.783	288	5.402	-3.614	160		
2004	6.638	-3.801	279	5.466	-3.643	158		
2005	6.794	-3.850	278	5.554	-3.656	158		
2006	6.914	-3.809	274	5.635	-3.631	156		
2007	6.698	-3.665	267	5.530	-3.549	147		
2008	6.579	-3.655	261	5.356	-3.552	145		
2009	6.662	-3.710	258	5.477	-3.578	147		
Mean	6.626	-3.300		5.281	-3.180			
Sum			7188			5161		

#### 3.2 Estimation results of the Boone indicator

We estimate the following four Boone indicators for regional banking industries for each year: (1) financial institutions in all three business categories (all financial institutions), (2) regional banks, (3) Shinkin banks, and (4) credit unions. From Eq. (12), the coefficient of the marginal cost, obtained from the estimates using OLS and 2SLS, is defined as the PE. After multiplying the value of the coefficient obtained by -1, the results could be interpreted as showing that the larger the value is, the more competitive is the market.

	All financi	ial institut	ions				Regional b	oanks				
	Boone	CI	CI		N	$R^2$	Boone	CI	CI		N	$R^2$
	indicator	(upper)	(lower)				indicator	(upper)	(lower)			
1989	2.4216	3.295	1.548	[0.445]***	917	0.6701	3.7645	5.864	1.665	[1.060]***	123	0.5906
1990	0.6090	1.694	-0.476	[0.553]	880	0.5886	4.9938	7.778	2.209	[1.404]***	114	0.4810
1991	0.3809	1.390	-0.628	[0.514]	859	0.6511	4.8127	7.030	2.595	[1.120]***	123	0.6814
1992	1.6126	2.452	0.773	[0.428]***	862	0.6653	5.7689	7.667	3.871	[0.958]***	120	0.6956
1993	1.4804	2.367	0.593	[0.452]***	841	0.5850	4.5664	6.732	2.401	[1.093]***	121	0.5742
1994	1.2392	2.021	0.458	0.398 ***	844	0.6909	4.2390	5.831	2.647	[0.803]***	119	0.6818
1995	1.2785	2.013	0.544	0.374 ***	838	0.6584	2.9179	4.453	1.383	0.775	123	0.6323
1996	0.6794	1.200	0.159	[0.265]**	822	0.6893	2.1367	3.361	0.912	[0.618]***	119	0.5435
1997	0.8405	1.319	0.362	[0.244]***	779	0.6785	1.6264	2.849	0.404	[0.617]***	117	0.5440
1998	1 0978	1 578	0.618	[0.244]***	749	0.6758	2 4190	3 875	0.963	[0.734]***	113	0.6179
1999	1 4657	1 983	0.949	[0.263]***	711	0.6990	4 1917	5 418	2 966	[0.618]***	114	0.6889
2000	1.6668	2 298	1 035	[0.322]***	673	0.6877	2 4201	3 824	1 016	[0 708]***	109	0.6248
2001	1 8901	2 541	1 239	[0.331]***	596	0.6656	2 7966	4 067	1.526	[0.640]***	107	0.6605
2001	1.6629	2.011	1.020	[0.327]***	587	0.6396	3 3261	4 520	2 1 3 2	[0.602]***	110	0.6601
2002	1.8841	2.500	1.020	[0.268]***	554	0.6031	2 5363	3 179	1 001	[0.320]***	106	0.00001
2003	1.0041	2.410	1 1 9 9	[0.200]	520	0.0331 0.7119	2.0000	9.997	2 497	[0.320]	100	0.7533
2004	1.7556	2.323	1.100	[0.291]	530	0.7112 0.7114	2 0162	3 680	2.407	[0.340]	102	0.7579
2005	1.8745	2.434	1.010	[0.203]	520	0.7114	2.9102	2 824	2.132	[0.365]	100	0.0756
2000	2.6067	2.401	1.017	[0.292]	530	0.7032	2.9213	1 5 4 4	2.009	[0.409] [0.500]***	100	0.0005
2007	2.0907	0.440 0.455	1.947	[0.362]	510	0.7027	5.4902	4.044	2.449	[0.526]	102	0.7297
2008	2.7598	3.455	2.004	[0.354]	503	0.0013	4.4443	5.507	3.382	[0.335]	98	0.7324
2009	1.9409	2.073	1.209	[0.373]***	900	0.0041	3.9830	4.878	3.088	[0.450]	95	0.7157
	Shinkin ba	anks					Credit uni	ons				
	Shinkin ba	anks					Credit uni	ions				
	Shinkin ba Boone	anks CI	CI		Ν	$R^2$	Credit uni Boone	ions	CI		Ν	$R^2$
	Shinkin ba Boone indicator	anks CI (upper)	CI (lower)		Ν	$R^2$	Credit uni Boone indicator	CI (upper)	CI (lower)		Ν	$R^2$
1989	Shinkin ba Boone indicator 4.9114	CI (upper) 5.997	CI (lower) 3.826	[0.552]***	N 428	$R^2$ 0.7669	Credit uni Boone indicator 3.6173	CI (upper) 4.658	CI (lower) 2.577	[0.529]***	N 366	$R^2$ 0.5655
1989 1990	Shinkin ba Boone indicator 4.9114 5.2970	eanks CI (upper) 5.997 6.677	CI (lower) 3.826 3.917	[0.552]*** [0.702]***	N 428 413	$R^2$ 0.7669 0.7159	Credit uni Boone indicator 3.6173 1.0355	CI (upper) 4.658 2.952	CI (lower) 2.577 -0.881	$[0.529]^{***}$ [0.974]	N 366 353	$R^2$ 0.5655 0.5254
1989 1990 1991	Shinkin ba Boone indicator 4.9114 5.2970 3.1392	CI (upper) 5.997 6.677 4.776	CI (lower) 3.826 3.917 1.502	[0.552]*** [0.702]*** [0.833]***	N 428 413 403	$R^2$ 0.7669 0.7159 0.7264	Credit uni Boone indicator 3.6173 1.0355 1.1117	CI (upper) 4.658 2.952 2.682	CI (lower) 2.577 -0.881 -0.458	[0.529]*** [0.974] [0.798]	N 366 353 333	$R^2$ 0.5655 0.5254 0.5192
1989 1990 1991 1992	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879	CI (upper) 5.997 6.677 4.776 4.593	CI (lower) 3.826 3.917 1.502 2.583	[0.552]*** [0.702]*** [0.833]*** [0.511]***	N 428 413 403 406	$R^2$ 0.7669 0.7159 0.7264 0.7388	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214	CI (upper) 4.658 2.952 2.682 4.150	CI (lower) 2.577 -0.881 -0.458 1.692	[0.529]*** [0.974] [0.798] [0.625]***	N 366 353 333 336	$R^2$ 0.5655 0.5254 0.5192 0.5087
1989 1990 1991 1992 1993	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260	CI (upper) 5.997 6.677 4.776 4.593 4.285	CI (lower) 3.826 3.917 1.502 2.583 1.367	[0.552]*** [0.702]*** [0.833]*** [0.511]*** [0.742]***	N 428 413 403 406 392	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649	CI (upper) 4.658 2.952 2.682 4.150 3.872	CI (lower) 2.577 -0.881 -0.458 1.692 1.458	[0.529]*** [0.974] [0.798] [0.625]*** [0.614]***	N 366 353 333 336 328	$R^2$ 0.5655 0.5254 0.5192 0.5087 0.4388
1989 1990 1991 1992 1993 1994	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333	[0.552]*** [0.702]*** [0.511]*** [0.742]*** [0.373]***	N 428 413 403 406 392 392	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769	[0.529]*** [0.974] [0.625]*** [0.614]*** [0.467]***	N 366 353 333 336 328 333	$R^2$ 0.5655 0.5254 0.5192 0.5087 0.4388 0.5752
1989 1990 1991 1992 1993 1994 1995	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4 157	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223	$[0.552]^{***}$ $[0.702]^{***}$ $[0.833]^{***}$ $[0.511]^{***}$ $[0.742]^{***}$ $[0.373]^{***}$ $[0.492]^{***}$	N 428 413 403 406 392 392 391	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177	[0.529]*** [0.974] [0.798] [0.625]*** [0.467]*** [0.366]***	N 366 353 333 336 328 333 324	$R^2$ 0.5655 0.5254 0.5192 0.5087 0.4388 0.5752 0.4927
1989 1990 1991 1992 1993 1994 1995 1996	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338	$[0.552]^{***}$ $[0.702]^{***}$ $[0.833]^{***}$ $[0.511]^{***}$ $[0.742]^{***}$ $[0.373]^{***}$ $[0.492]^{***}$ $[0.264]^{***}$	N 428 413 403 406 392 392 391 385	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322	[0.529]*** [0.974] [0.798] [0.625]*** [0.614]*** [0.336]*** [0.238]***	N 366 353 333 336 328 333 324 318	$R^2$ 0.5655 0.5254 0.5192 0.5087 0.4388 0.5752 0.4927 0.5256
1989 1990 1991 1992 1993 1994 1995 1996 1997	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1470	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699	$\begin{array}{c} [0.552]^{***}\\ [0.702]^{***}\\ [0.833]^{***}\\ [0.511]^{***}\\ [0.742]^{***}\\ [0.373]^{***}\\ [0.492]^{***}\\ [0.264]^{***}\\ [0.228]^{***} \end{array}$	N 428 413 403 406 392 392 391 385 379	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8260	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.357	[0.529]*** [0.974] [0.798] [0.625]*** [0.614]*** [0.467]*** [0.238]*** [0.238]***	N 366 353 333 336 328 333 324 318 283	$R^2$ 0.5655 0.5254 0.5192 0.5087 0.4388 0.5752 0.4927 0.5256 0.4753
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597 2.576	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675	[0.552]*** [0.702]*** [0.833]*** [0.511]*** [0.742]*** [0.373]*** [0.492]*** [0.264]*** [0.228]***	N 428 413 403 406 392 392 391 385 379 367	R <sup>2</sup> 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903 0.7903 0.7903	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8269 0.7884	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.261	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.357 0.315	$\begin{array}{c} [0.529]^{***}\\ [0.974]\\ [0.798]\\ [0.625]^{***}\\ [0.614]^{***}\\ [0.467]^{***}\\ [0.336]^{***}\\ [0.238]^{***}\\ [0.239]^{***}\\ [0.240]^{***} \end{array}$	N 366 353 333 336 328 333 324 318 283 269	$R^2$ 0.5655 0.5254 0.5192 0.5087 0.4388 0.5752 0.4927 0.5256 0.4927 0.5256 0.4753 0.5043
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 4.4208	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597 2.576 2.085	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756	[0.552]*** [0.702]*** [0.511]*** [0.742]*** [0.742]*** [0.492]*** [0.264]*** [0.228]*** [0.228]***	N 428 413 403 406 392 392 391 385 379 367 354	R <sup>2</sup> 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903 0.7899 0.7749	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8269 0.7881 0.6118	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.261 1.071	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.357 0.315 0.153	[0.529]*** [0.974] [0.798] [0.625]*** [0.614]*** [0.336]*** [0.238]*** [0.239]*** [0.239]***	N 366 353 333 336 328 333 324 318 283 269 243	$R^2$ 0.5655 0.5254 0.5192 0.5087 0.4388 0.5752 0.4927 0.5256 0.4753 0.5043 0.5043 0.5014
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 1.4208 1.4208	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597 2.576 2.085 2.343	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 0.756	$\begin{array}{c} [0.552]^{***} \\ [0.702]^{***} \\ [0.833]^{***} \\ [0.511]^{***} \\ [0.742]^{***} \\ [0.742]^{***} \\ [0.264]^{***} \\ [0.228]^{***} \\ [0.229]^{***} \\ [0.338]^{***} \\ [0.310]^{***} \end{array}$	N 428 413 403 406 392 392 391 385 379 367 354 345	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903 0.7899 0.7749 0.7749 0.749	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8269 0.7881 0.6118 0.7772	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.261 1.071 4.458	CI (lower) 2.577 -0.881 -0.458 1.658 1.458 1.769 1.177 0.322 0.357 0.315 0.153 0.088	[0.529]*** [0.974] [0.798] [0.625]*** [0.614]*** [0.467]*** [0.238]*** [0.239]*** [0.239]*** [0.240]*** [0.240]***	N 366 353 333 336 328 333 324 318 283 269 243 219	$R^2$ 0.5655 0.5254 0.5192 0.4388 0.5752 0.4388 0.5752 0.4927 0.5256 0.4753 0.5043 0.5043
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 1.4208 1.7337 1.7005	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597 2.576 2.085 2.343 2.453	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 1.125	$\begin{matrix} [0.552]^{***}\\ [0.702]^{***}\\ [0.702]^{***}\\ [0.511]^{***}\\ [0.742]^{***}\\ [0.492]^{***}\\ [0.264]^{***}\\ [0.228]^{***}\\ [0.229]^{***}\\ [0.338]^{***}\\ [0.310]^{***}\\ [0.329]^{***} \end{matrix}$	N 428 413 403 406 392 392 391 385 379 367 354 345 312	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903 0.7899 0.7749 0.7749 0.7748 0.6717	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6648 1.8382 0.7894 0.8269 0.7881 0.6118 0.7727 0.8430	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.261 1.071 1.458	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.357 0.315 0.153 0.082 0.173	[0.529]*** [0.974] [0.625]*** [0.614]*** [0.467]*** [0.238]*** [0.239]*** [0.240]*** [0.240]*** [0.240]**	N 366 353 333 336 328 333 324 318 283 269 243 219 177	$R^2$ 0.5655 0.5254 0.5192 0.4388 0.5752 0.4388 0.5752 0.4927 0.5256 0.4753 0.5043 0.5043 0.5043 0.5049 0.5054
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 1.4208 1.7337 1.7995	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597 2.576 2.085 2.343 2.453 2.453	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 1.125 1.145	$[0.552]^{***}$ $[0.702]^{***}$ $[0.702]^{***}$ $[0.511]^{***}$ $[0.492]^{***}$ $[0.492]^{***}$ $[0.264]^{***}$ $[0.228]^{***}$ $[0.338]^{***}$ $[0.338]^{***}$ $[0.332]^{***}$	N 428 413 403 406 392 392 391 385 379 367 354 345 312 306	$R^2$ 0.7669 0.7159 0.7264 0.7038 0.8063 0.8063 0.7703 0.8221 0.7903 0.7749 0.7749 0.7749 0.7748 0.6717 0.6705	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6649 2.6868 1.8382 0.7894 0.8269 0.7881 0.6118 0.7727 0.8430 0.5551	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.261 1.071 1.458 1.515 1.282	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.357 0.315 0.153 0.088 0.172 0.172	$\begin{array}{c} [0.529]^{***}\\ [0.974]\\ [0.798]\\ [0.625]^{***}\\ [0.614]^{***}\\ [0.336]^{***}\\ [0.238]^{***}\\ [0.239]^{***}\\ [0.233]^{***}\\ [0.233]^{***}\\ [0.233]^{***}\\ [0.340]^{**}\\ [0.360] \end{array}$	N 366 353 333 336 328 333 324 318 283 269 243 219 177 171	$R^2$ 0.5655 0.5254 0.5087 0.4388 0.5752 0.4927 0.5256 0.4753 0.5043 0.5043 0.5914 0.5049 0.5081 0.4258
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 1.4208 1.7337 1.7995 1.7718	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597 2.576 2.085 2.343 2.453 2.453 2.464 2.914	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 1.125 1.145 1.145	$\begin{array}{c} [0.552]^{***}\\ [0.702]^{***}\\ [0.702]^{***}\\ [0.511]^{***}\\ [0.742]^{***}\\ [0.373]^{***}\\ [0.292]^{***}\\ [0.228]^{***}\\ [0.228]^{***}\\ [0.338]^{***}\\ [0.332]^{***}\\ [0.332]^{***}\\ [0.310]^{***}\\ [0.322]^{***}\\ [0.322]^{***}\\ [0.221]^{***}\\ [0.322]^{**}\\ [0.322]^{**}\\ [0.3$	$\begin{array}{c} N \\ 428 \\ 413 \\ 403 \\ 406 \\ 392 \\ 392 \\ 391 \\ 385 \\ 379 \\ 367 \\ 354 \\ 345 \\ 312 \\ 306 \\ 288 \end{array}$	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903 0.7899 0.7749 0.7438 0.6717 0.6795 0.6923	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8269 0.7881 0.6118 0.7727 0.8430 0.5551	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.261 1.071 1.458 1.515 1.283 0.954	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.355 0.153 0.088 0.172 -0.173	[0.529]*** [0.974] [0.798] [0.625]*** [0.614]*** [0.336]*** [0.238]*** [0.239]*** [0.240]*** [0.240]*** [0.348]** [0.340]** [0.369] [0.252]*	N 366 353 333 336 328 333 324 318 283 269 243 219 177 171 160	$R^2$ 0.5655 0.5254 0.5192 0.5087 0.4388 0.5752 0.4288 0.5914 0.5043 0.5043 0.5044 0.5049 0.5081 0.4252 0.5051
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1479 2.1254 1.4208 1.7337 1.7995 1.7718 2.1873 2.0707	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597 2.576 2.085 2.343 2.453 2.453 2.464 2.814	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 1.125 1.145 1.080 1.561	$[0.552]^{***}$ $[0.702]^{***}$ $[0.531]^{***}$ $[0.511]^{***}$ $[0.742]^{***}$ $[0.492]^{***}$ $[0.492]^{***}$ $[0.228]^{***}$ $[0.338]^{***}$ $[0.332]^{***}$ $[0.332]^{***}$ $[0.352]^{***}$ $[0.318]^{***}$	N 428 413 403 392 391 385 379 367 354 345 312 306 288	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903 0.7749 0.7749 0.7749 0.7748 0.6717 0.6795 0.6933 0.7720	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8269 0.7881 0.6118 0.7727 0.8430 0.5551 0.4489 0.1241	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.297 1.297 1.297 1.261 1.071 1.458 1.515 1.283 0.954 0.954	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.357 0.315 0.153 0.088 0.172 -0.173 -0.052		N 366 353 333 336 328 333 324 318 283 269 243 219 177 171 160	$\begin{array}{c} R^2 \\ \hline 0.5655 \\ 0.5254 \\ 0.5192 \\ 0.5087 \\ 0.4388 \\ 0.5752 \\ 0.4927 \\ 0.5256 \\ 0.4753 \\ 0.5914 \\ 0.5914 \\ 0.5041 \\ 0.4252 \\ 0.5044 \\ 0.4252 \\ 0.5044 \\ 0.4752 \\ 0.4752$
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 1.4208 1.7337 1.7995 1.7718 2.1873 2.0797 1.0642	$\begin{array}{c} \text{CI} \\ (\text{upper}) \\ 5.997 \\ 6.677 \\ 4.776 \\ 4.593 \\ 4.285 \\ 2.799 \\ 4.157 \\ 2.377 \\ 2.576 \\ 2.085 \\ 2.343 \\ 2.453 \\ 2.453 \\ 2.464 \\ 2.814 \\ 2.625 \\ 2.461 \end{array}$	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 1.125 1.145 1.080 1.561 1.551 1.432	$\begin{array}{c} [0.552]^{***}\\ [0.702]^{***}\\ [0.702]^{***}\\ [0.511]^{***}\\ [0.742]^{***}\\ [0.742]^{***}\\ [0.492]^{***}\\ [0.228]^{***}\\ [0.228]^{***}\\ [0.328]^{***}\\ [0.332]^{***}\\ [0.312]^{***}\\ [0.318]^{***}\\ [0.277]^{***}\\ [0.277]^{***} \end{array}$	N 428 413 403 392 391 385 379 367 354 345 312 306 288 279	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903 0.7749 0.7438 0.6717 0.6795 0.6933 0.7730 0.7730 0.7730	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6668 1.8382 0.7894 0.8269 0.7881 0.6118 0.7727 0.8430 0.5551 0.4489 0.1341	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.261 1.071 1.458 1.515 1.283 0.954 0.803 0.9054	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.357 0.315 0.153 0.088 0.172 -0.173 -0.056 -0.535 0.112		N 3666 353 333 328 333 324 318 283 269 243 219 177 171 160 158	$R^2$ 0.5655 0.5254 0.5087 0.4388 0.5752 0.4927 0.5256 0.4927 0.5256 0.4753 0.5043 0.5043 0.5049 0.5049 0.5049 0.5044 0.4252 0.5044 0.4252 0.5044 0.4252 0.5044 0.4252 0.5044 0.4252 0.5054 0.5055 0.5055 0.5057 0.5054 0.5056
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 1.4208 1.7337 1.7995 1.7718 2.1873 2.0797 1.9646	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597 2.576 2.343 2.453 2.464 2.814 2.625 2.491	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 1.125 1.145 1.080 1.561 1.535 1.438		N 428 413 403 392 391 385 379 367 354 345 312 306 288 279 278	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903 0.7899 0.7749 0.6717 0.6795 0.6933 0.7730 0.7027 0.7027	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8269 0.7881 0.6118 0.7727 0.8430 0.5551 0.4489 0.1341 0.4434	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.261 1.071 1.4518 1.515 1.283 0.954 0.803 0.998	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.357 0.315 0.153 0.058 0.172 -0.173 -0.056 -0.535 -0.112 0.020	[0.529]*** [0.974] [0.625]*** [0.614]*** [0.614]*** [0.336]*** [0.238]*** [0.238]*** [0.239]*** [0.239]*** [0.340]** [0.340]** [0.340]* [0.256]* [0.339] [0.281] [0.281] [0.293]***	N 3666 353 333 336 328 269 243 219 177 171 160 158 158	$R^2$ 0.5655 0.5254 0.5192 0.5087 0.4388 0.5752 0.4927 0.5256 0.4753 0.5043 0.5043 0.5049 0.5049 0.5081 0.4252 0.5044 0.4729 0.5524 0.5723
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 1.4208 1.7337 1.7995 1.7718 2.1873 2.0797 1.9646 1.4687	CI (upper) 5.997 6.677 4.776 4.593 4.285 2.799 4.157 2.377 2.597 2.576 2.085 2.343 2.453 2.464 2.814 2.625 2.491 1.930	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 1.125 1.145 1.080 1.561 1.535 1.438 1.007		N 428 413 403 406 392 392 391 385 379 367 354 345 312 306 288 279 278 278 278	$R^2$ 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.8221 0.7903 0.7899 0.7749 0.7749 0.6717 0.6795 0.6933 0.7730 0.7027 0.7806 0.7806	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8269 0.7881 0.6118 0.7727 0.8430 0.5551 0.4489 0.1341 0.4434 0.8711 1.4762	CI (upper) 4.658 2.952 2.682 4.150 2.500 1.257 1.297 1.261 1.071 1.458 1.515 1.283 0.954 0.803 0.998 1.539	CI (lower) 2.577 -0.881 -0.458 1.695 1.458 1.769 1.177 0.322 0.357 0.315 0.153 0.035 0.153 0.172 -0.173 -0.056 -0.535 -0.112 0.203		N 366 353 333 328 333 328 333 324 318 269 243 219 177 171 160 158 158 156 158	$R^2$ 0.5655 0.5254 0.5192 0.4388 0.5752 0.4927 0.5256 0.4753 0.5043 0.5043 0.50914 0.50914 0.4252 0.5081 0.4252 0.5044 0.4729 0.5524 0.5733 0.50524
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 1.4208 1.7337 1.7995 1.7718 2.1873 2.0797 1.9646 1.4687 2.5122	$\begin{array}{c} \text{CI} \\ (\text{upper}) \\ 5.997 \\ 6.677 \\ 4.776 \\ 4.593 \\ 4.285 \\ 2.799 \\ 4.157 \\ 2.377 \\ 2.597 \\ 2.576 \\ 2.085 \\ 2.343 \\ 2.453 \\ 2.453 \\ 2.464 \\ 2.814 \\ 2.625 \\ 2.491 \\ 1.930 \\ 3.457 \\ 2.576 \end{array}$	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 1.125 1.145 1.080 1.561 1.535 1.438 1.007 1.567		N 428 413 403 392 391 385 379 367 354 345 312 306 288 279 278 274 267 274	$R^2$ 0.7669 0.7159 0.7264 0.5094 0.8063 0.7703 0.8221 0.7903 0.7749 0.749 0.749 0.7749 0.6717 0.6795 0.6933 0.7730 0.7027 0.7806 0.7438	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8269 0.7881 0.6118 0.7727 0.8430 0.5551 0.4489 0.1341 0.4434 0.8711 1.4769	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.297 1.261 1.071 1.458 1.515 1.283 0.954 0.803 0.998 1.539 2.558	CI (lower) 2.577 -0.881 -0.458 1.692 1.458 1.769 1.177 0.322 0.357 0.315 0.153 0.0153 0.153 0.172 -0.173 -0.056 -0.535 -0.112 0.203 0.395		N 366 353 333 328 333 324 318 269 243 219 177 171 160 158 158 156 147 	$R^2$ 0.5655 0.5254 0.5087 0.4388 0.5752 0.4927 0.5256 0.4753 0.5043 0.5043 0.5043 0.50914 0.5091 0.4252 0.5044 0.4729 0.5524 0.5733 0.5294 0.5294
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008	Shinkin ba Boone indicator 4.9114 5.2970 3.1392 3.5879 2.8260 2.0657 3.1900 1.8575 2.1479 2.1254 1.4208 1.7337 1.7995 1.7718 2.1873 2.0797 1.9646 1.4687 2.5122 2.5324	$\begin{array}{c} {\rm CI} \\ ({\rm upper}) \\ \overline{5.997} \\ \overline{6.677} \\ 4.776 \\ 4.593 \\ 4.285 \\ 2.799 \\ 4.157 \\ 2.377 \\ 2.576 \\ 2.085 \\ 2.343 \\ 2.453 \\ 2.453 \\ 2.464 \\ 2.814 \\ 2.625 \\ 2.491 \\ 1.930 \\ 3.457 \\ 3.478 \end{array}$	CI (lower) 3.826 3.917 1.502 2.583 1.367 1.333 2.223 1.338 1.699 1.675 0.756 1.125 1.145 1.080 1.561 1.551 1.438 1.007 1.567 1.587	$\begin{array}{c} [0.552]^{***}\\ [0.702]^{***}\\ [0.833]^{***}\\ [0.511]^{***}\\ [0.742]^{***}\\ [0.373]^{***}\\ [0.492]^{***}\\ [0.229]^{***}\\ [0.228]^{***}\\ [0.338]^{***}\\ [0.332]^{***}\\ [0.332]^{***}\\ [0.310]^{***}\\ [0.313]^{***}\\ [0.313]^{***}\\ [0.227]^{***}\\ [0.232]^{***}\\ [0.232]^{***}\\ [0.232]^{***}\\ [0.232]^{***}\\ [0.232]^{***}\\ [0.232]^{***}\\ [0.232]^{***}\\ [0.232]^{***}\\ [0.234]^{***}\\ [0.240]^{***}\\ [0.480]^{**}\\ [0.480]^{**$	N 428 413 403 392 392 391 385 379 367 354 345 312 306 288 279 279 278 278 274 267 260	R <sup>2</sup> 0.7669 0.7159 0.7264 0.7388 0.5094 0.8063 0.7703 0.7903 0.7899 0.7749 0.7438 0.6717 0.6795 0.6933 0.7730 0.7027 0.7027 0.7806 0.7438 0.67438 0.67438	Credit uni Boone indicator 3.6173 1.0355 1.1117 2.9214 2.6649 2.6868 1.8382 0.7894 0.8269 0.7881 0.6118 0.7727 0.8430 0.5551 0.4489 0.1341 0.4434 0.8711 1.4769 1.2186	CI (upper) 4.658 2.952 2.682 4.150 3.872 3.605 2.500 1.257 1.261 1.071 1.458 1.515 1.283 0.954 0.8054 0.998 1.539 2.558 2.040	CI (lower) 2.577 -0.818 1.692 1.458 1.769 1.177 0.322 0.357 0.315 0.153 0.088 0.172 -0.173 -0.056 -0.555 -0.112 0.203 0.395 0.397		N 366 353 333 336 328 333 324 318 283 269 243 219 177 171 160 158 156 147 145	$\begin{array}{c} R^2 \\ \hline 0.5655 \\ 0.5254 \\ 0.5192 \\ 0.5087 \\ 0.4388 \\ 0.5752 \\ 0.4927 \\ 0.5256 \\ 0.4753 \\ 0.5043 \\ 0.5043 \\ 0.5044 \\ 0.4252 \\ 0.5044 \\ 0.4729 \\ 0.5524 \\ 0.5524 \\ 0.5524 \\ 0.5524 \\ 0.5294 \\ 0.5685 \\ 0.5026$

Table 3. Estimation result of the Boone indicator: OLS

Note: Robust standard errors in parentheses. Asterisks indicate significance at the following levels: \* significance 10%, \*\* significance 5%, \*\* \* significance 1%.

	All financi	ial institut	ions		Regional banks							
	Boone	CI	CI		N	$R^2$	Boone	CI	CI		N	$\mathbb{R}^2$
	indicator	(upper)	(lower)	to wowlikely			indicator	(upper)	(lower)	Factor and a halo data		
1989	6.2053	7.376	5.034	$[0.597]^{***}$	917	0.6325	7.6837	10.331	5.036	$[1.351]^{***}$	123	0.5358
1990	6.7534	9.060	4.447	$[1.177]^{***}$	880	0.5034	7.2818	10.075	4.489	$[1.425]^{***}$	114	0.4707
1991	6.7125	8.587	4.838	$[0.956]^{***}$	859	0.5680	4.8802	6.907	2.853	$[1.034]^{***}$	123	0.6813
1992	5.7600	7.212	4.308	$[0.741]^{***}$	862	0.6140	5.7469	7.425	4.068	$[0.856]^{***}$	120	0.6956
1993	4.7099	6.110	3.310	$[0.714]^{***}$	841	0.5433	4.8796	6.788	2.971	$[0.974]^{***}$	121	0.5737
1994	4.3459	5.503	3.188	$[0.591]^{***}$	844	0.6477	6.4140	8.242	4.586	$[0.933]^{***}$	119	0.6619
1995	4.1939	5.426	2.962	$[0.629]^{***}$	838	0.6106	5.8738	7.819	3.929	$[0.992]^{***}$	123	0.5779
1996	2.9526	3.738	2.168	[0.401]***	822	0.6386	4.5361	5.931	3.141	[0.712]***	119	0.4857
1997	3.0315	3.763	2.300	[0.373]***	779	0.6313	3.7614	4.934	2.589	[0.598]***	117	0.4869
1998	2.8996	3.680	2.120	[0.398]***	749	0.6417	4.3919	5.573	3.211	[0.603]***	113	0.5784
1999	3.3566	4.109	2.604	$[0.384]^{***}$	711	0.6654	5.4405	6.524	4.357	$[0.553]^{***}$	114	0.6741
2000	3.7337	4.524	2.943	$[0.403]^{***}$	673	0.6514	4.8000	6.181	3.419	$[0.705]^{***}$	109	0.5643
2001	4.0854	5.023	3.148	$[0.478]^{***}$	596	0.6307	4.7502	6.126	3.374	$[0.702]^{***}$	107	0.6259
2002	3.1084	3.842	2.375	$[0.374]^{***}$	587	0.6201	3.8496	4.993	2.706	$[0.584]^{***}$	110	0.6656
2003	2.6700	3.339	2.001	$[0.341]^{***}$	554	0.6862	2.2638	2.862	1.666	$[0.305]^{***}$	106	0.7582
2004	2.8857	3.574	2.197	$[0.351]^{***}$	539	0.6981	3.0691	3.716	2.422	$[0.330]^{***}$	102	0.7577
2005	2.8992	3.603	2.196	$[0.359]^{***}$	539	0.7006	3.2294	3.998	2.461	[0.392]***	103	0.6733
2006	3.1143	3.922	2.306	[0.412]***	530	0.6890	3.3700	4.173	2.567	[0.410]***	100	0.6617
2007	3.8826	4.839	2.926	$[0.488]^{***}$	516	0.6918	3.8087	4.679	2.938	$[0.444]^{***}$	102	0.7280
2008	3.8530	4.684	3.022	$[0.424]^{***}$	503	0.6409	4.7806	5.778	3.784	$[0.509]^{***}$	98	0.7311
2009	3.1449	4.033	2.257	$[0.453]^{***}$	500	0.6495	4.1220	5.079	3.165	$[0.488]^{***}$	95	0.7154

Table 4. Estimation result of the Boone indicator: 2SLS

	Shinkin ba	anks	Credit unions									
	Boone indicator	CI (upper)	CI (lower)		N	$\mathbb{R}^2$	Boone indicator	CI (upper)	CI (lower)		N	$\mathbb{R}^2$
1989	5.8114	6.863	4.760	[0.537]***	428	0.7644	6.0424	7.285	4.800	[0.634]***	366	0.5344
1990	7.4345	9.015	5.854	[0.807]***	413	0.7078	5.5030	8.653	2.353	[1.607]***	353	0.4521
1991	4.9863	7.247	2.726	[1.153]***	403	0.7200	7.0050	9.558	4.452	[1.303]***	333	0.4225
1992	4.3728	5.831	2.915	[0.744]***	406	0.7374	6.3339	8.109	4.559	[0.906]***	336	0.4466
1993	3.3860	5.992	0.780	[1.330]**	392	0.5083	5.2856	6.727	3.844	[0.735]***	328	0.3907
1994	3.4577	4.441	2.474	$[0.502]^{***}$	392	0.7967	4.4571	5.453	3.461	$[0.508]^{***}$	333	0.5423
1995	4.2892	5.466	3.113	[0.600]***	391	0.7642	3.5822	4.532	2.632	$[0.485]^{***}$	324	0.4441
1996	2.4211	3.046	1.796	$[0.319]^{***}$	385	0.8190	2.3667	3.085	1.649	$[0.366]^{***}$	318	0.4490
1997	2.7646	3.302	2.227	$[0.274]^{***}$	379	0.7865	2.4348	3.194	1.675	$[0.388]^{***}$	283	0.3943
1998	2.5249	3.068	1.982	$[0.277]^{***}$	367	0.7884	2.1087	2.853	1.365	$[0.380]^{***}$	269	0.4434
1999	1.9696	2.817	1.122	$[0.432]^{***}$	354	0.7716	2.1657	2.964	1.368	$[0.407]^{***}$	243	0.5185
2000	2.5393	3.210	1.869	$[0.342]^{***}$	345	0.7376	2.5810	3.581	1.581	$[0.510]^{***}$	219	0.4196
2001	2.6517	3.403	1.900	$[0.383]^{***}$	312	0.6656	2.9443	4.043	1.845	$[0.561]^{***}$	177	0.4162
2002	2.4767	3.318	1.635	$[0.429]^{***}$	306	0.6748	1.8898	2.640	1.140	$[0.383]^{***}$	171	0.3719
2003	2.7743	3.497	2.051	$[0.369]^{***}$	288	0.6896	1.2899	2.043	0.537	$[0.384]^{***}$	160	0.4718
2004	2.5911	3.205	1.977	$[0.313]^{***}$	279	0.7697	1.6613	2.474	0.849	$[0.415]^{***}$	158	0.3991
2005	2.7068	3.354	2.060	$[0.330]^{***}$	278	0.6954	1.6423	2.373	0.912	$[0.373]^{***}$	158	0.5070
2006	2.0684	2.626	1.511	$[0.285]^{***}$	274	0.7757	2.1782	3.133	1.223	$[0.487]^{***}$	156	0.5343
2007	3.2209	4.117	2.324	$[0.457]^{***}$	267	0.7386	2.7544	4.111	1.398	$[0.692]^{***}$	147	0.5011
2008	2.7359	3.617	1.855	$[0.450]^{***}$	260	0.6835	2.5808	3.727	1.434	$[0.585]^{***}$	145	0.5334
2009	2.8535	4.172	1.535	$[0.673]^{***}$	258	0.7123	1.9550	2.883	1.027	$[0.473]^{***}$	147	0.5777

Note: Robust standard errors in parentheses. Asterisks indicate significance at the following levels: \* significance 10%, \*\* significance 5%, \*\* \* significance 1%.



Figure 1. Estimates of Boone indicator using OLS



Figure 2. Estimates of Boone indicator using 2SLS

Table 3 shows the results of the estimations using OLS, and Table 4 the results using 2SLS. Starting from the left, these tables show the Boone indicator, confidence interval, robust standard error, and sample size. In addition, Figure 1 depicts the OLS result and Figure 2 the 2SLS result as well as the confidence intervals.

In the estimation results for the financial institutions from all three business categories, the PE values from the 2SLS estimator are larger than those from the OLS estimator. The results show that, in the period 1990 to 1992, the fluctuation in the level of competition was large for both estimators, and in both, their trends moved in opposite directions. Note that their confidence intervals are quite wide and these estimates are not statistically different. However, the p-value rule should not be overconfident. In fact, the point estimates seems to have a long-run trend, and thus, we interpret the long-run changes in the estimates as change in competition. In this period, Japan experienced a bubble economy, followed by its collapse. In other words, it is assumed a period when there was major turmoil in lending markets. After this period, it is confirmed that both estimators trended roughly in parallel. In particular, it is confirmed that in both estimators, after 2003, the level of competition trended upwards, and then in 2009, dramatically declined. The capital markets were dysfunctional at that time due to the sub-prime loan crisis, and as a result, firms had difficulties raising funds by issuing stocks and corporate bonds. It is thought that demand for borrowing increased from those Japanese financial institutions that had managed to maintain their soundness, and thereby there was an easing of inter-bank competition. From these results, in the period other than 1990 to 1992, it can be observed that the regional lending markets became moderately competitive, although there were some fluctuations.

Next, we consider the results of the Boone indicator estimates according to business category. We confirm that the degree of competition for regional banks, Shinkin banks, and credit unions trended generally about the same. First, the degree of competition trended downward until the first half of the 1990s. However, caution is necessary when evaluating this period, because the width of the confidence interval is large. In the second half of the 1990s, we observe that the degree of competition levels off or increases moderately, while still fluctuating. We identify the following characteristics when we include the results of the Boone indicator estimates for the three business categories. First, considering the period as a whole, we observe that, while fluctuations were severe in the 1990s, on entering the 2000s, the degree of competition moderately increased. One reason for this is considered as follows: owing to the effects of the financial big bang that began in 1996, the markets became competitive in stages in each of the business categories. Moreover, it is possible that due to the effects of such events as banking mergers, the financial crisis, and the sub-prime loan problem, inefficient financial institutions left the market, which may have contributed to the increase in the degree of competition. Second, when we compare the averages for the degree of competition over the period, we find that for both estimators, the order is as follows: regional banks > Shinkin banks > credit unions. From 1989 to 1999, there were hardly any differences in the degree of competition between business categories, but these differences became large from 2000 onwards. In 1998, the Japanese government legalized financial holding companies. This led to a wave of big financial groups, including banks, insurance companies, and security companies, especially among city banks and regional banks. On the other hand, a number of relatively small financial institutions, that is, Shinkin banks and credit unions, failed to merge in these periods. This surge is evident in the figures indicating differences of competition among business categories after 2000. Third, we observe decreases in the degree of competition in the period after the collapse of the bubble, in the first half of the 1990s, and in 2009 immediately after the global financial crisis. It is considered that these were periods of turmoil in the regional financial markets and that this had an impact on the lending market.

## 3.3 Robustness checks of basic results

In this subsection, we provide a check on the robustness of the results in the previous subsection. To do so, we replace the explanatory and/or instrumental variables in Eq. (12) with alternative variables.

First, the estimates are carried out by adding the ratio of non-performing loans to the control variable of the estimation equation in Eq. (12). Figure 3 shows the results of the estimations using OLS, while Figure 4 shows the results of the estimations using 2SLS. The estimation period used is 1998 to 2009 owing to the availability of the data.



Figure 3. Estimates of Boone indicator using OLS



Figure 4. Estimates of Boone indicator using 2SLS

Second, the 2SLS estimates are carried out using the deposit-cost rate and the debt ratio as the instrumental variables. These results are shown in Figure 5. Third, the 2SLS estimates are carried out using the average cost as the instrumental variable. These results are shown in Figure 6.



Figure 5. Estimates of Boone indicator using 2SLS



Figure 6. Estimates of Boone indicator using 2SLS



Fourth, the estimates are carried out using the average cost instead of the marginal cost. The results of the estimates using OLS are shown in Figure 7, while the results using 2SLS are shown in Figure 8.

Figure 7. Estimates of Boone indicator using OLS (average cost)



Figure 8. Estimates of Boone indicator using 2SLS (average cost)

When we compare these results with the results using OLS in Figure 1 and 2SLS in Figure 2, we observe that, while the values are different for some of the period, in terms of the overall trend, there are no differences for any of the variables used.

#### 3.4 Other measures of competition

We now compare the results for the Boone indicator with those for other competition measures considered in the previous literature, namely the HHI, PCM, and *H*-statistic. The first indicator for market power is the HHI, which measures the degree of market concentration. This indicator is often used in the context of the "structure-conduct-performance" (SCP) model, which assumes that market structure affects banks' behavior, which in turn determines their performance. The idea is that a smaller number of banks makes collusion more likely. However, the HHI has a disadvantage in that concentration may be due to consolidation forced by intense competition. We calculate the HHI using the amount of loan data. This can be calculated as the sum of the squared market shares of all banks:

$$HHI = \sum_{i=1}^{N} \left(\frac{q_i}{Q}\right)^2,$$

where  $Q = \sum_{i=1}^{N} q_i$  and  $q_i$  is the amount of bank loan. Figure 9 shows the time series of the HHI for each type of banking institution. Roughly speaking, the HHIs tended to increase gradually, which suggests that the concentration ratio was rising in the Japanese banking industry through the sample period. As long as a rise in concentration means a decline in competition, this trend turns out opposite to the result for the Boone indicator.



Figure 9. Estimates of the HHI

As discussed in subsection 2.1, market power may be related to banks' profit. Second, a traditional measure of profitability is the PCM, which is equal to the output price minus marginal cost (mark-up of price), divided by the output price. This indicates that significantly higher profits may point to weak competition. We calculate the PCM as follows:

$$PCM = \frac{p_i - c_i}{p_i},$$

where  $p_i$  is bank loan interest rate, defined as the ratio of the interest on loans to the total amount of loans.  $c_i$  is marginal cost,  $\hat{c}_i$ .



Figure 10. Estimates of the PCM

The results of the PCM are shown in Figure 10. The results of the PCM for all financial institutions show that it continues rising from 1989 through to the mid-2000s. Bank market power increases from 1989 through to the mid-2000s, but rebounds somewhat from 2005. The point at which competition improves from the mid-2000s is consistent with the results of the Boone indicator. Despite the Japanese regional banking industry experiencing a deep crisis and financial liberalization during our sample periods, the HHI and PCM do not seem able to capture those influences. This discrepancy might occur by the reallocation effect, named by Boone et al. (2007). An increase in competition seems to reduce firms' PCM. However, an increase in competition raises the market share of efficient firms with high PCM. Hence, attention should be paid to the results of PCM from the viewpoint of the reallocation effect.

Third, we estimate the *H*-statistic using Panzar and Rosse's (1987) methodology. The *H*-statistic is calculated from reduced-form bank revenue equations and measures the sum of the elasticities of the total revenue of the banks with respect to their input prices. The *H*-statistic is interpreted as follows. H < 0 indicates a monopoly; H = 1 indicates perfect competition; and 0 < H < 1 indicates monopolistic competition. Moreover, under a certain assumption, a higher *H* means a higher degree of competition. To obtain the *H*-statistic, we estimate the following reduced-form revenue equation:

$$\ln R_i = \beta_0 + \beta_1 \ln w_{1i} + \beta_2 \ln w_{2i} + X'_i \zeta + \varepsilon_i$$

where  $R_i$  denotes ordinary income,  $w_1$  is the interest rate for fund-raising, defined as the ratio of interest on expenses to the total amount of deposits, and  $w_2$  is the wage rate, defined as the ratio of personnel expenses to the number of employees. We add two control variables reflecting bank size effect,  $X_i$ , which is the number of branches and total assets. We take the natural logarithm of these variables. The *H*-statistic can be computed as

$$H = \hat{\beta}_1 + \hat{\beta}_2.$$

Therefore, H is the sum of the elasticities of the total interest revenue of the bank with respect to their factor input price.

On the other hand, while for the *H*-statistic, the size values and degrees of competition are proportional under conditions of certainty, as pointed out by Matsumura (2005), there are various problems with their use. The first is that the size of the value does not necessarily signify the degree of competition. In previous studies using the H-statistic, the values are from 0 to 1, and, in most cases, it is assumed that the closer the value is to 1, the higher is the degree of competition. This is established based on certain conditions, but in general, these conditions are not observed. Second, even without perfect competition, a judgment of perfect competition can be made, or conversely, perfect competition can be dismissed even though the competition is actually perfect. This captures the fact that it is only proven that the H-statistic equals 1 under a simple condition. Third, the Hstatistic can be negative in the case of a monopoly. In this case, it is difficult to judge the degree of competition. Fourth, as the findings of Panzar and Rosse (1987) are established only in the event of long-run equilibrium, they are not suitable for estimates using cross-sectional data. Even when using panel data, it is necessary to verify whether there is a state of long-run equilibrium. With these types of problems, the *H*-statistic is not suitable for verifying the degree of competition. However, we conduct estimations using the H-statistic with our data in order to carry out a comparison with the results from the previous subsection.

Figure 11 shows the time series of the *H*-statistic. The *H*-statistic fluctuates at a low level, and gradually decreases through the period. The estimated result shows that regional lending markets are monopolistically competitive.



Figure 11. Estimates of the *H*-statistic

Unlike the results from the Boone indicator, in the time series for each *H*-statistic, competition declined until around 2005, while still fluctuating. The results are consistent in that the degree of competition increased in the period after 2006, but at a low level in each of the banking industries. As indicated by the HHI and PCM results, it is difficult to imagine that competition in all three banking industries eased during this period, considering the failure of many regional financial institutions due to the financial crisis along with the long-term economic recession beginning in the second half of the 1990s.

It seems that the estimated *H*-statistic does not capture the actual state of competitiveness in the Japanese regional banking industry during this period. Therefore, when viewed from this perspective, it can be said that our estimates using the Boone indicator offer extremely normal results.

## 4 Conclusion

In this study, we used the PE proposed by Boone et al. (2007) to verify the degree of competition in Japan's regional banking industries (regional banks, Shinkin banks, and credit unions) from 1989 to 2009. From the estimated Boone indicators, while we observed differences in the degree of competition according to business category, it was clarified that, over the long term, there was an upward trend, and Japan's regional lending markets have become more competitive. In order to confirm whether this trend would have been evident with the other indicators, we used the sample from the same period and recalculated the data using the HHI, PCM, and *H*-statistic. However, when using these indicators, the opposite trend was observed, and the degree of competition decreased.

Our estimation period coincided with a time in which the financial market was undergoing deregulation in various ways and therefore, intuitively, we consider the results obtained from the Boone indicators to be more consistent with reality.

## **Appendix: Estimation of Marginal Cost**

Because marginal cost is not observable, we estimate the translog cost function, as in the Hayashi (2000) approach. The cost function is  $C(q,w_1,w_2)$ , where q is output and  $w_j$  is factor price j = 1, 2. Taking the second-order Taylor expansion of  $\ln C(q,w_1,w_2)$  with respect to  $\ln q = 0$  and  $\ln w_j = 0$  (j = 1, 2), we obtain:

$$\ln C = \alpha_0 + \sum_{j=1}^2 \alpha_j \widetilde{\ln w_j} + \frac{1}{2} \sum_{j=1}^2 \sum_{k=1}^2 \gamma_{jk} \widetilde{\ln w_j} \widetilde{\ln w_k}$$
$$+ \alpha_q \widetilde{\ln q} + \frac{1}{2} \gamma_{qq} \left(\widetilde{\ln q}\right)^2 + \sum_{j=1}^2 \gamma_{jq} \widetilde{\ln w_j} \widetilde{\ln q} + \varepsilon,$$
(A1)

where  $\tilde{x}$  denotes the value that equals x minus its average. Note that we drop a subscript that denotes index, i = 1, ..., n. We use the symmetry assumption,  $\gamma_{jk} = \gamma_{kj}$  (j, k = 1, 2). For j = 1, 2, share equations are

$$s_j = \alpha_j + \sum_{k=1}^2 \gamma_{jk} \, \widetilde{\ln w_k} + \gamma_{jq} \, \widetilde{\ln q}, \tag{A2}$$

where  $s_j$  is the share of input factor *j*. Adding an error term to each share equation, we obtain

$$s_{1} = \alpha_{1} + \gamma_{11} \widetilde{\ln w_{1}} + \gamma_{12} \widetilde{\ln w_{2}} + \gamma_{1q} \widetilde{\ln q} + \varepsilon_{1},$$

$$s_{2} = \alpha_{2} + \gamma_{21} \widetilde{\ln w_{1}} + \gamma_{22} \widetilde{\ln w_{2}} + \gamma_{2q} \widetilde{\ln q} + \varepsilon_{2}.$$
(A3)

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Due to adding-up restrictions,

$$\begin{cases} \alpha_1 + \alpha_2 = 1\\ \gamma_{11} + \gamma_{21} = 0\\ \gamma_{12} + \gamma_{22} = 0\\ \gamma_{1q} + \gamma_{2q} = 0 \end{cases}$$
(A4)

and the symmetry assumption, we rewrite the share equations as

$$s_{1} = \alpha_{1} + \gamma_{11} \left( \widetilde{\ln w_{1}} - \widetilde{\ln w_{2}} \right) + \gamma_{1q} \widetilde{\ln q} + \varepsilon_{1},$$

$$s_{2} = \alpha_{2} + \gamma_{11} \left( \widetilde{\ln w_{1}} - \widetilde{\ln w_{2}} \right) + \gamma_{2q} \widetilde{\ln q} + \varepsilon_{2}.$$
(A5)

We can estimate all of the parameters using only one share equation and the parameter restrictions. First, we estimate

$$s_1 = \alpha_1 + \gamma_{11} \left( \widetilde{\ln w_1} - \widetilde{\ln w_2} \right) + \gamma_{1q} \, \widetilde{\ln q} + \varepsilon_1,$$

by OLS to obtain three parameters,  $\alpha_1$ ,  $\gamma_{11}$ , and  $\gamma_{1q}$ . Then, using the restrictions, we obtain the other parameters,  $\alpha_2 = 1 - \alpha_1$ ,  $\gamma_{12} = -\gamma_{11}$ ,  $\gamma_{21} = \gamma_{12}$ ,  $\gamma_{22} = -\gamma_{21}$  and  $\gamma_{2q} = -\gamma_{1q}$ . Substituting these parameters into the translog equation yields

$$Y^* = \alpha_0 + \alpha_q \, \mathrm{ln}\, q + \frac{1}{2} \gamma_{qq} \left( \mathrm{ln}\, q \right)^2 + \varepsilon, \tag{A6}$$

where

$$Y^* = \ln C - \sum_{j=1}^{2} \hat{\alpha}_j \, \widetilde{\ln w_j} - \frac{1}{2} \sum_{j=1}^{2} \sum_{k=1}^{2} \hat{\gamma}_{jk} \, \widetilde{\ln w_j} \, \widetilde{\ln w_j} \, \widetilde{\ln w_k} - \sum_{j=1}^{2} \hat{\gamma}_{jq} \, \widetilde{\ln w_j} \, \widetilde{\ln w_j} \, \widetilde{\ln q}. \tag{A7}$$

Because Eq. (A7) has no restrictions, we can estimate it by OLS to obtain  $\alpha_0$ ,  $\alpha_q$ , and  $\gamma_{qq}$ .

Finally, differentiating the translog function with respect to output, we obtain marginal cost:

$$\hat{c}_{i} = \frac{\partial C(q_{i}, w_{1}, w_{2})}{\partial q_{i}}$$

$$= \frac{C_{i}}{q_{i}} \frac{\partial \ln C_{i}}{\partial \ln q_{i}}$$

$$= \frac{C_{i}}{q_{i}} \left( \hat{\alpha}_{q} + \hat{\gamma}_{qq} \operatorname{\overline{\ln q_{i}}} + \hat{\gamma}_{1q} \operatorname{\overline{\ln w_{1i}}} + \hat{\gamma}_{2q} \operatorname{\overline{\ln w_{2i}}} \right).$$
(A8)

From Eq. (A8), the marginal cost of bank output is  $\hat{c}_i$ .

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