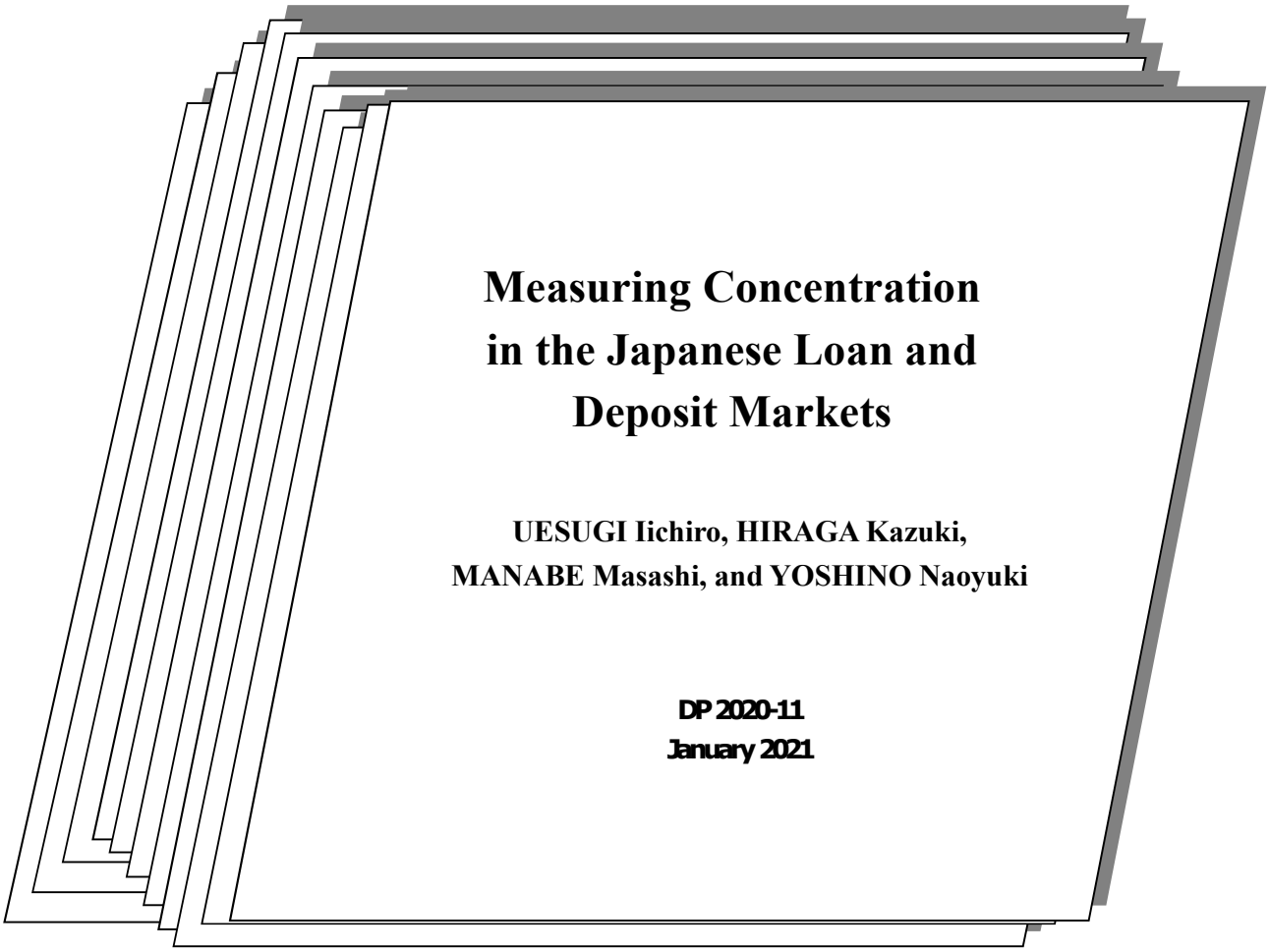
FSA Institute Discussion Paper Series



Measuring Concentration in the Japanese Loan and Deposit Markets

UESUGI Iichiro, HIRAGA Kazuki,
MANABE Masashi, and YOSHINO Naoyuki

DP 2020-11
January 2021

Financial Research Center (FSA Institute)
Financial Services Agency
Government of Japan
3-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8967, Japan

< FSA Institute Discussion Paper Series DP2020-11 (January, 2021)>

Measuring Concentration in the Japanese Loan and Deposit Markets

UESUGI Iichiro * HIRAGA Kazuki ** MANABE Masashi *** YOSHINO Naoyuki****

Abstract

This study is the first to exhaustively calculate the degree of concentration in regional banking markets using the outstanding amount of loans and deposits at branches and headquarters of financial institutions located in Japan. Calculating the Herfindahl-Hirschman Index (HHI) for loans and deposits for each prefecture and for each urban employment area for the period 2005–2019, we show differences in the HHI across regions and its development over time. Furthermore, we decompose HHI into two factors, namely one related to the number of financial institutions and the other to deviation from the mean market share. We also examine the extent of the increase in the HHI caused by mergers of financial institutions and its persistence. The main results obtained are as follows. First, loan and deposit HHI show an upward trend; however, the HHI of loans in large metropolitan areas, which were already low, show a trend of further decline. Competition among financial institutions becomes tougher in large metropolitan regions. Second, increases in HHI are not only due to reductions in the number of financial institutions but also to increasing variations in financial institutions' market share. And third, while the increase in loan HHI due to financial institution mergers is sustained for a certain period, its duration tends to be shorter in regions with a low market concentration.

Keywords: Herfindahl-Hirschman Index; Market concentration; Competition; Financial institution mergers.

* Professor, Institute of Economic Research, Hitotsubashi University (Research Fellow, Financial Research Center, Financial Services Agency), Corresponding author
** Associate Professor, Faculty of Political Science and Economics, Tokai University (Research Fellow, Financial Research Center, Financial Services Agency)
*** Professor, Faculty of Business Innovation, Kaetsu University (Research Fellow, Financial Research Center, Financial Services Agency)
**** Professor Emeritus, Keio University; Director, Financial Research Center, Financial Services Agency
We are grateful to the Banking Regional Policy Office of the Financial Services Agency for the use of branch-level information on loans and deposits, which is essential to the construction of the HHI. We received valuable feedbacks from many professionals, including OHGO Naoki and SATO Susumu. This paper contains personal views of the authors and does not represent official views of the Financial Services Agency or the Financial Research Center.

1. Introduction

Japan's deposit-taking financial institutions have faced a variety of changes in their business environment from the 1990s to the present, including the bursting of the asset price bubble, the disposal of bad loans and the financial crisis, sluggish loan demand due to long-term economic stagnation, a shrinking population, and the growth of fintech. Many financial institutions have merged or integrated operations as part of their responses to these changes. Regional banks, which have not integrated their operations much to date, have recently begun to do so and have also taken steps to form alliances with other financial institutions. In addition to business mergers and alliances, financial institutions are not only uncovering the demand for loans in their traditional business areas but are also making an effort to lend in regions distinct from those of their traditional business—so-called cross-regional lending.

What is the extent of competition among deposit-taking financial institutions in Japan as a result of these actions, including business mergers, alliances, and cross-regional lending? Studies have been conducted using different methods to answer this question. Some studies assess the degree of competition in the market by focusing on the price-cost margin, which is the difference between the interest rate set by financial institutions and marginal cost (Ogura, 2012; Ojima, 2018).[1] Some studies judge whether the loan market is monopolistic, perfectly competitive, or somewhere in between, adopting the conduct parameter approach that simultaneously considers supply and demand structures (Uchida and Tsutsui, 2005; Maruyama, 2020; Ogura, 2020).[2] Other studies calculate market concentration using the Herfindahl-Hirschman Index (HHI) and consider it as the degree of competition under certain assumptions (Nakata and Adachi, 2006; Ogura, 2012; Harimaya and Ozaki, 2017).

In this study, we focus on one of these approaches, using HHI to assess the extent of competition. The HHI is a method of calculating market concentration by identifying the scope of a market and then adding the square of the market shares of the financial institutions present in that market. If the market is dominated by a single financial institution, the HHI will be 1, and the degree of competition is viewed as most relaxed; on the other hand, if the number of financial institutions in the market is large and the market share is evenly distributed between them, the HHI value will be small and the degree of competition is viewed as intense. Theoretically, if each financial institution assumes that an increase in loans/deposits by one institution has the same impact on the supply of loans/deposits in the entire market, HHI is proportionately related to the price-cost margin, which represents the market power, and shows the degree of competition in the market.

[1] The price-cost margin is the difference between the interest rate set by a financial institution and marginal cost, divided by the interest rate. It is considered to be a measure of the market power.

[2] The conduct parameter is a value that is estimated to judge the level of competition in the market. This takes a value of 0 under perfect competition, a value of 1 under monopoly, and a value between 0 and 1 under Cournot competition with multiple competing firms.

The HHI is widely used by policymakers because it shows the degree of competition in the market under certain theoretical assumptions and because it is relatively easy to measure. For example, in the "Guidelines to Application of the Antimonopoly Act Concerning Review of Business Combinations," the Fair Trade Commission positions the extent of change in HHI as one of the criteria for determining whether a business combination should be subject to review. In actual reviews of bank mergers, the Fair Trade Commission publishes the HHI of the target market. In the case of Fukuoka Financial Group's integration of the Eighteenth Bank, approved in August 2018, the review shows HHI in the loan market before the merger and the extent of expected increase in HHI after the merger.[3]

However, administrative authorities have not yet presented comprehensive HHIs for loan and deposit markets for every region in Japan.[4] Although researchers have measured HHI of loan markets based on available data, they have not been able to measure HHI comprehensively and accurately due to a lack of required information. Nakata and Adachi (2006), Ogura (2012), and Harimaya and Ozaki (2017) calculate HHI based on certain assumptions about loans and total assets of financial institutions by region, as not all data on loan and deposit values by region and by financial institution are available, which may have resulted in deviation from the true HHI. Deviations may exist because of the exclusion of large banks from calculations (Nakata and Adachi, 2006; Harimaya and Ozaki, 2017), as well as due to assumptions of uniform loan and deposit values at all branches of financial institutions (Ogura, 2012; Harimaya and Ozaki, 2017). In addition, due to limitations in the available data, prior studies have mainly conducted analyses at the prefectural level, and have not examined whether prefectures constitute an appropriate geographic scope for loan and deposit markets.

Against this backdrop, this study aims to present the extent of concentration in Japan's regional loan and deposit markets comprehensively by HHI. We construct HHI of local loan and deposit markets for the period 2005-2019. This HHI is more comprehensive and accurate than the ones provided in earlier studies as we use branch-level information on the outstanding amount of loans and deposits reported by financial institutions (banks, *shinkin* banks, and credit cooperatives) and collected by the Financial Services Agency. The HHI is calculated not only at the prefectural level but also at the level of metropolitan employment areas (MEAs) and micropolitan employment areas (MCEA), regional classifications proposed by Kanemoto and Tokuoka (2002) to precisely reflect the state of regional economic integrations.

This study also aims to examine the characteristics of the loan and deposit HHIs we

[3] The results of this review are available at
https://www.jftc.go.jp/houdou/pressrelease/h30/aug/180824.html

[4] In the US, the Federal Deposit Insurance Corporation (FDIC) publishes the outstanding amount of deposits held by financial institutions aggregated for various geographic categories, including by zip codes. On the FDIC's website, one can also calculate the current HHI for deposits and a hypothetical HHI for any combination of banks in a consolidation. A Pro-Forma (HHI) Report on deposits is available at https://www7.fdic.gov/sod/sodMarketBank.asp?barItem=2.

calculate. For this purpose we first perform a factor decomposition of the HHI. As highlighted by Hannan (1997) and Cetorelli (1999), the fewer the number of financial institutions participating in a market or the greater the deviation from the mean market share, the higher the HHI value. Thus, we decompose HHI into two components: one related to the number of deposit-taking financial institutions and the other to deviation from the mean market share, and then examine which of the two elements explains the level of HHI and its changes better than the other.

We next examine the extent to which consolidation of financial institutions increases the HHI and the extent to which such an increase in the HHI persists. When two or more financial institutions merge, the share of the merged institution always increases in the market. Thus, focusing on the mergers of financial institutions in Japan, we calculate the expected increase in HHI relative to the ex-ante HHI level. In addition, we examine how long higher HHI levels persist in regions where mergers have taken place. These analyses reveal the medium-term effects of bank mergers on the concentration of loan and deposit markets.

The main results obtained are as follows. Both loan HHI and deposit HHI tend to be low in metropolitan prefectures and high in rural prefectures. Furthermore, the HHI at the MEA level tends to be lower in areas where prefectural governments and government ordinance-designated cities are located compared to the HHI in areas consisting of non-designated cities only. Heterogeneity in market concentration exists not only across prefectures between metropolitan prefectures and rural counterparts, but also within the same prefecture between areas that include prefectural capital cities and areas without such cities. The average value of loan HHI and deposit HHI increased throughout the analysis period. However, for the loan HHI, there is a tendency to decline further for metropolitan areas, which have already been at low levels, as competition becomes tougher.

The increase in the HHI are not only due to reductions in the number of financial institutions but also to larger variations in financial institutions' market share. Examining the persistence of HHI increases due to bank mergers, we find that the increase in loan HHI diminishes to about half the originally anticipated increase in five years after the merger. The persistence of an increase in loan HHI differs depending on the level of ex-ante market concentration. In prefectures with lower market concentration the increase in loan HHI that occurred at the time of the merger becomes statistically insignificant within five years, while in regions with higher concentration the increase remains unchanged.

The structure of this paper is as follows. Section 2 describes our analytical framework and explains the methods used to measure HHI and perform factor decomposition. Section 3 introduces the data used in the analysis. Section 4 presents the results of measuring HHI, while Section 5 presents a factor decomposition of HHI and the results of the analysis of the extent to which financial institution mergers affect HHI. Section 6 presents the conclusions.

2. Analytical Framework

2.1 Measurement of HHI

The HHI is defined using the following equation for the loan and deposit markets in region *r* at time *t*.

$$HHI\_Loan_{rt} = \sum_{i=1}^{n} Share\_Loan_{irt}^2 \quad (1)$$

$$HHI\_Deposit_{rt} = \sum_{i=1}^{n} Share\_Deposit_{irt}^2 \quad (2)$$

Regarding the HHI of the loan market, its components are the square of the share of loan by financial institution *i* of the total outstanding amount of loans in the market in region *r* at time *t*, $Share\_Loan_{irt} = {Loan_{irt}}/{\sum_{i=1}^{n} Loan_{irt}}$. Summing this for all financial institutions in the market, we obtain *HHI_Loan*, that is, the HHI of the loan market. *HHI_Deposit*, the HHI for the deposit market, is calculated in the same manner.

The financial institutions included are city banks, trust banks, de novo banks, former long-term credit banks, regional banks, second-tier regional banks, *shinkin* banks, credit cooperatives, and foreign banks. Government-affiliated financial institutions, including the Norinchukin Bank, the Federation of Credit Agriculture and Fishery Cooperatives, the Shoko Chukin Bank, Japan Post Bank, the Federation of Labor Banks, labor banks, and agricultural and fishery cooperatives, are not included. Some types of financial institutions are not included because regional data are not available for those types of financial institutions, or because financial institutions in question have integrated their branches across prefectures during the analysis period, which would cause a sizable disruption to developments in HHI for the period. In interpreting the results, the impact of excluding these types of financial institutions must be considered. We calculate HHI for all target financial institutions, HHI for regional financial institutions, and HHI for regional banks and second-tier regional banks. The sample period spans between March 2005 and March 2019 given the availability of data from the FSA (Financial Services Agency, Government of Japan). As a result, the HHI is calculated on 15 occasions during this period.

We use prefectures and urban employment areas (hereafter UEAs) alternately for the definitions of geographic scope of the loan and deposit markets. Given that most previous studies have considered each prefecture as a market, we first employ prefectures as the geographic scope of loan and deposit markets. Prefectures are administrative divisions, which may differ from the geographic scope of actual loan and deposit markets.[5] As an alternative definition of market scope,

[5] Under Japanese business combination guidelines, the so-called SSNIP (Small but Significant and Non-transitory Increase in Price) test is adopted in determining the scope of the market. The idea is that if all suppliers in region A raise prices by a small but substantial and non-transient amount, and if consumers switch their purchases to a different region B, then A and B may be considered to belong to the same market. An application of this procedure might enable us to define different lending markets than those based on prefectures or municipalities.

we employ UEAs that are based on the degree to which the labor force commutes between cities and towns. Cities and towns whose workers frequently commute to and from each other belong to the same urban employment area. More specifically, the following rules established by Kanemoto and Tokuoka (2002) are applied to the definition of the area. First, central cities are defined as municipalities which have densely inhabited districts (DID) with a population above a certain level. A metropolitan area with a DID population of 50,000 or more in a central city is called an MEA, while one with a DID population of 10,000 to 50,000 is termed an MCEA.[6] Second, municipalities whose commuting ratio to the central cities is 10% or more are considered suburban cities. And third, multiple central cities may exist within the same area, and sets of municipalities comprising central cities and suburban cities that fit these rules are considered UEAs. In this study, we consider both MEAs and MCEAs as UEAs.

After identifying the geographic scope of markets, we use address information on banks' headquarters and branches and aggregate their loan and deposit outstanding amount within the market. In the process of data aggregation, we assume that loans and deposits are made within the prefectures or UEAs in which branches are located. Financial institutions and borrower firms are often physically close to each other, and it is natural to assume that they are located in the same region. Based on information on approximately 3.6 million business relationships between firms and financial institutions in the databases of a credit research company, Ono et al. (2016) found that the average distance between firms and their financial institutions is 5.5 km, while the median value is 1.6 km. Similarly, the distance between financial institutions and deposit-making households is likely to be small because of the convenience of withdrawing cash. In light of these points, our analysis proceeds on the assumption that financial institution branches, borrower firms, and deposit-making households are located within the same market.

However, there are some exceptions in which branches of a financial institution are likely to extend loans beyond boundaries of prefectures and UEAs. These occur when all the branches of a financial institution in a market are closed during the analysis period and consolidated to branches located in adjacent markets. For such financial institutions, the locations of their branches and the locations of their borrower firms, are less likely to align. Therefore, a financial institution whose branch networks drastically shrunk during the analysis period is excluded from the calculation of HHI.

2.2 HHI factor decomposition and the impact of mergers on HHI

We have detailed the methodology to calculate the HHI in the previous subsection and the next issue is to understand its determinants and their relevance. One way to address this issue is the factor decomposition. HHI can be decomposed into the inverse of the number of financial

6) We refer to the following website for the classification of urban employment areas: http://www.csis.u-tokyo.ac.jp/UEA/uea_def_e.htm

institutions in the market and the factor that includes coefficients of variation for banks' shares in the market. Another way is to focus on the impact of bank mergers and to examine the extent bank mergers increase loan and deposit HHI and persistence of the increase in HHI.

2.2.1 Decomposition into factors related to market share variability and number of financial institutions

HHI can be decomposed into two parts, one related to the number of financial institutions and the other to the degree of deviation from a situation where the shares are evenly distributed, as in the following equation.

$$HHI\_Loan_{rt} = {CV_{rt}^2}/{n_{rt}} + {1}/{n_{rt}}, \quad (3)$$

where HHI_Loan_{rt} represents the loan HHI at time t in region r, CV_{rt}^2 is the square of the coefficient of variation of loan share defined by $n_{rt}\sum_{i=1}^{n_{rt}}\left(\frac{Loan_{irt}}{\sum_i Loan_{irt}} - \frac{1}{n_{rt}}\right)^2$, n_{rt} is the number of financial institutions at time t in region r.

The same relationship holds for the deposit HHI. Equation (3) shows that HHI is higher when the number of financial institutions participating in the market is fewer or the variation in the share of loan and deposit is larger. Thus, by dividing the HHI into two components, we can identify which component better explains the level of concentration and its changes over time.

2.2.2 Changes in the HHI due to mergers of financial institutions

If the merging financial institutions operate in the same loan market, the loan HHI will always rise after the merger because loans that used to be divided into two or more institutions become one after the merger. The same applies to the HHI in the deposit market after mergers. Focusing on this point, we first show the extent the HHI is expected to increase after bank mergers using the information on loans and deposits held by the merging banks before the merger. Next, we examine the extent these expected increases in the HHI are realized after the merger and the extent the increases persist over time.

Let $\Delta HHI\_Counterfactual_{rt-1}$ be the expected increase in the HHI at time t-1 due to the merger of financial institutions at time t in region r. $\Delta HHI\_Counterfactual_{rt-1}$ is positive if both financial institutions participating in a merger have a certain amount of loans or deposits in the same region. The more such mergers take place in the region, the larger the expected increase in the HHI. We show these increases after standardizing them by the HHI in region r at time t-1 as follows:

$$\Delta HHI\_Counterfactual_{rt-1}/HHI_{rt-1} \quad (4)$$

Equation (4) predicts the extent of an increase in concentration due to a bank merger, based on the information on the outstanding amount of loans and deposits before the merger. Another important issue is the extent these predicted increases in loan and deposit market concentration are realized and sustained after the merger. For this purpose, we regress the actual change in the loan and deposit market concentrations after bank mergers on the predicted change in the market concentration as shown in Equation (5):

$$\left(\frac{\Delta HHI_{rt+j,t-1}}{HHI_{rt-1}}\right) = \alpha + \beta_j(\Delta HHI\_Counterfactual_{rt-1}/HHI_{rt-1}) + \varepsilon_{rt+j} \quad (5)$$

where $\Delta HHI_{rt+j,t-1}$ represents the actual change in HHI from time t-1 to time t+j and j is from 0 to 5. In the estimations, we check how β_j changes over the years from year t-1 to year t+j. If the expected increase in the HHI is fully realized at the time of the merger, the coefficient of β_0 will be unity. Further, if the increase in the HHI is persistent several years after the merger, β_j will remain close to one for j=1 to 5. If there are many financial institutions that enter the market after the merger, it will be crowded with banks and β_j will become substantially less than one. Conversely, if the market share of merged banks further increases after the merger, the coefficients of β_j may exceed the value of one over time.

3. Data

In order to conduct the analysis we described in the previous section, we construct a dataset based on the information on the outstanding amount of loans and deposits for banks' branches and headquarters.[7] The information, which spans between March 2005 and March 2019, is reported by financial institutions located in Japan to the Financial Services Agency of the Japanese government (FSA).

Note, however, that the above dataset is not enough to calculate the regional level HHI since it lacks certain necessary geographical information on branches. The dataset includes only bank branch codes and names, while postal codes are available only for a limited number of branches. Therefore, we supplement the dataset with additional locational information on branch addresses and municipality names and codes they are located by using other data sources such as *Nihon kinyu meikan* (The Directory of Financial Institutions), a comprehensive list of headquarters and branches of all the financial institutions in Japan that is published annually by The Japan Financial News Co., Ltd.

[7] Hereafter we simply refer them as "branches."

Upon merging the information included in the Directory of Financial Institutions with the FSA dataset, however, there are still a few issues that need to be addressed. First, bank branch names and codes in the FSA dataset do not perfectly coincide with those included in the Directory of Financial Institutions. Further, there are branches and divisions within a financial institution whose locations are difficult to identify. In some cases there are divisions in a bank's headquarters that it reports as having loan and deposit outstanding amount. But these divisions have no official branch codes necessary to merge data with those in the Directory of Financial Institutions.

Second, there is an issue of missing data, that is, some financial institutions fail to report information to the FSA on the outstanding amount of loans and deposits for certain branches for certain years. We fill these missing data by extrapolation. More specifically, we employ branch-level information on loan and deposit outstanding amount that is available before or after the missing years. We also use prefecture-level loan and deposit information that are separately reported by these financial institutions and calculate year-on-year growth rates of loans and deposits at the prefecture level. Then we combine these two types of information to fill the missing information on the branch-level loan and deposit amount outstanding.

After these data cleaning procedures, we construct a dataset necessary for the calculation of loan and deposit HHI at the prefecture and the urban employment area level. More details on the construction of the dataset are provided in the Appendix.

4. Results: Measuring HHI

In this section, we measure the loan and deposit HHIs for all financial institutions, regional financial institutions, regional and second-tier regional banks at the prefecture and the urban employment area level. As a result, we construct twelve different series of HHIs, all of which are provided in the online appendix tables at the FSA website.[8]

4.1 HHI in prefectural loan and deposit markets

We start by presenting descriptive statistics of HHIs when loan and deposit markets are defined at the prefecture level. Table 1, which shows the changes in HHIs for all financial institutions included in the analysis, reveals several notable features.

The average HHI for the prefectural loan market is 0.2099 (in 2005) and 0.2301 (in 2019), while that for the deposit market is 0.2280 (in 2005) and 0.2535 (in 2019), respectively. At any point, the HHI in the deposit market is greater than that in the loan market. In both the loan and deposit markets, the average HHI and the market concentration tend to increase over time. The standard deviation of HHI is larger for deposit HHI than for loan HHI. Having recorded the smallest standard deviation for both loan and deposit market at around 2006, it has increased since then.

[8] https://www.fsa.go.jp/frtc/seika/R2.html#11

In the table we present the HHI at different quantiles, the minimum and 5% quantile values of the loan HHI move differently from those of other quantiles. They have become smaller rather than larger over time, which is in contrast to the loan HHI quantile values of above 10% and all the deposit HHI quantile values. In prefectures where concentration level is already low in the loan market, the loan HHI has become even lower during the period of analysis. In Figure 1, we see this tendency clearly in the development of the histogram for the loan HHI during the period. In 2005, the three prefectures recorded the lowest loan HHI values in the range of between 0.07 and 0.1, closely followed by several other prefectures in the range of 0.1 and greater. Since then, however, there has been a widening gap between prefectures in the lowest loan HHI group (Aichi, Osaka, Hyogo, and Tokyo prefectures) and those in the second lowest group. In contrast, we do not observe such a phenomenon for the deposit HHI.

For both loan and deposit markets, prefectures located in metropolitan areas tend to record lower HHI values than those in rural areas, indicating that the level of concentration is lower in metropolitan areas. We define the metropolitan prefectures as those in the Tokyo metropolitan (Saitama, Chiba, Tokyo, and Kanagawa prefectures), the Keihanshin (Kyoto, Osaka, Hyogo prefectures), and the Chukyo (Aichi prefecture) areas and then compare their HHI in 2005 with HHI in other prefectures. The mean, minimum, median, and maximum values of loan HHI in metropolitan prefectures are 0.11, 0.07, 0.11, and 0.18, while those in other prefectures are 0.23, 0.13, 0.24, and 0.34, respectively. For all quantiles values, HHIs in the metropolitan area are lower than those in the non-metropolitan area.

In Table 2, we limit our scope to regional financial institutions (regional banks, second-tier regional banks, *shinkin* banks, and credit cooperatives) and observe the evolution of their HHI values. A comparison of the results with those in Table 1 for financial institutions as a whole, highlights the following points. HHI values are higher in Table 2, reflecting the fact that there are fewer financial institutions in the market. The tendency for the deposit HHI to be higher than the loan HHI, and the tendency for the average loan and deposit HHIs to increase over the period, are the same as those we find in HHIs for all the financial institutions. In contrast, the development of quantile values for the loan HHI is somewhat different from that in Table 1 in that not only the minimum but also the maximum values of loan HHIs decrease over time.

Table 3 shows the evolution of HHIs when we focus on regional and second-tier regional banks. Following notable features are in order. The HHI values become more sizable due to the limited number of regional banks in the market. There is one prefecture (Yamanashi) where only one regional bank has its branch networks, indicating that the value of HHI being unity. For the loan HHI, its average increases in the first half followed by a decrease in the latter half. As a result, the average values of loan HHI are similar between the years 2005 and 2019. As for deposit HHI, the average increases over the period. Regarding the quantile values of the loan HHI, those at the minimum and 5% point decrease over time, which is the same as we see in Table 1. Meanwhile, values at the median and 75% point also decrease, which is different from the result we obtain for

all the financial institutions.

To summarize, the deposit HHI is higher than the loan HHI at the prefecture level. Over the past 15 years, the average extent of market concentration has increased for both deposit and loan markets, except when HHI values are calculated for regional banks only. In some loan markets located in the metropolitan area, however, the extent of concentration was low at the outset and has further declined during the period of analysis. In contrast, the values of deposit HHI for all quantiles have increased during the period.

4.2 HHI in markets defined by urban employment areas

In this subsection, we present results of the HHIs for the loan and deposit market defined by UEAs. The UEAs comprise metropolitan economic areas (MEAs) and micropolitan economic areas (MCEAs). As Table 4 shows, the total number of MEAs and MCEAs was 251 in 2005, while it decreased to 222 in 2015 due to a large number of mergers between local governments. Since the number of UEAs is still far larger than the number of prefectures, the HHI calculated for each employment area may be larger on average than the HHI for each prefecture.[9, 10]

Results are presented in Table 5. As we did in the previous subsection, we employ three different groups of financial institutions as those participating in the market. First, we employ financial institutions of all types (city banks, trust banks, de novo banks, former long-term credit banks, regional banks, second-tier regional banks, *shinkin* banks, credit cooperatives, and foreign banks) as those in the market. The average loan HHI is 0.2629 (in 2005) and 0.2777 (in 2019), while the average deposit HHI is 0.2877 (in 2005) and 0.3079 (in 2019). At any point, the deposit HHI is greater than the loan HHI. In both the loan and deposit markets, the average HHI value tends to increase over time, indicating that the extent of concentration increases.

In terms of standard deviations, there is not much difference in their levels between the loan and deposit markets. The levels are also similar when comparing years 2005 and 2019. Unlike the case where the markets are defined by prefecture, the degree of variation in HHIs across markets does not substantially change over time.

---

[9] The geographic scope of MEAs and MCEAs is smaller on average than that of prefectures. The exception is the MEA covering the Tokyo Special Administrative Region as its central city, which forms a vast urban employment area that encompasses 152 municipalities as of 2015.

[10] It should be noted that municipal mergers or the transition to a government ordinance city may occur within the five-year intervals in which the same definition of urban employment areas is applied. In order to keep calculating HHIs consistently even when these changes occur, we need to choose between the two options: (1) to keep original municipality codes for the municipalities that experienced mergers or transitions to ordinance-designated cities; or (2) to drop these municipalities from the sample. In this study we choose the latter option and exclude the municipalities that experience these mergers and transitions. Specifically, we exclude Mizusawa city (3204), Haramachi city (7206), Hondo city (43207), Kokubu city (46212), Shizunai town (1605), Innoshima city (34206), Nase city (46207), and Furukawa city (42040) between 2006 and 2009 as their municipality codes were changed due to municipal mergers. We also exclude Kumamoto city (43100) from the analysis between 2012–2014, Niigata city (15100) between 2007–2009, Hamamatsu city (22300) between 2007–2009, and Okayama city (33100) in 2009 due to changes in city codes resulting from transition to government ordinance-designated cities.

A detailed examination of loan HHI by quantiles indicates that the minimum, 95%, and maximum values decrease rather than increase throughout the period. This is in contrast to the other quantile values for the loan HHI, which increases in later years. This means that the distribution of the loan HHI as a whole moves to the right over time, while the left and right edges of the distribution move to the left.

This tendency is also observed to some extent in the histogram of Figure 2, which represents the loan HHI distribution for each year. In the figure, the left tail of the distribution in year 2019 (i.e., the area where the HHI is smaller than 0.1) tends to become slightly thicker, and the right tail (i.e., the area where the HHI is greater than 0.45) tends to become slightly thinner compared to that in 2005. Note, however, that there exists no clear tendency that areas that are already low in the extent of loan market concentrations experience a further decline in the loan HHI. This is in clear contrast with the results for the loan HHI at the prefecture level market.

In terms of the HHI values, those in the urban MEAs or MCEAs, which often include prefectural capital cities or ordinance-designated cities, tend to be lower than the HHI values in the rural MEAs or MCEAs. We compare HHIs as of year 2005 for the urban UEAs and the rural UEAs. The mean, minimum, median, and maximum loan HHI values in the MEAs which include prefectural capital cities and/or ordinance-designated cities are 0.24, 0.06, 0.24, and 0.42, respectively, while the corresponding values in the other MEAs and MCEAs are 0.27, 0.11, 0.26, and 0.60, respectively. Although margins are not as large as the differences between metropolitan prefectures and other prefectures, the difference in HHI levels between populous UEAs and other areas is still substantial.

We also show graphically the varying extent of concentration depending on the definition of the market in Figure 3. The differences between prefectures and between UEAs are shown in color on the map. Loan HHIs for all financial institutions are plotted for 2019 at the prefectural and urban employment area levels. Prefectures that belong to metropolitan areas are less concentrated than are other prefectures and painted in light colors. Further, UEAs which include prefectural capitals and government ordinance-designated cities tend to report lower HHI and are painted in lighter colors than other employment areas.

Tables 6 and 7 show the HHI for regional financial institutions, and the HHI for regional banks and second-tier regional banks, respectively. There are some notable features when compared with Table 5. First, since the number of financial institutions covered in the analysis is small, values of the HHI are larger than those in Table 5 in which all financial institutions are included. In particular, Table 7, which covers only regional banks and second-tier regional banks, shows the presence of several UEAs with the HHI values being unity. There is only one such case at the prefecture level analysis, while there are several of them at the UEA level. They are the UEAs in Hokkaido, Saitama, Yamanashi, and Aichi prefectures. Second, we also observe an upward trend in the average loan and deposit HHIs to increase in Tables 6 and 7. Third, among the quantile values, the minimum values of loan HHI decline during the period in all the Tables

5 to 7. In addition, values at the 5% point of loan HHI also decline in Table 7.

In summary, the overall trend in HHI at the urban employment area level is similar to that in HHI at the prefecture level. The deposit HHI is higher than the loan HHI. Just as the HHIs in prefectures belonging to metropolitan areas being smaller than the HHIs in other prefectures, the HHIs of UEAs that include prefectural capital cities and government ordinance-designated cities are smaller than those of other UEAs. Further, the extent of market concentration has increased on average over the last 15 years. Meanwhile, in some regional loan markets with low concentrations from the outset, the concentration has further declined over time.

5. Results of HHI factor decomposition and the impact of mergers

In this section, we first decompose the HHI into two components and examine which one of them is more important in explaining changes in the HHI during the period. Second, we investigate the impact of bank mergers on HHI for the loan and deposit markets. For the sake of brevity, we present results only for the analysis covering all financial institutions.

5.1 Decomposition into factors related to variation in shares and the number of financial institutions

First, we focus on the prefectural loan and deposit markets and decompose the HHI into factors related to the coefficient of variation and factors related to the number of financial institutions. Table 8 presents the results, in which the element of the coefficient of variation explains more the developments in HHI than the element of the inverse of the number of financial institutions.

In terms of the average HHI values, the components of the inverse of the number of financial institutions are almost the same for loan and deposit HHIs at 0.043 (in 2005) and 0.046 (in 2019), respectively, increasing over time. This is due to the declining number of financial institutions with branches in each region after a series of branch consolidations. The component of the square of the coefficient of variation divided by the number of financial institutions is 0.167 (in 2005) and 0.184 (in 2019) for loans and 0.185 (in 2005) and 0.207 (in 2019) for deposits, both of which increased over time. These elements, which represent the variability in market shares of financial institutions, are larger in their contribution to the level of and changes in HHIs.

Second, we focus on the market defined by the UEAs and implement the same exercise. This time, the component of the inverse of the number of financial institutions is larger in its contribution to the level of HHI because the number of financial institutions is in general smaller in the UEAs than in prefectures. However, the component related to the coefficient of variation continues to be more important in explaining variations in HHI.

We show the results of decomposition in Table 9. The component of the inverse of the number of financial institutions in loan and deposit markets is 0.135 (in 2005) and 0.140 (in 2019). These are almost the same for loans and deposits and increasing over time. This is again due to the declining number of financial institutions with branches in each area after a series of branch

consolidations. The component of the square of the coefficient of variation divided by the number of financial institutions is 0.128 (in 2005) and 0.138 (in 2019) for loans and 0.153 (in 2005) and 0.168 (in 2019) for deposits. Both of these series increased over time. This component is more important than the component of the inverse of bank numbers in its contribution to the changes in HHIs.

To summarize, the gradual increase in the extent of concentration in loan and deposit markets is more strongly affected by the increase in the dispersion of banks' market shares than by the decline in the number of financial institutions. This holds whether the market is defined by prefectures or by UEAs.

5.2 Changes in HHI due to mergers between financial institutions

In this section, we focus on the effect of financial institutions' mergers on changes in HHI. Covering all financial institutions in our scope, we discuss an impact on the prefecture-level HHI and an impact on the UEA-level HHI in turn.

5.2.1 The effects of mergers at the prefectural level

First, we present results on the impact of the merger using the formula (4). The number of prefecture-year observations in which the expected increase in the HHI is positive due to financial institution mergers is 118 in the loan market and 117 in the deposit market, out of 705 observations in total (i.e., 47 prefectures for 15 years). Note, however, that many of these positive values are close to zero, since the merging financial institutions often hold a very small share in a prefectural loan market.

Table 10 shows prefecture-year and the extent of the increase in HHI in case the increase measured in formula (4) is 1% or above. The largest merger-induced increase in the loan HHI was expected in Wakayama prefecture in 2006. The margin of increase relative to the loan HHI is 30.3%. Similarly, for deposits, the largest increase in the HHI was expected in Tokyo metropolitan prefecture in 2005 with the margin of 26.2%. Overall, the table shows that while the HHI was expected to rise sharply in prefectures located within metropolitan areas (Tokyo, Osaka, and Aichi prefectures), primarily because of mergers between sizable city banks, there are also a considerable number of cases where HHI was expected to rise sharply in prefectures located outside metropolitan areas (for example, Wakayama, Yamagata, Hokkaido, and Gifu prefectures) due to mergers between regional financial institutions.

Second, we present estimation results of Equation (5). For both the loan and deposit markets, we examine the extent to which $\Delta HHI\_Counterfactual_{rt-1}/HHI_{rt-1}$ is reflected in the actual change in HHI, $\Delta HHI_{rt+j,t-1}/HHT_{rt-1}$ from year t to t+5. We set year t-1 to be 2005 through 2013. Table 11 presents the results. In Columns (1) to (6), we employ as the dependent variable the change in the actual loan HHI from year t-1 to year t through t+5. Similarly, in Columns (7) to (12) we use the change in the actual deposit HHI. In Column (1), the coefficient on the expected

increase in the loan HHI is 0.89. Although this is significantly different from unity, prior expectations are reflected to a considerable extent in the actual increase in the loan HHI. Note, however, that the initial impact on the actual HHI diminished in five years after the merger. The coefficients in Columns (2) to (6) gradually decrease from 0.78 in t+1 to 0.51 in t+5. This decline in the impact of mergers on the loan HHI is possibly due to a decline in market share of the merged banks or due to an increase in the share of rival banks.

Columns (7) to (12), which show results for the deposit HHI, also show a tendency for the HHI to rise almost as expected in the year a merger occurs but decline after the merger. However, the speed of the decline in the coefficient size is much slower than in the loan market. In the deposit market, the competitive pressure from rival banks might be weaker than in the loan market and these rival banks do not increase their market share even after the bank mergers.

What factors influence the results obtained above? In other words, what causes the merger-induced increase in the HHI to dampen in several years? In order to answer the question, we perform an additional analysis considering the possibility that the degree of competition before bank mergers has some impact. Even in case HHI increases due to a bank merger, if the market is competitive, other financial institutions may be aggressive in trying to capture loan and deposit shares from the merged banks. In such cases, the HHI declines rapidly following the merger. Conversely, if there is low competitive pressure in the market, rival financial institutions may remain accommodative and allow merged banks to keep high shares in the loan and deposit market. Assuming that the degree of concentration corresponds to the degree of competition in the market, we estimate Equation (5) again, dividing the sample into two by the ex-ante degree of concentration in the market.

Columns (1) through (12) in Table 12 show the results for the loan market, while Columns (13) through (24) show the results for the deposit market. Within the loan market, the first six columns, (1) through (6), present results only for prefectures where the loan HHI in 2005 was higher than the median value and the degree of competition is considered relatively low, while the subsequent six columns, (7) through (12), present results only for prefectures below the median value and with comparatively high levels of competition. These show contrasting coefficient movements. The coefficients for the former range between 0.83 and 0.97, not significantly different from 1 except for the result at time t. Coefficients for this group show no tendency to diminish as t increases following the merger. Meanwhile, the coefficient of the latter is 0.90 at the time of the merger, which is not significantly different from 1, but the coefficient then diminishes significantly. After four years, the coefficient is not significantly different from 0. These findings suggest that the merged bank's market share declines as other rival financial institutions intensify their aggressive lending operations after the merger.

Similarly, in the deposit market, the first six columns, Columns (13) to (18), show the results only for prefectures where the deposit HHI in 2005 is higher than the median value and the degree of competition is relatively low, and the next six columns, Columns (19) to (24), show

the results only for prefectures where the deposit HHI is below the median value and the degree of competition is relatively high. The trend is the same as for the loan HHI, but once the deposit HHI rises as a result of a merger, it tends to persist longer compared to the loan market, regardless of the level of competition. This is especially true for regions where concentration is high. The coefficients range between 0.96 and 1.07, which are not significantly different from 1. Even in areas that appear to be less concentrated and more competitive, the coefficient after five years of the merger is significant at 0.56. These results suggest that the aggressive operations by other financial institutions in the deposit market is not as intense as that in the loan market, and because of this, the merged bank's share in deposits does not substantially decline.

5.2.2 The effects of mergers at the urban employment area level

Here, we employ UEAs to define the loan and deposit market and repeat the same exercise as we did in the previous subsection. The number of urban employment area-year where the expected increase in HHI is positive due to financial institution mergers is 133 in the loan market and 132 in the deposit market, compared to the total 3648 observations.

Table 13 lists UEA-year in order of the extent of the increase in HHI where the increases measured in formula (4) are 1% or above. Since there are fewer financial institutions in each UEA than in a prefecture, individual financial institutions hold a larger share of the market. Therefore, each individual bank merger will have a more sizable impact on the HHI in UEAs than in prefectures. Actually, the number of UEAs by year where HHI increases above the threshold level is larger in Table 13 than in Table 10.

We present estimation results of Equation (5) for the UEAs in Table 14. In Columns (1) to (6), where we employ as the dependent variable the change in the actual loan HHI from year t-1 to year t through t+5, coefficients on the expected increase in the loan HHI range between 0.93 in year t and 0.76 in year t+5. The extent of increase is diminishing over the five years after the merger, but the speed is slower here than in the prefecture-level examination. In Columns (7) to (12), which show the results for the deposit HHI, there exists a tendency for the HHI to rise almost as expected in the year of a merger but decline after the merger. More specifically, coefficients on the expected increase in the deposit range between 0.91 in year t and 0.76 in years t+3 and t+4, which is similar to the results in the loan market.

Further, Table 15 shows the results of the estimation of Equation (5) after dividing the UEAs into two types according to the extent of ex-ante concentration in the loan and the deposit market. Columns (1) through (12) show the results for the loan market, while Columns (13) through (24) are for the deposit market. Within the loan market, the first six columns, (1) through (6), present results only for UEAs where the loan HHI in 2005 is higher than the median value, and the degree of competition is considered relatively low, while the subsequent six columns, (7) through (12), present results only for UEAs below the median value and with comparatively high levels of competition. Unlike the results of the examination at the prefecture level, there is no

substantial difference in the extent of the reduction of coefficients between areas of different degree of ex-ante concentration.

Similarly, in the deposit market, the first six columns, Columns (13) to (18), show the results only for prefectures where the loan HHI in 2005 is higher than the median value. The next six columns, Columns (19) to (24), show the results only for UEAs where the loan HHI is below the median value. The results here again do not show substantial difference in the extent to which the coefficients decrease between high concentration areas and low concentration areas.

As an additional examination, in a separate set of further estimations in which sample is limited to the bottom 10% of ex-ante loan market concentration, we find that the initial increase in the concentration in the loan market after the merger rapidly diminishes in several years (results are not provided in this paper). This suggests that only a limited number of UEAs with very low market concentration face strong competitive pressure from rival banks after bank mergers. Since mergers participated by small financial institutions are relevant at the UEA level than at the prefecture level, the results indicate that small bank mergers tend to have a lasting impact on the extent of market concentration.

6. Conclusion

Using the information on the value of loans and deposits at the branches of financial institutions located in Japan, this study attempts to exhaustively calculate the degree of concentration in regional financial markets for the first time and statistically clarify their characteristics. In addition to loan and deposit HHIs at the prefectural level, we also create HHIs based on urban employment areas, which are defined by links between cities and towns based on how workers commute to work. We conduct factor decomposition and examine the persistence of the increase in HHIs after mergers of financial institutions.

The purpose of this study is to carry out a fact-finding analysis on HHIs in the Japanese loan and deposit markets rather than to implement a rigorous hypothesis testing. Therefore, there are various future research issues using these HHIs. These include the following. First, it is important to examine how the level of concentration, as indicated by the HHI we constructed here, affects the behavior of financial institutions and is related to the extent of competition in the market. The HHI trends show that the concentration of the loan market in Japan has increased in recent years. In contrast, as shown in Ojima (2018), price-cost margins of the Japanese banks have long declined, indicating that their market power has substantially decreased. How we should reconcile these seemingly contrasting phenomena of increasing concentration and diminishing market power is an important research question to be addressed. Second, we made a rather ad hoc assumption that loan and deposit markets are defined either at the prefecture level or at the urban employment area level. Even though it has been customary to use administrative boundaries for the geographical definition of the market, we may want to make a more serious effort to provide rigorous examinations on how to define the loan and deposit markets. Third and

finally, we need to consider the impact of financial institutions which we excluded from the analysis, such as postal banks, agricultural and fishery cooperatives, and government financial institutions. In order to have a more comprehensive and clearer picture of the loan and deposit market concentration in the country, we need to obtain better information on these institutions and study how their behavior is related to that of the financial institutions we have examined in this article.

Appendix: Methodology for calculating the sum of loans and deposits of financial institutions by municipality

A1. Introduction

In this appendix, we describe the method used to aggregate the value of loans and deposits of financial institutions by municipality. For this purpose we combine data on loans and deposits based on the information provided by financial institutions and collected by the Financial Services Agency (hereafter FSA data) and data on locations of branches and headquarters of financial institutions based on the information in the *Nihon kinyu meikan* (Japan Finance Directory; hereafter Finance Directory data).

Information on the outstanding balance of loans and deposits held by each branch of each financial institution as of the end of March is reported annually to the FSA, along with the name of the branch, the prefecture where the branch is located, and the branch code. The information used in this study covers the period 2005–2019. Some branches are recorded with a postal code of their locations. However, there exists a substantial variety in the size of the area each postal code covers. Moreover, many branches have no postal code recorded. Hence, it is impossible to aggregate branch information by municipality or by other geographical jurisdictions using only the FSA data. Further, there is not always a one-to-one correspondence between a branch code and a branch name in the FSA data. For example, departments or sub branches belonging to a head office or regular branches are sometimes assigned no branch codes or, if any, duplicated branch codes.

Due to the lack of detailed geographical information in the FSA data, we supplement them with another set of data for branch locations of financial institutions, which is the Finance Directory data. The Japan Financial News Company Limited annually issues the Japan Finance Directory that includes the Finance Directory data. The directory contains—in an attached CD-ROM, and a printed booklet covers a wider range of financial institutions—information concerning financial institutions located in Japan, including domestically licensed banks, *shinkin* banks, credit cooperatives, labor banks, and the Norinchukin Bank. Although it has no information on the amount of loans and deposits at each branch, other branch level information such as its address, number of employees, and names of branch managers are available. In addition, the data include sequential number codes for sub branches that belong to the head office or regular branches. Therefore, all the branches included in the Finance Directory data are uniquely identified by the combination of financial institution codes, branch codes, and sequential number codes.

The FSA data are more comprehensive than the Finance Directory data in terms of the range of financial institutions and their branches included in the dataset. The FSA data include information concerning offices of foreign banks in Japan and credit agricultural and fishery cooperatives association. They also include information on overseas branches of Japanese banks,

and on divisions within head offices and branches such as sales departments and accounting departments, branches for money transfers, foreign exchange transactions, and internet transactions that are managed by the head office. Such information is not available in the Finance Directory data.

Hence, it is possible to aggregate the sum of loans and deposits held by each financial institution by region if we combine the FSA data and the Finance Directory data. But for doing this, we need to take into account differences in the characteristics of these data. In below, we describe how we reorganize the FSA data and how we combine the FSA data with the Finance Directory data.

A2. Procedure of combining the two data sources

The procedure to integrate the FSA data with the Finance Directory data is that we first augment the four-digit financial institution code and the three-digit branch code with additional information and then use them as an identifier.

On the one hand, the FSA data include information on several types of branches and divisions that cannot be merged with the Financial Directory data as many of them do not have branch codes. These include departments within the head office and branches, such as overseas branches, sales departments, and accounting departments, as well as branches for money transfers, foreign exchange, and internet transactions. In order to identify these divisions and branches in the FSA data from the ones to which unique financial institution and branch codes are already assigned, we create a new four-digit branch code and assign special numbers to these unidentified divisions and branches. For those that are already uniquely identified with their three-digit branch codes, we add zero in front of their old branch codes. On the other hand, the Finance Directory Data contains additional identification codes for sub branches that are called sequential number codes but the FSA data do not have such information. Therefore, we additionally employ the two-digit sequential number code that are used in the Finance Directory data.

Then we combine all of these codes, the financial institution code, the new branch code, and the sequential number code to create a 10-digit identification code. We show how they compare with identifiers in the FSA data and the Finance Directory data in Table A-1. In below we detail how we merge the two data sources using these new identification codes.

Table A-1 Identification codes for financial institutions and branches

	Financial Institution Code				Branch Code				Sequencial Number Code	
FSA Data										
Finance Director Data										
This Paper's Data										

(Note 1) For branches that are already assigned with a three-digit branch code in the FSA data or in the Finance Directory data, we add 0 to the first digit in order to convert it to the new four-digit branch code.
(Note 2) When adding a sequential number code to the FSA data, the initial setting is 00.

A2.1 Collation of data by year, financial institution code, and branch code

First, the FSA data are cross-referenced with the Finance Directory data by year, financial institution code, and store code. The two are then merged.

A2.2 Collation of data without year and confirmation using the branch name

Next, we remove the year and integrate those that can be collated by the financial institution code and branch code. This is in response to cases where the year reflecting the establishment or consolidation of a branch differs between the FSA data and the Finance Directory data. All branches for which information exists in the FSA data, that could be collated by removing the year, are integrated with the Finance Directory data. Note that if the branch code of a completely different branch that existed in the past is reused for a new branch, care should be taken to confirm whether the branch names match. The following measures are taken for those that could not be matched.

A2.3 Head offices

First, we assign the head office branch code 9999 to the head office and to branches that are considered belonging to the head office (the head office sales department and branches for money transfer, currency exchange, and Internet transactions). They are assumed to be located at the address of the head office. Since the Finance Directory data have a branch type code, with 00 indicating the head office, we integrate the address and other information for branch type code 00. As a general rule, only one branch of a financial institution must have a branch type code of 00 in the Finance Directory data, but there are a few cases where two branches have 00, and these are modified by allocating the code to the most appropriate branch.

A2.4 Overseas branches

Next, branches that appear to be overseas branches (branches with the names of overseas cities)

are given an overseas store code of 8888. However, overseas branches could not be collated because the information did not exist in the Finance Directory data.

A2.5 Collation of data using the branch name

The FSA and Finance Directory data correspond to the same branch name, even if the branch code does not match. These are collated by branch name, and the branch codes in the FSA data are overwritten with the branch codes and sequential number codes in the Finance Directory data. While the names of branches in the FSA data may or may not be suffixed with "branch" or "sub branch" depending on the financial institution, "branch" or "sub branch" are always appended in the Finance Directory data. For some branches in the FSA data, "branch" or "sub branch" is added at the end of the branch name.

A2.6 Regional flagship branches

Finally, for branches in regional centers that are not head offices (such as regional sales headquarters or regional loan center), those that could not be collated due to the absence of corresponding information in the Finance Directory data, the branch number of the closest flagship branch is given individually.

A3. Cleaning and integration of major bank data

In addition to the procedures described in Section A.2, the following procedures are used for integration after data cleansing for major banks (e.g., city banks, trust banks, and foreign banks in Japan).

For banks and branches that do not exist in the Finance Directory data, such as foreign banks, the five-digit municipality code of the relevant zip code is appended where zip code information existed in the FSA data. If zip code information does not exist, it is sourced through an online search, and the municipality code is added in the same manner.

In addition, there are cases where information on loans and deposits by branch is not available even though information on loans and deposits by prefecture exists. This may be because the financial institutions concerned did not report information on the amount of loans and deposits by branch. Therefore, for each bank, we use the amount of loans and deposits by branch and the amount of loans and deposits by prefecture in 2006 to calculate each branch's share of loans and deposits in that prefecture. We then calculate the value of loans and deposits for each branch in 2005 by calculating the value of loans and deposits by prefecture in 2005 by the share of these values as of 2006.[11)]

[11] This calculation assumes that branches that existed in 2006 also existed in 2005. One method could be to use the 2005 branch information in the Finance Directory data and prorate for branches that existed in 2005. However, because there is no standard for determining branch share when using this method, and

A4. Data cleaning and integration for regional banks, *shinkin* banks, credit cooperatives, and other financial institutions

Data of regional banks (regional banks, second-tier regional banks), *shinkin* banks, credit cooperatives, and other financial institutions are integrated after data cleaning, in addition to the steps described in Section A2.

First, for credit agricultural and fisheries cooperative associations, we conducted Internet searches for branch information and supplemented this with addresses (municipality codes) since Finance Directory data do not cover them. However, in cases where branch locations have been relocated but retain the same branch name, such information is supplemented with the newest address available, as only the most recent information is available.

In some cases, branch codes differ greatly between the FSA data and Finance Directory data, so we verify and individually overwrite the branch codes and sequential number codes in the Finance Directory data. There are also cases where we correct loan and deposit amounts that have been entered incorrectly.

Furthermore, as with major banks in Section A3, there are a considerable number of cases involving regional banks (regional banks and second-tier regional banks), *shinkin* banks, credit cooperatives, and other financial institutions where there is information concerning loan and deposit by prefecture but no information on loans and deposits by branch. The value of loans and deposits by branch is not given for a significant number of regional financial institutions in 2014. For these financial institutions, if the information on loans and deposits by branch for the following year exist, the share of loans and deposits is calculated using that information, and the loans and deposits by the prefecture for the current year are proportionally divided by these shares to calculate the amount of loans and deposits for each branch for the missing year. If information by branch for the following year does not exist, the value of loans and deposits for each branch in the deficit year is calculated by calculating the value of loans and deposits by the branch in the previous year and then the value of loans and deposits by the prefecture for the current year.[12)]

A5. Future tasks

In this appendix, we explain how to use FSA data on loans and deposits by financial institution branches to create a data set for analysis by cleansing and supplementing it with Finance Directory

---

because it can be assumed that loan and deposit are generally transferred between neighboring branches even for new branches established between 2005 and 2006, we assume that branches that existed in 2006 also existed in 2005 and carry out a proportional allocation, as described in the main text of this paper.

[12)] Although few, some financial institutions that were merged into other banks during the period have no branch-specific information at all (including before and after). Such cases were handled by dividing the value of lending by financial institution by prefecture equally based on the branch names obtained from the Finance Directory.

data, and then aggregate the value of loans and deposits by the municipality. Most financial institution branches included in this data set for analysis had been assigned addresses and latitudinal/longitudinal information, which allowed us to aggregate the value of loans and deposits by any regional category and calculate indicators such as the degree of concentration in Japanese loan and deposit markets.[13)]

Furthermore, using this data set to connect information such as branch size, as measured by the number of employees and branch manager names in the Finance Directory data, makes the following analysis possible, though not attempted in this study. The first is the demarcation of the geographical scope of the loan and deposit markets. By combining information on the location of financial institution branches with information concerning their respective loan and deposit values, as well as focusing on events such as mergers between financial institutions and bank-specific or region-specific shocks to loan and deposit rates, it may be possible to identify the geographical scope of loan and deposit markets by examining the distance over which changes in loan and deposit values spread. The second is an analysis of financial institutions' personnel appraisal systems by associating changes in the value of loans and deposits at each branch with information on changes in branch managers. In addition to the information concerning branch managers used in this study, by obtaining and joining information concerning executives at each financial institution, we can clarify how changes in the value of loan and deposit affect subsequent changes in branch managers.

Lastly, we would like to discuss the importance of the continuous and consistent collection of FSA data. In Japan, deposits held by private financial institutions totaled 1,589 trillion yen, and loans by private financial institutions amounted to 817 trillion yen. From the perspective of households, deposits with, and lending by, financial institutions play a significant role in the Japanese economy, as evinced by the fact that 933 trillion yen of the 1,883 trillion yen in total household assets consists of deposits held by financial institutions, and 424 trillion yen of the 1,233 trillion yen in total liabilities of non-financial corporations consists of loans from financial institutions. There is a great significance to understand from various perspectives the current state of the functions of financial institutions that mediate these vast sums, such as the degree of concentration in the market and the circulation of funds among regions. This would be a key source of data for decision-making in various fields, including financial administration and macroprudential policy.

When collecting data from financial institutions for FSA data, the following steps should be taken to quickly and accurately obtain such statistical information: (1) specify in advance the format of the branch code so that it can be easily combined with other data; (2) make arrangements to assign some kind of code to branches and departments that do not have regular branch codes;

[13)] The exceptions are foreign banks in Japan and some branches of credit agricultural and fishery cooperatives associations. A municipality code is assigned to these.

(3) ask financial institutions to submit reports again if there are items that have been incorrectly entered or not included; and (4) make efforts to obtain reports from all financial institutions included in the data each year. Furthermore, where possible, the utility of the information will be further enhanced if it includes not only the total value of loans, but also information on loans by use, such as corporate loans and housing loans, and information on interest rates. We would like to express our heartfelt thanks and respect to the governmental authorities for their continuous efforts in collecting data, and as a researcher, we wish to continue to offer cooperation in the future.

Table 1: Loan HHI and deposit HHI (All financial institutions, by prefecture)

Loan HHI	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.2099	0.0711	0.0716	0.0845	0.1176	0.1571	0.2188	0.2650	0.3010	0.3153	0.3353
2006	0.2093	0.0675	0.0800	0.0894	0.1221	0.1540	0.2216	0.2663	0.3000	0.3104	0.3250
2007	0.2125	0.0697	0.0724	0.0848	0.1229	0.1497	0.2296	0.2668	0.3000	0.3119	0.3305
2008	0.2149	0.0693	0.0683	0.0831	0.1267	0.1627	0.2192	0.2671	0.3088	0.3110	0.3257
2009	0.2179	0.0685	0.0545	0.0939	0.1329	0.1688	0.2284	0.2671	0.3076	0.3113	0.3232
2010	0.2196	0.0697	0.0538	0.0908	0.1304	0.1711	0.2192	0.2748	0.3095	0.3157	0.3262
2011	0.2215	0.0699	0.0505	0.0870	0.1318	0.1724	0.2202	0.2782	0.3096	0.3103	0.3293
2012	0.2221	0.0702	0.0505	0.0876	0.1361	0.1733	0.2189	0.2807	0.3047	0.3104	0.3366
2013	0.2244	0.0707	0.0501	0.0873	0.1408	0.1786	0.2219	0.2820	0.3016	0.3137	0.3366
2014	0.2252	0.0697	0.0522	0.0894	0.1406	0.1828	0.2271	0.2835	0.3010	0.3172	0.3421
2015	0.2260	0.0711	0.0512	0.0881	0.1413	0.1794	0.2280	0.2849	0.3036	0.3151	0.3469
2016	0.2272	0.0718	0.0503	0.0867	0.1419	0.1834	0.2288	0.2874	0.3055	0.3177	0.3490
2017	0.2287	0.0740	0.0501	0.0811	0.1417	0.1869	0.2294	0.2888	0.3110	0.3315	0.3618
2018	0.2296	0.0756	0.0486	0.0761	0.1408	0.1874	0.2299	0.2952	0.3126	0.3301	0.3700
2019	0.2301	0.0758	0.0505	0.0747	0.1352	0.1851	0.2329	0.2932	0.3135	0.3462	0.3674

Deposit HHI	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.2280	0.0836	0.0869	0.0941	0.0992	0.1584	0.2426	0.2957	0.3168	0.3339	0.4263
2006	0.2292	0.0803	0.1003	0.1046	0.1078	0.1577	0.2434	0.2896	0.3229	0.3342	0.4257
2007	0.2317	0.0816	0.0984	0.1023	0.1071	0.1582	0.2496	0.2860	0.3231	0.3427	0.4319
2008	0.2317	0.0822	0.0964	0.1018	0.1083	0.1581	0.2371	0.2911	0.3303	0.3410	0.4310
2009	0.2334	0.0820	0.0960	0.1024	0.1079	0.1597	0.2416	0.2890	0.3344	0.3488	0.4360
2010	0.2373	0.0847	0.0964	0.1046	0.1091	0.1622	0.2471	0.2933	0.3432	0.3637	0.4509
2011	0.2378	0.0848	0.0957	0.1043	0.1091	0.1640	0.2512	0.2939	0.3441	0.3582	0.4523
2012	0.2396	0.0849	0.0967	0.1038	0.1096	0.1688	0.2500	0.2947	0.3467	0.3538	0.4569
2013	0.2417	0.0847	0.0990	0.1037	0.1120	0.1808	0.2525	0.3000	0.3454	0.3567	0.4553
2014	0.2441	0.0832	0.1000	0.1104	0.1256	0.1786	0.2516	0.3051	0.3433	0.3559	0.4558
2015	0.2453	0.0841	0.1007	0.1094	0.1196	0.1772	0.2538	0.3076	0.3459	0.3646	0.4603
2016	0.2460	0.0833	0.1001	0.1114	0.1199	0.1786	0.2564	0.3052	0.3435	0.3597	0.4609
2017	0.2487	0.0848	0.1021	0.1129	0.1152	0.1810	0.2581	0.3107	0.3506	0.3593	0.4624
2018	0.2512	0.0861	0.1021	0.1128	0.1168	0.1837	0.2605	0.3192	0.3564	0.3660	0.4640
2019	0.2535	0.0850	0.1027	0.1183	0.1243	0.1862	0.2643	0.3181	0.3556	0.3622	0.4684

Table 2: Loan HHI and deposit HHI (Regional financial institutions, by prefecture)

Loan HHI	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.2614	0.0943	0.0369	0.0567	0.1330	0.1975	0.2914	0.3223	0.3623	0.3772	0.5171
2006	0.2617	0.0964	0.0286	0.0572	0.1373	0.2030	0.2790	0.3233	0.3543	0.3688	0.5704
2007	0.2655	0.0988	0.0265	0.0563	0.1410	0.2014	0.2856	0.3274	0.3551	0.3769	0.5607
2008	0.2680	0.0972	0.0266	0.0554	0.1467	0.2155	0.2850	0.3279	0.3531	0.3727	0.5432
2009	0.2691	0.0949	0.0238	0.0549	0.1484	0.2194	0.2830	0.3323	0.3558	0.3723	0.5331
2010	0.2710	0.0952	0.0264	0.0548	0.1480	0.2206	0.2860	0.3327	0.3696	0.3774	0.5086
2011	0.2731	0.0942	0.0226	0.0603	0.1488	0.2235	0.2851	0.3363	0.3658	0.3804	0.4873
2012	0.2736	0.0933	0.0225	0.0578	0.1496	0.2268	0.2916	0.3375	0.3597	0.3860	0.4771
2013	0.2756	0.0931	0.0223	0.0572	0.1490	0.2373	0.2941	0.3398	0.3642	0.3848	0.4718
2014	0.2753	0.0921	0.0235	0.0581	0.1432	0.2368	0.2929	0.3420	0.3645	0.3891	0.4489
2015	0.2756	0.0924	0.0226	0.0559	0.1425	0.2341	0.2937	0.3366	0.3744	0.3933	0.4378
2016	0.2757	0.0921	0.0242	0.0557	0.1410	0.2344	0.2859	0.3379	0.3762	0.3941	0.4350
2017	0.2765	0.0930	0.0271	0.0560	0.1391	0.2378	0.2820	0.3412	0.3947	0.4131	0.4314
2018	0.2763	0.0939	0.0241	0.0562	0.1368	0.2405	0.2812	0.3378	0.3960	0.4112	0.4289
2019	0.2767	0.0945	0.0246	0.0561	0.1339	0.2431	0.2775	0.3377	0.3912	0.4185	0.4291

Deposit HHI	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.2845	0.1052	0.0481	0.0648	0.1239	0.2215	0.2993	0.3660	0.3839	0.4000	0.5120
2006	0.2841	0.1058	0.0520	0.0640	0.1241	0.2220	0.3046	0.3541	0.3875	0.3961	0.5402
2007	0.2877	0.1082	0.0541	0.0649	0.1256	0.2250	0.3077	0.3462	0.3957	0.4527	0.5361
2008	0.2882	0.1078	0.0525	0.0643	0.1264	0.2278	0.2967	0.3464	0.3985	0.4624	0.5170
2009	0.2913	0.1077	0.0525	0.0656	0.1289	0.2298	0.2992	0.3543	0.4071	0.4610	0.5133
2010	0.2957	0.1096	0.0541	0.0648	0.1299	0.2322	0.3069	0.3597	0.4155	0.4591	0.5121
2011	0.2962	0.1090	0.0544	0.0727	0.1309	0.2362	0.3112	0.3614	0.4160	0.4572	0.5129
2012	0.2976	0.1089	0.0537	0.0697	0.1309	0.2559	0.3076	0.3645	0.4220	0.4593	0.5169
2013	0.2994	0.1087	0.0542	0.0682	0.1315	0.2559	0.3089	0.3678	0.4221	0.4569	0.5148
2014	0.3001	0.1077	0.0583	0.0729	0.1290	0.2576	0.3110	0.3695	0.4233	0.4544	0.5149
2015	0.3007	0.1075	0.0592	0.0716	0.1294	0.2595	0.3137	0.3681	0.4293	0.4571	0.5156
2016	0.3009	0.1068	0.0609	0.0697	0.1280	0.2568	0.3159	0.3684	0.4218	0.4608	0.5149
2017	0.3043	0.1084	0.0620	0.0731	0.1280	0.2594	0.3177	0.3753	0.4359	0.4592	0.5157
2018	0.3068	0.1096	0.0623	0.0728	0.1284	0.2609	0.3168	0.3775	0.4406	0.4601	0.5171
2019	0.3090	0.1092	0.0620	0.0751	0.1291	0.2641	0.3190	0.3777	0.4416	0.4627	0.5222

Table 3: Loan HHI and deposit HHI (Regional and second-tier regional banks, by prefecture)

Loan HHI	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.4172	0.1563	0.0318	0.1336	0.2682	0.3320	0.4176	0.4817	0.5913	0.6905	0.9897
2006	0.4191	0.1609	0.0305	0.1334	0.2743	0.3290	0.4138	0.4792	0.5964	0.6838	0.9905
2007	0.4225	0.1649	0.0292	0.1291	0.2813	0.3295	0.4120	0.4714	0.5973	0.7016	0.9917
2008	0.4239	0.1628	0.0279	0.1263	0.2909	0.3423	0.4169	0.4806	0.6046	0.7044	0.9925
2009	0.4260	0.1622	0.0273	0.1232	0.3021	0.3384	0.4273	0.4847	0.6158	0.6898	0.9934
2010	0.4272	0.1627	0.0263	0.1243	0.3022	0.3394	0.4261	0.5096	0.6095	0.6878	0.9954
2011	0.4275	0.1615	0.0261	0.1238	0.3070	0.3418	0.4235	0.5025	0.6088	0.6912	1.0000
2012	0.4263	0.1614	0.0253	0.1208	0.3098	0.3450	0.4200	0.4890	0.6174	0.6907	1.0000
2013	0.4264	0.1622	0.0250	0.1227	0.3027	0.3468	0.4151	0.4918	0.6216	0.6851	1.0000
2014	0.4242	0.1619	0.0245	0.1194	0.2969	0.3512	0.4109	0.4861	0.6177	0.6800	1.0000
2015	0.4217	0.1619	0.0242	0.1185	0.2897	0.3527	0.4011	0.4804	0.6139	0.6800	1.0000
2016	0.4196	0.1613	0.0241	0.1189	0.2827	0.3563	0.3989	0.4754	0.6041	0.6865	1.0000
2017	0.4178	0.1615	0.0247	0.1208	0.2757	0.3493	0.4005	0.4729	0.5936	0.6987	1.0000
2018	0.4161	0.1623	0.0254	0.1214	0.2700	0.3502	0.3949	0.4772	0.6024	0.7020	1.0000
2019	0.4146	0.1623	0.0283	0.1212	0.2626	0.3462	0.4007	0.4666	0.5936	0.7063	1.0000

Deposit HHI	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.4788	0.1596	0.0880	0.1650	0.3181	0.3865	0.4750	0.5572	0.6633	0.7429	0.9873
2006	0.4814	0.1630	0.0901	0.1647	0.3201	0.3861	0.4764	0.5597	0.6644	0.7412	0.9894
2007	0.4876	0.1675	0.0878	0.1628	0.3140	0.3885	0.4780	0.5665	0.7168	0.7440	0.9896
2008	0.4901	0.1667	0.0839	0.1620	0.3408	0.3931	0.4786	0.5808	0.7132	0.7508	0.9890
2009	0.4940	0.1667	0.0791	0.1630	0.3514	0.3930	0.4800	0.5812	0.7186	0.7444	0.9898
2010	0.4983	0.1681	0.0906	0.1598	0.3544	0.3948	0.4809	0.5853	0.7302	0.7483	0.9883
2011	0.4988	0.1665	0.0884	0.1931	0.3573	0.3944	0.4748	0.5868	0.7270	0.7473	1.0000
2012	0.4996	0.1662	0.0917	0.1900	0.3615	0.3957	0.4733	0.5869	0.7282	0.7516	1.0000
2013	0.5014	0.1658	0.0881	0.1889	0.3528	0.3968	0.4832	0.5844	0.7236	0.7543	1.0000
2014	0.5018	0.1659	0.0853	0.1868	0.3515	0.3993	0.4836	0.5833	0.7252	0.7527	1.0000
2015	0.5021	0.1661	0.0816	0.1856	0.3523	0.4056	0.4897	0.5831	0.7284	0.7552	1.0000
2016	0.5016	0.1664	0.0761	0.1806	0.3479	0.4050	0.4896	0.5829	0.7248	0.7622	1.0000
2017	0.5034	0.1662	0.0794	0.1806	0.3472	0.4144	0.4934	0.5873	0.7287	0.7619	1.0000
2018	0.5061	0.1671	0.0755	0.1807	0.3497	0.4185	0.4956	0.5936	0.7328	0.7651	1.0000
2019	0.5105	0.1659	0.1158	0.1807	0.3522	0.4181	0.4975	0.5970	0.7403	0.7692	1.0000

Table 4: Number of MEAs and MCEAs, number of municipalities included

	2005	2010	2015
MEA	109	108	100
Number of municipalities	1278	1122	1106
MCEA	142	121	122
Number of municipalities	480	354	364
MEA+MCEA	251	229	222
Number of municipalities	1758	1476	1328

Note: Each ordinance-designated city is counted as one city.
Tokyo 23 special districts are counted as one.

Table 5: Loan HHI and deposit HHI (All financial institutions, by urban employment area)

Loan HHI	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	251	0.2629	0.0838	0.0594	0.1446	0.1644	0.2000	0.2588	0.3103	0.3612	0.4041	0.5986
2006	243	0.2619	0.0827	0.0730	0.1463	0.1628	0.2032	0.2546	0.3109	0.3617	0.3982	0.5401
2007	241	0.2641	0.0833	0.0693	0.1473	0.1623	0.2056	0.2616	0.3142	0.3588	0.4031	0.5385
2008	241	0.2664	0.0840	0.0678	0.1510	0.1656	0.2092	0.2589	0.3142	0.3549	0.4035	0.5955
2009	240	0.2716	0.0855	0.0640	0.1574	0.1713	0.2137	0.2676	0.3185	0.3645	0.4047	0.6415
2010	229	0.2723	0.0853	0.0626	0.1534	0.1696	0.2162	0.2674	0.3243	0.3678	0.4206	0.5683
2011	229	0.2728	0.0854	0.0587	0.1560	0.1739	0.2138	0.2646	0.3217	0.3735	0.4051	0.5912
2012	228	0.2745	0.0869	0.0591	0.1551	0.1735	0.2136	0.2724	0.3249	0.3786	0.4192	0.5931
2013	228	0.2747	0.0864	0.0591	0.1561	0.1740	0.2126	0.2733	0.3266	0.3730	0.4054	0.5926
2014	228	0.2744	0.0854	0.0602	0.1557	0.1794	0.2138	0.2714	0.3274	0.3719	0.4207	0.5919
2015	222	0.2756	0.0835	0.0548	0.1599	0.1810	0.2159	0.2728	0.3267	0.3728	0.4049	0.6109
2016	222	0.2765	0.0831	0.0539	0.1619	0.1822	0.2156	0.2752	0.3305	0.3754	0.4089	0.6080
2017	222	0.2789	0.0842	0.0535	0.1596	0.1857	0.2200	0.2754	0.3317	0.3796	0.4079	0.6066
2018	222	0.2790	0.0845	0.0520	0.1586	0.1847	0.2218	0.2752	0.3345	0.3815	0.4084	0.5858
2019	222	0.2777	0.0846	0.0541	0.1575	0.1847	0.2180	0.2744	0.3295	0.3798	0.4018	0.5850

Deposit HHI	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	251	0.2877	0.0860	0.0683	0.1469	0.1840	0.2330	0.2854	0.3387	0.3962	0.4361	0.5539
2006	243	0.2860	0.0826	0.0833	0.1487	0.1811	0.2297	0.2807	0.3411	0.3928	0.4124	0.5610
2007	241	0.2886	0.0831	0.0802	0.1509	0.1839	0.2326	0.2863	0.3429	0.3909	0.4176	0.5585
2008	241	0.2891	0.0832	0.0797	0.1529	0.1840	0.2383	0.2879	0.3420	0.3915	0.4168	0.5643
2009	240	0.2918	0.0848	0.0797	0.1537	0.1872	0.2406	0.2902	0.3435	0.3922	0.4221	0.6284
2010	229	0.2931	0.0864	0.0831	0.1567	0.1858	0.2341	0.2937	0.3445	0.4024	0.4334	0.5642
2011	229	0.2932	0.0865	0.0829	0.1576	0.1858	0.2309	0.2926	0.3454	0.4000	0.4363	0.5686
2012	228	0.2949	0.0878	0.0803	0.1568	0.1894	0.2345	0.2935	0.3475	0.4038	0.4484	0.5713
2013	228	0.2968	0.0882	0.0809	0.1570	0.1915	0.2354	0.2964	0.3476	0.4065	0.4511	0.5734
2014	228	0.2996	0.0880	0.0939	0.1579	0.1926	0.2412	0.2955	0.3514	0.4048	0.4582	0.5582
2015	222	0.3010	0.0857	0.0910	0.1615	0.1964	0.2483	0.2992	0.3531	0.4044	0.4430	0.5422
2016	222	0.3021	0.0850	0.0918	0.1624	0.1994	0.2486	0.2993	0.3547	0.4040	0.4433	0.5443
2017	222	0.3045	0.0850	0.0898	0.1716	0.2005	0.2477	0.3042	0.3582	0.4118	0.4436	0.5404
2018	222	0.3064	0.0853	0.0895	0.1744	0.2012	0.2496	0.3042	0.3603	0.4157	0.4448	0.5497
2019	222	0.3079	0.0849	0.0951	0.1747	0.2039	0.2492	0.3043	0.3597	0.4135	0.4498	0.5531

Table 6: Loan HHI and deposit HHI (Regional financial institutions, by urban employment area)

Loan HHI	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	251	0.3045	0.0889	0.0366	0.1799	0.2025	0.2382	0.2984	0.3596	0.4070	0.4635	0.6661
2006	243	0.3049	0.0886	0.0342	0.1807	0.2012	0.2448	0.3006	0.3581	0.4168	0.4530	0.5898
2007	241	0.3077	0.0907	0.0329	0.1804	0.2069	0.2444	0.3047	0.3593	0.4210	0.4627	0.5904
2008	241	0.3106	0.0905	0.0336	0.1824	0.2006	0.2507	0.3055	0.3619	0.4199	0.4648	0.5955
2009	240	0.3158	0.0924	0.0331	0.1861	0.2035	0.2604	0.3084	0.3695	0.4197	0.4892	0.6415
2010	229	0.3157	0.0921	0.0333	0.1844	0.2061	0.2601	0.3104	0.3654	0.4297	0.4888	0.6455
2011	229	0.3166	0.0924	0.0325	0.1879	0.2078	0.2634	0.3129	0.3653	0.4298	0.4877	0.6665
2012	228	0.3183	0.0938	0.0328	0.1860	0.2093	0.2589	0.3138	0.3676	0.4332	0.4926	0.6667
2013	228	0.3188	0.0936	0.0329	0.1850	0.2125	0.2582	0.3153	0.3705	0.4341	0.4839	0.6650
2014	228	0.3191	0.0927	0.0326	0.1873	0.2118	0.2573	0.3174	0.3683	0.4314	0.4859	0.6609
2015	222	0.3204	0.0924	0.0323	0.1918	0.2121	0.2626	0.3176	0.3704	0.4364	0.4845	0.6802
2016	222	0.3207	0.0915	0.0322	0.1933	0.2136	0.2659	0.3163	0.3704	0.4405	0.4850	0.6757
2017	222	0.3231	0.0928	0.0324	0.1971	0.2168	0.2671	0.3193	0.3766	0.4401	0.4742	0.6750
2018	222	0.3231	0.0928	0.0320	0.1989	0.2177	0.2667	0.3192	0.3767	0.4389	0.4766	0.6534
2019	222	0.3226	0.0937	0.0324	0.1923	0.2160	0.2631	0.3198	0.3758	0.4372	0.4744	0.6605

Deposit HHI	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	251	0.3342	0.0920	0.0378	0.1962	0.2295	0.2745	0.3344	0.3903	0.4400	0.4705	0.6352
2006	243	0.3327	0.0897	0.0387	0.1963	0.2269	0.2725	0.3326	0.3986	0.4374	0.4665	0.6223
2007	241	0.3359	0.0918	0.0395	0.1953	0.2280	0.2715	0.3354	0.3989	0.4415	0.4766	0.6214
2008	241	0.3374	0.0916	0.0391	0.1955	0.2321	0.2784	0.3395	0.3986	0.4446	0.4763	0.6251
2009	240	0.3412	0.0931	0.0392	0.2005	0.2324	0.2795	0.3424	0.3986	0.4527	0.4880	0.6284
2010	229	0.3421	0.0952	0.0406	0.1988	0.2222	0.2822	0.3387	0.3963	0.4627	0.4995	0.6308
2011	229	0.3426	0.0953	0.0417	0.1996	0.2266	0.2834	0.3395	0.3969	0.4659	0.5018	0.6372
2012	228	0.3441	0.0967	0.0419	0.2024	0.2334	0.2836	0.3405	0.4019	0.4723	0.5000	0.6405
2013	228	0.3459	0.0970	0.0420	0.2018	0.2336	0.2840	0.3402	0.4024	0.4655	0.5047	0.6449
2014	228	0.3473	0.0975	0.0426	0.2073	0.2347	0.2827	0.3391	0.4109	0.4652	0.5117	0.6497
2015	222	0.3486	0.0977	0.0433	0.2056	0.2359	0.2866	0.3409	0.4072	0.4685	0.5140	0.6535
2016	222	0.3494	0.0971	0.0441	0.2056	0.2391	0.2873	0.3411	0.4083	0.4666	0.5018	0.6661
2017	222	0.3526	0.0983	0.0455	0.2040	0.2406	0.2913	0.3456	0.4101	0.4840	0.5119	0.6645
2018	222	0.3545	0.0985	0.0465	0.2065	0.2359	0.2922	0.3469	0.4143	0.4850	0.5118	0.6598
2019	222	0.3567	0.0990	0.0483	0.2083	0.2391	0.2943	0.3485	0.4167	0.4897	0.5170	0.6641

Table 7: Loan HHI and deposit HHI (Regional and second-tier regional banks, by UEA)

Loan HHI	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	250	0.4599	0.1680	0.0707	0.2634	0.2849	0.3512	0.4238	0.5262	0.6941	0.7919	1.0000
2006	242	0.4600	0.1670	0.0669	0.2677	0.2895	0.3515	0.4240	0.5261	0.6904	0.7613	1.0000
2007	240	0.4621	0.1691	0.0633	0.2646	0.2907	0.3493	0.4266	0.5215	0.6920	0.7863	1.0000
2008	240	0.4655	0.1688	0.0632	0.2665	0.2917	0.3556	0.4259	0.5300	0.7007	0.7786	1.0000
2009	239	0.4740	0.1691	0.0624	0.2676	0.2954	0.3619	0.4419	0.5357	0.6979	0.7878	1.0000
2010	228	0.4786	0.1733	0.0611	0.2613	0.2913	0.3704	0.4484	0.5560	0.7068	0.8206	1.0000
2011	228	0.4771	0.1735	0.0601	0.2615	0.2875	0.3669	0.4412	0.5487	0.7053	0.8268	1.0000
2012	227	0.4787	0.1741	0.0590	0.2600	0.2931	0.3621	0.4426	0.5499	0.7055	0.8221	1.0000
2013	227	0.4777	0.1730	0.0580	0.2590	0.2881	0.3615	0.4464	0.5466	0.7044	0.8317	1.0000
2014	227	0.4771	0.1729	0.0562	0.2617	0.2891	0.3642	0.4439	0.5481	0.7076	0.8210	1.0000
2015	221	0.4780	0.1721	0.0552	0.2617	0.2999	0.3711	0.4459	0.5479	0.6900	0.8179	1.0000
2016	221	0.4783	0.1723	0.0544	0.2631	0.3031	0.3686	0.4497	0.5478	0.6871	0.8260	1.0000
2017	221	0.4794	0.1727	0.0546	0.2635	0.3074	0.3683	0.4476	0.5502	0.6845	0.8367	1.0000
2018	221	0.4785	0.1728	0.0552	0.2582	0.3073	0.3671	0.4494	0.5458	0.6858	0.8386	1.0000
2019	221	0.4766	0.1731	0.0561	0.2585	0.3101	0.3727	0.4430	0.5427	0.6867	0.8321	1.0000

Deposit HHI	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	250	0.5057	0.1623	0.1112	0.2934	0.3344	0.3934	0.4822	0.5758	0.7074	0.8173	1.0000
2006	242	0.5059	0.1614	0.1128	0.3056	0.3374	0.3976	0.4845	0.5701	0.7050	0.8049	1.0000
2007	240	0.5093	0.1643	0.1138	0.3098	0.3379	0.4036	0.4890	0.5753	0.7185	0.8340	1.0000
2008	240	0.5126	0.1640	0.1131	0.3206	0.3427	0.4068	0.4886	0.5813	0.7239	0.8423	1.0000
2009	239	0.5194	0.1624	0.1120	0.3150	0.3449	0.4188	0.5003	0.5841	0.7318	0.8475	1.0000
2010	228	0.5216	0.1666	0.1179	0.3174	0.3467	0.4151	0.4994	0.5908	0.7500	0.8495	1.0000
2011	228	0.5204	0.1659	0.1181	0.3086	0.3456	0.4169	0.5003	0.5898	0.7269	0.8472	1.0000
2012	227	0.5223	0.1660	0.1194	0.3170	0.3469	0.4177	0.5001	0.6042	0.7416	0.8497	1.0000
2013	227	0.5246	0.1649	0.1196	0.3155	0.3461	0.4173	0.5046	0.6057	0.7418	0.8493	1.0000
2014	227	0.5251	0.1643	0.1194	0.3227	0.3476	0.4201	0.5023	0.6115	0.7334	0.8445	1.0000
2015	221	0.5313	0.1642	0.1192	0.3340	0.3659	0.4280	0.5068	0.6082	0.7388	0.8531	1.0000
2016	221	0.5322	0.1633	0.1198	0.3398	0.3753	0.4280	0.5051	0.5971	0.7491	0.8581	1.0000
2017	221	0.5338	0.1629	0.1247	0.3364	0.3766	0.4285	0.5087	0.5953	0.7554	0.8546	1.0000
2018	221	0.5358	0.1628	0.1291	0.3364	0.3792	0.4332	0.5065	0.5975	0.7497	0.8552	1.0000
2019	221	0.5378	0.1634	0.1363	0.3383	0.3820	0.4306	0.5093	0.6043	0.7549	0.8584	1.0000

Table 8: Factor decomposition of loan HHI and deposit HHI (All financial institutions, by prefecture)

Prefectures, All financial institutions, Loan HHI

Component of coefficient of variation	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.1673	0.0554	0.0628	0.0757	0.0976	0.1172	0.1651	0.2063	0.2377	0.2450	0.2827
2006	0.1660	0.0520	0.0663	0.0849	0.1013	0.1194	0.1647	0.2047	0.2303	0.2397	0.2704
2007	0.1688	0.0545	0.0587	0.0803	0.1025	0.1219	0.1712	0.2112	0.2405	0.2474	0.2779
2008	0.1708	0.0538	0.0546	0.0785	0.1063	0.1259	0.1792	0.2178	0.2380	0.2516	0.2731
2009	0.1733	0.0537	0.0407	0.0832	0.1129	0.1376	0.1749	0.2144	0.2458	0.2565	0.2706
2010	0.1744	0.0546	0.0401	0.0813	0.1108	0.1383	0.1740	0.2198	0.2469	0.2548	0.2706
2011	0.1761	0.0550	0.0368	0.0806	0.1121	0.1405	0.1743	0.2225	0.2443	0.2547	0.2737
2012	0.1768	0.0551	0.0370	0.0744	0.1165	0.1438	0.1731	0.2307	0.2477	0.2492	0.2811
2013	0.1788	0.0552	0.0364	0.0718	0.1212	0.1470	0.1778	0.2307	0.2461	0.2515	0.2811
2014	0.1794	0.0544	0.0381	0.0713	0.1206	0.1471	0.1766	0.2278	0.2455	0.2516	0.2865
2015	0.1802	0.0555	0.0371	0.0699	0.1209	0.1462	0.1825	0.2272	0.2459	0.2513	0.2913
2016	0.1816	0.0560	0.0362	0.0685	0.1219	0.1490	0.1762	0.2256	0.2441	0.2564	0.2934
2017	0.1832	0.0582	0.0358	0.0629	0.1191	0.1496	0.1790	0.2259	0.2535	0.2839	0.2944
2018	0.1837	0.0595	0.0343	0.0579	0.1158	0.1490	0.1790	0.2280	0.2571	0.2825	0.2930
2019	0.1838	0.0599	0.0362	0.0565	0.1108	0.1493	0.1768	0.2241	0.2578	0.2874	0.2998
Component of the number of financial institutions	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.0426	0.0269	0.0044	0.0132	0.0172	0.0238	0.0400	0.0526	0.0667	0.0909	0.1667
2006	0.0433	0.0267	0.0045	0.0137	0.0179	0.0250	0.0417	0.0526	0.0667	0.0909	0.1667
2007	0.0437	0.0268	0.0045	0.0137	0.0179	0.0250	0.0417	0.0526	0.0714	0.0909	0.1667
2008	0.0441	0.0268	0.0046	0.0137	0.0179	0.0250	0.0417	0.0526	0.0714	0.0909	0.1667
2009	0.0445	0.0269	0.0047	0.0139	0.0182	0.0250	0.0435	0.0526	0.0714	0.0909	0.1667
2010	0.0452	0.0274	0.0047	0.0137	0.0179	0.0256	0.0435	0.0556	0.0769	0.0909	0.1667
2011	0.0454	0.0277	0.0047	0.0137	0.0182	0.0256	0.0435	0.0556	0.0769	0.1000	0.1667
2012	0.0453	0.0277	0.0047	0.0135	0.0182	0.0250	0.0435	0.0556	0.0769	0.1000	0.1667
2013	0.0457	0.0276	0.0047	0.0137	0.0185	0.0256	0.0435	0.0556	0.0769	0.1000	0.1667
2014	0.0458	0.0276	0.0053	0.0141	0.0185	0.0256	0.0455	0.0556	0.0769	0.1000	0.1667
2015	0.0458	0.0276	0.0048	0.0141	0.0185	0.0263	0.0455	0.0556	0.0769	0.1000	0.1667
2016	0.0456	0.0254	0.0049	0.0141	0.0185	0.0263	0.0455	0.0556	0.0769	0.1000	0.1429
2017	0.0455	0.0254	0.0050	0.0143	0.0189	0.0263	0.0455	0.0556	0.0769	0.1000	0.1429
2018	0.0460	0.0255	0.0050	0.0143	0.0189	0.0263	0.0476	0.0556	0.0769	0.1000	0.1429
2019	0.0463	0.0256	0.0054	0.0143	0.0196	0.0263	0.0476	0.0556	0.0769	0.1000	0.1429

Prefectures, All financial institutions, Deposit HHI

Component of coefficient of variation	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.1854	0.0696	0.0759	0.0792	0.0832	0.1255	0.1971	0.2298	0.2692	0.2898	0.3596
2006	0.1860	0.0667	0.0814	0.0873	0.0951	0.1273	0.1959	0.2255	0.2753	0.2887	0.3590
2007	0.1881	0.0676	0.0796	0.0888	0.0936	0.1290	0.2042	0.2276	0.2755	0.2915	0.3605
2008	0.1877	0.0677	0.0775	0.0900	0.0912	0.1271	0.1974	0.2310	0.2827	0.2989	0.3596
2009	0.1890	0.0675	0.0775	0.0879	0.0974	0.1274	0.1997	0.2328	0.2844	0.3053	0.3646
2010	0.1922	0.0693	0.0786	0.0882	0.1003	0.1300	0.2037	0.2368	0.2932	0.3137	0.3740
2011	0.1924	0.0692	0.0775	0.0895	0.0973	0.1317	0.2029	0.2375	0.2914	0.3082	0.3754
2012	0.1943	0.0691	0.0792	0.0904	0.0992	0.1365	0.2045	0.2397	0.2941	0.3038	0.3800
2013	0.1961	0.0687	0.0812	0.0924	0.0990	0.1540	0.2038	0.2407	0.2918	0.3005	0.3783
2014	0.1983	0.0676	0.0818	0.0936	0.1043	0.1530	0.2062	0.2407	0.2774	0.3033	0.3789
2015	0.1996	0.0684	0.0850	0.0931	0.1079	0.1509	0.2072	0.2447	0.2821	0.3120	0.3834
2016	0.2004	0.0675	0.0860	0.0948	0.1108	0.1523	0.2076	0.2515	0.2816	0.3070	0.3840
2017	0.2032	0.0692	0.0875	0.0956	0.1097	0.1547	0.2101	0.2581	0.2962	0.3051	0.3855
2018	0.2053	0.0702	0.0887	0.0972	0.1073	0.1571	0.2116	0.2627	0.2995	0.3066	0.3871
2019	0.2073	0.0692	0.0915	0.1005	0.1169	0.1575	0.2148	0.2622	0.3014	0.3064	0.3915
Component of the number of financial institutions	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	0.0426	0.0269	0.0043	0.0132	0.0172	0.0233	0.0400	0.0526	0.0667	0.0909	0.1667
2006	0.0432	0.0267	0.0044	0.0135	0.0179	0.0250	0.0417	0.0526	0.0667	0.0909	0.1667
2007	0.0436	0.0268	0.0045	0.0135	0.0179	0.0250	0.0417	0.0526	0.0714	0.0909	0.1667
2008	0.0441	0.0268	0.0045	0.0135	0.0179	0.0250	0.0417	0.0526	0.0714	0.0909	0.1667
2009	0.0445	0.0270	0.0046	0.0137	0.0179	0.0250	0.0435	0.0526	0.0714	0.0909	0.1667
2010	0.0452	0.0274	0.0047	0.0135	0.0179	0.0256	0.0435	0.0556	0.0769	0.0909	0.1667
2011	0.0453	0.0278	0.0046	0.0135	0.0182	0.0256	0.0435	0.0556	0.0769	0.1000	0.1667
2012	0.0453	0.0278	0.0046	0.0133	0.0182	0.0250	0.0435	0.0556	0.0769	0.1000	0.1667
2013	0.0456	0.0277	0.0047	0.0135	0.0185	0.0256	0.0435	0.0556	0.0769	0.1000	0.1667
2014	0.0458	0.0276	0.0052	0.0141	0.0185	0.0256	0.0455	0.0556	0.0769	0.1000	0.1667
2015	0.0458	0.0276	0.0047	0.0139	0.0185	0.0263	0.0455	0.0556	0.0769	0.1000	0.1667
2016	0.0455	0.0255	0.0048	0.0139	0.0185	0.0263	0.0455	0.0556	0.0769	0.1000	0.1429
2017	0.0455	0.0255	0.0049	0.0141	0.0189	0.0263	0.0455	0.0556	0.0769	0.1000	0.1429
2018	0.0459	0.0256	0.0049	0.0141	0.0189	0.0263	0.0476	0.0556	0.0769	0.1000	0.1429
2019	0.0462	0.0256	0.0053	0.0143	0.0196	0.0263	0.0476	0.0556	0.0769	0.1000	0.1429

Table 9: Factor decomposition of loan HHI and deposit HHI (All financial institutions, by UEA)

UEAs, All financial institutions, Loan HHI

Component of coefficient of variation	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	251	0.1281	0.0664	0.0010	0.0336	0.0549	0.0815	0.1199	0.1703	0.2069	0.2423	0.3986
2006	243	0.1279	0.0634	0.0010	0.0419	0.0558	0.0841	0.1216	0.1684	0.2086	0.2448	0.3510
2007	241	0.1286	0.0644	0.0005	0.0398	0.0582	0.0835	0.1205	0.1731	0.2089	0.2446	0.3866
2008	241	0.1290	0.0647	0.0018	0.0396	0.0582	0.0813	0.1212	0.1687	0.2094	0.2421	0.3817
2009	240	0.1311	0.0640	0.0021	0.0394	0.0579	0.0869	0.1229	0.1708	0.2156	0.2470	0.3681
2010	229	0.1358	0.0665	0.0028	0.0402	0.0570	0.0845	0.1278	0.1762	0.2256	0.2609	0.3681
2011	229	0.1362	0.0665	0.0044	0.0398	0.0557	0.0859	0.1270	0.1801	0.2359	0.2579	0.3682
2012	228	0.1371	0.0687	0.0056	0.0389	0.0559	0.0879	0.1271	0.1789	0.2389	0.2598	0.3885
2013	228	0.1374	0.0694	0.0055	0.0380	0.0547	0.0847	0.1273	0.1778	0.2331	0.2722	0.3889
2014	228	0.1370	0.0697	0.0072	0.0399	0.0549	0.0871	0.1275	0.1818	0.2291	0.2639	0.4050
2015	222	0.1381	0.0715	0.0058	0.0383	0.0536	0.0884	0.1273	0.1825	0.2305	0.2757	0.4118
2016	222	0.1388	0.0713	0.0065	0.0393	0.0529	0.0872	0.1309	0.1822	0.2307	0.2748	0.4249
2017	222	0.1405	0.0727	0.0066	0.0392	0.0551	0.0911	0.1325	0.1807	0.2303	0.2773	0.4736
2018	222	0.1400	0.0731	0.0086	0.0351	0.0550	0.0903	0.1324	0.1814	0.2301	0.2698	0.4768
2019	222	0.1377	0.0745	0.0000	0.0348	0.0512	0.0896	0.1284	0.1776	0.2323	0.2714	0.5113
Component of the number of financial institutions	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	251	0.1347	0.0663	0.0039	0.0370	0.0500	0.0833	0.1250	0.1667	0.2000	0.2500	0.3333
2006	243	0.1340	0.0667	0.0039	0.0385	0.0500	0.0833	0.1250	0.1667	0.2000	0.2500	0.3333
2007	241	0.1355	0.0670	0.0040	0.0400	0.0500	0.0909	0.1250	0.1667	0.2500	0.2500	0.3333
2008	241	0.1374	0.0691	0.0040	0.0400	0.0526	0.0909	0.1250	0.1667	0.2500	0.2500	0.3333
2009	240	0.1404	0.0732	0.0041	0.0408	0.0541	0.0909	0.1250	0.1667	0.2500	0.2500	0.5000
2010	229	0.1365	0.0703	0.0041	0.0345	0.0476	0.0909	0.1250	0.1667	0.2000	0.2500	0.3333
2011	229	0.1367	0.0703	0.0041	0.0345	0.0476	0.0909	0.1250	0.1667	0.2000	0.2500	0.3333
2012	228	0.1374	0.0703	0.0041	0.0345	0.0500	0.0909	0.1250	0.1667	0.2000	0.2500	0.3333
2013	228	0.1372	0.0702	0.0041	0.0357	0.0526	0.0909	0.1250	0.1667	0.2000	0.2500	0.3333
2014	228	0.1374	0.0701	0.0045	0.0370	0.0500	0.0909	0.1429	0.1667	0.2000	0.2500	0.3333
2015	222	0.1376	0.0704	0.0042	0.0370	0.0476	0.0909	0.1429	0.1667	0.2000	0.2500	0.3333
2016	222	0.1377	0.0707	0.0042	0.0370	0.0500	0.0909	0.1429	0.1667	0.2000	0.2500	0.3333
2017	222	0.1384	0.0708	0.0043	0.0370	0.0500	0.0909	0.1429	0.1667	0.2500	0.2500	0.3333
2018	222	0.1390	0.0715	0.0043	0.0370	0.0500	0.0909	0.1429	0.1667	0.2500	0.2500	0.3333
2019	222	0.1400	0.0743	0.0047	0.0370	0.0500	0.0909	0.1429	0.1667	0.2500	0.2500	0.5000

UEAs, All financial institutions, Deposit HHI

Component of coefficient of variation	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	251	0.1531	0.0697	0.0017	0.0569	0.0664	0.0970	0.1462	0.2046	0.2459	0.2705	0.3924
2006	243	0.1520	0.0658	0.0017	0.0617	0.0713	0.1039	0.1450	0.2005	0.2389	0.2688	0.3880
2007	241	0.1531	0.0664	0.0020	0.0622	0.0749	0.1012	0.1485	0.2053	0.2394	0.2634	0.3918
2008	241	0.1518	0.0657	0.0012	0.0621	0.0740	0.0994	0.1468	0.1996	0.2370	0.2559	0.3823
2009	240	0.1516	0.0663	0.0011	0.0584	0.0743	0.0994	0.1447	0.1990	0.2389	0.2614	0.3820
2010	229	0.1566	0.0711	0.0002	0.0586	0.0697	0.1004	0.1531	0.2071	0.2477	0.2705	0.4006
2011	229	0.1565	0.0710	0.0002	0.0577	0.0689	0.1018	0.1532	0.2073	0.2462	0.2666	0.4014
2012	228	0.1576	0.0727	0.0004	0.0552	0.0706	0.1018	0.1503	0.2092	0.2528	0.2798	0.4126
2013	228	0.1596	0.0733	0.0010	0.0597	0.0696	0.1038	0.1520	0.2093	0.2580	0.2860	0.4164
2014	228	0.1622	0.0743	0.0010	0.0542	0.0746	0.1047	0.1542	0.2132	0.2597	0.2914	0.4254
2015	222	0.1634	0.0751	0.0007	0.0551	0.0758	0.1029	0.1574	0.2143	0.2609	0.2925	0.4261
2016	222	0.1644	0.0742	0.0065	0.0608	0.0752	0.1046	0.1575	0.2148	0.2605	0.2923	0.4332
2017	222	0.1662	0.0753	0.0089	0.0592	0.0760	0.1058	0.1607	0.2186	0.2646	0.2948	0.4288
2018	222	0.1675	0.0761	0.0027	0.0599	0.0776	0.1070	0.1640	0.2204	0.2699	0.2952	0.4267
2019	222	0.1680	0.0774	0.0020	0.0586	0.0739	0.1055	0.1645	0.2238	0.2647	0.2972	0.4312
Component of the number of financial institutions	N	mean	sd	min	p5	p10	p25	p50	p75	p90	p95	max
2005	251	0.1346	0.0663	0.0038	0.0370	0.0500	0.0833	0.1250	0.1667	0.2000	0.2500	0.3333
2006	243	0.1340	0.0668	0.0039	0.0385	0.0500	0.0833	0.1250	0.1667	0.2000	0.2500	0.3333
2007	241	0.1355	0.0671	0.0039	0.0400	0.0500	0.0909	0.1250	0.1667	0.2500	0.2500	0.3333
2008	241	0.1373	0.0690	0.0040	0.0400	0.0526	0.0909	0.1250	0.1667	0.2500	0.2500	0.3333
2009	240	0.1403	0.0731	0.0040	0.0408	0.0541	0.0909	0.1250	0.1667	0.2500	0.2500	0.5000
2010	229	0.1365	0.0704	0.0041	0.0345	0.0476	0.0909	0.1250	0.1667	0.2000	0.2500	0.3333
2011	229	0.1366	0.0703	0.0040	0.0345	0.0476	0.0909	0.1250	0.1667	0.2000	0.2500	0.3333
2012	228	0.1372	0.0703	0.0040	0.0345	0.0500	0.0909	0.1250	0.1667	0.2000	0.2500	0.3333
2013	228	0.1372	0.0703	0.0041	0.0357	0.0500	0.0909	0.1250	0.1667	0.2000	0.2500	0.3333
2014	228	0.1374	0.0701	0.0045	0.0370	0.0500	0.0909	0.1429	0.1667	0.2000	0.2500	0.3333
2015	222	0.1376	0.0705	0.0041	0.0370	0.0476	0.0909	0.1429	0.1667	0.2000	0.2500	0.3333
2016	222	0.1377	0.0707	0.0042	0.0370	0.0500	0.0909	0.1429	0.1667	0.2000	0.2500	0.3333
2017	222	0.1384	0.0709	0.0042	0.0370	0.0500	0.0909	0.1429	0.1667	0.2500	0.2500	0.3333
2018	222	0.1389	0.0716	0.0042	0.0370	0.0500	0.0909	0.1429	0.1667	0.2500	0.2500	0.3333
2019	222	0.1399	0.0743	0.0046	0.0370	0.0500	0.0909	0.1429	0.1667	0.2500	0.2500	0.5000

Table 10: Prefecture-year where a sizable HHI increase was expected due to bank mergers (All financial institutions)

Year	Prefecture code	Expected Δ LoanHHI/LoanHHI	Year	Prefecture code	Expected Δ DepositHHI/DepositHHI
2006	30	0.30320	2005	13	0.26161
2005	13	0.30018	2013	13	0.23692
2007	6	0.20009	2006	30	0.21950
2013	13	0.17355	2005	27	0.21171
2008	1	0.16892	2005	23	0.18041
2012	21	0.15378	2008	1	0.16590
2005	23	0.12745	2007	6	0.15069
2005	27	0.11963	2012	21	0.12006
2019	27	0.06583	2005	14	0.09090
2013	27	0.05452	2005	26	0.06075
2009	8	0.05073	2005	28	0.04867
2005	14	0.03706	2005	12	0.04029
2012	27	0.03608	2009	8	0.03500
2009	2	0.03045	2009	2	0.03430
2005	26	0.02845	2005	11	0.03269
2015	18	0.02270	2015	18	0.03043
2012	13	0.02143	2018	22	0.02693
2013	23	0.02030	2005	29	0.02131
2005	29	0.02006	2013	27	0.01959
2010	27	0.01998	2007	10	0.01783
2005	28	0.01952	2019	27	0.01745
2007	10	0.01828	2019	22	0.01629
2018	22	0.01793	2018	24	0.01430
2005	11	0.01644	2005	6	0.01254
2018	24	0.01548	2010	27	0.01195
2012	23	0.01372	2007	30	0.01133
2006	35	0.01335			
2006	32	0.01308			

Table 11: Estimation results for the extent to which the expected HHI increase is reflected in the actual HHI (All financial institutions, by prefecture)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dep var.:ΔLoanHHI/LoanHHI						Dep. var.:ΔDepositHHI/DepositHHI					
	t	t+1	t+2	t+3	t+4	t+5	t	t+1	t+2	t+3	t+4	t+5
Expected Δ LoanHHI/LoanHHI	0.888***	0.775***	0.654***	0.670***	0.551***	0.509***						
	(0.0529)	(0.0900)	(0.120)	(0.145)	(0.161)	(0.176)						
Expected Δ DepositHHI/DepositHHI							0.900***	0.783***	0.694***	0.642***	0.643***	0.689***
							(0.0348)	(0.0614)	(0.0789)	(0.0923)	(0.103)	(0.114)
Constant	0.00468***	0.0139***	0.0225***	0.0296***	0.0355***	0.0408***	0.00504***	0.0139***	0.0221***	0.0314***	0.0405***	0.0493***
	(0.00152)	(0.00258)	(0.00344)	(0.00415)	(0.00463)	(0.00506)	(0.000981)	(0.00173)	(0.00222)	(0.00260)	(0.00291)	(0.00321)
Observations	423	423	423	423	423	423	423	423	423	423	423	423
R-squared	0.401	0.150	0.066	0.048	0.027	0.019	0.614	0.279	0.155	0.103	0.084	0.080

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 12: Estimation results for the extent to which the expected increase in HHI is reflected in the actual HHI (By HHI level of loans as of 2005, all financial institutions, by prefecture)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dep var.:ΔLoanHHI/LoanHHI						Dep. var.:ΔLoanHHI/LoanHHI					
	Prefecture-year that satisfy HHI_Loan_2005>median						Prefecture-year that satisfy HHI_Loan_2005<=median					
	t	t+1	t+2	t+3	t+4	t+5	t	t+1	t+2	t+3	t+4	t+5
Expected Δ LoanHHI/LoanHHI	0.843***	0.962***	0.826***	0.967***	0.940***	0.848***	0.898***	0.684***	0.553***	0.511**	0.357	0.331
	(0.0781)	(0.117)	(0.152)	(0.179)	(0.205)	(0.227)	(0.0736)	(0.130)	(0.175)	(0.212)	(0.234)	(0.256)
Constant	0.00299*	0.00968***	0.0150***	0.0200***	0.0257***	0.0303***	0.00633**	0.0182***	0.0302***	0.0393***	0.0455***	0.0515***
	(0.00168)	(0.00253)	(0.00327)	(0.00386)	(0.00442)	(0.00489)	(0.00252)	(0.00446)	(0.00598)	(0.00724)	(0.00801)	(0.00874)
Observations	207	207	207	207	207	207	216	216	216	216	216	216
R-squared	0.363	0.246	0.126	0.125	0.093	0.064	0.410	0.114	0.045	0.026	0.011	0.008

	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
	Dep. var.:ΔDepositHHI/DepositHHI						Dep. var.:ΔDepositHHI/DepositHHI					
	Prefecture-year that satisfy HHI_Deposit_2005>median						Prefecture-year that satisfy HHI_Deposit_2005<=median					
	t	t+1	t+2	t+3	t+4	t+5	t	t+1	t+2	t+3	t+4	t+5
Expected Δ DepositHHI/DepositHHI	0.955***	1.066***	0.964***	1.005***	0.970***	1.012***	0.881***	0.708***	0.603***	0.519***	0.520***	0.554***
	(0.0750)	(0.123)	(0.152)	(0.176)	(0.199)	(0.219)	(0.0427)	(0.0772)	(0.0999)	(0.116)	(0.130)	(0.142)
Constant	0.00312***	0.00894***	0.0133***	0.0195***	0.0273***	0.0335***	0.00693***	0.0187***	0.0308***	0.0431***	0.0537***	0.0649***
	(0.00118)	(0.00194)	(0.00240)	(0.00277)	(0.00313)	(0.00346)	(0.00155)	(0.00280)	(0.00363)	(0.00423)	(0.00472)	(0.00517)
Observations	207	207	207	207	207	207	216	216	216	216	216	216
R-squared	0.442	0.268	0.163	0.138	0.104	0.094	0.665	0.282	0.145	0.085	0.070	0.066

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 13: UEA-year where a sizable HHI increase is expected due to bank mergers (All financial institutions)

Year	UEA code	Expected Δ LoanHHI/Loan HHI	Year	UEA code	Expected Δ LoanHHI/Loan HHI
2006	30201	0.37560	2007	22215	0.04984
2008	1229	0.34105	2009	8204	0.04666
2005	13100	0.28188	2013	27100	0.04474
2007	6209	0.26303	2019	22209	0.04186
2007	1220	0.21287	2006	29207	0.04165
2007	6201	0.20143	2016	1202	0.03605
2018	22130	0.18890	2008	1208	0.03527
2008	1224	0.17885	2005	14212	0.03500
2013	13100	0.17691	2006	35202	0.03497
2006	30206	0.17116	2007	10202	0.03280
2007	6204	0.17089	2012	27100	0.03086
2008	1100	0.16294	2008	1223	0.03083
2008	1225	0.15929	2005	7202	0.03044
2012	21201	0.15791	2005	26100	0.02987
2005	23100	0.15413	2018	24201	0.02822
2008	1202	0.14785	2012	21205	0.02787
2007	6205	0.12263	2015	18201	0.02768
2009	8227	0.11993	2013	23100	0.02416
2005	27100	0.11534	2018	24203	0.02306
2008	1206	0.11185	2010	27100	0.02258
2009	8220	0.11052	2005	24202	0.02243
2007	6202	0.10686	2012	21202	0.02184
2006	32203	0.10568	2012	21203	0.02145
2009	8202	0.10191	2012	13100	0.02065
2009	1208	0.10178	2012	23100	0.01943
2006	30207	0.09949	2005	28100	0.01926
2019	22213	0.09647	2005	28201	0.01537
2007	6203	0.09605	2005	6201	0.01315
2008	1213	0.09569	2013	28100	0.01223
2009	8232	0.09476	2009	26100	0.01128
2017	1402	0.09220	2009	8201	0.01117
2008	1214	0.09154	2013	4100	0.01100
2008	1210	0.08943	2017	1100	0.01022
2007	1205	0.07948	2006	35203	0.01017
2019	22100	0.06565			
2015	21202	0.06311			
2008	1204	0.06226			
2019	27100	0.05879			
2008	1207	0.05348			
2008	1205	0.05222			

Table 13: UEA-year where a sizable HHI increase is expected due to bank mergers (All financial institutions, continued)

Year	UEA code	Expected Δ DepositHHI/DepositHHI	Year	UEA code	Expected Δ DepositHHI/DepositHHI
2006	30201	0.28771	2005	28100	0.03710
2005	13100	0.25161	2009	8232	0.03490
2005	14212	0.22806	2009	8220	0.03368
2005	23100	0.22434	2005	7202	0.03219
2018	22130	0.21391	2016	1202	0.03034
2005	27100	0.20216	2008	1208	0.02880
2008	1224	0.19483	2008	1204	0.02752
2013	13100	0.18937	2018	24201	0.02734
2008	1100	0.18532	2006	32203	0.02596
2007	1220	0.17277	2007	10202	0.02563
2007	6201	0.16263	2009	8204	0.02513
2008	1229	0.15806	2018	24203	0.02501
2007	6209	0.13816	2008	1207	0.02385
2017	1402	0.13061	2005	28201	0.02225
2012	21201	0.13043	2005	6201	0.02206
2019	22213	0.12339	2012	21202	0.02114
2006	30206	0.12211	2013	22130	0.02025
2007	6204	0.11588	2005	24202	0.01981
2008	1202	0.11241	2009	8202	0.01863
2009	1208	0.10288	2009	8201	0.01635
2007	6205	0.09179	2013	27100	0.01520
2019	22209	0.08433	2019	27100	0.01489
2007	1205	0.07730	2010	27100	0.01368
2009	8227	0.07550	2012	21203	0.01270
2006	30207	0.07510	2008	1214	0.01264
2007	6202	0.07247	2006	35202	0.01091
2008	1225	0.07145	2017	1100	0.01032
2008	1223	0.07109			
2005	26100	0.07094			
2019	22100	0.06813			
2008	1206	0.06670			
2008	1213	0.06546			
2012	21205	0.05621			
2007	22215	0.05137			
2007	6203	0.04614			
2015	21202	0.04539			
2008	1210	0.04348			
2006	29207	0.04007			
2015	18201	0.03963			
2008	1205	0.03735			

Table 14: Estimation results for the extent to which the expected HHI increase is reflected in the actual HHI (All financial institutions, by UEA)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dep var.:ΔLoanHHI/LoanHHI						Dep. var.:ΔDepositHHI/DepositHHI					
	t	t+1	t+2	t+3	t+4	t+5	t	t+1	t+2	t+3	t+4	t+5
Expected Δ LoanHHI/LoanHHI	0.934***	0.905***	0.876***	0.838***	0.783***	0.756***						
	(0.0471)	(0.0638)	(0.0797)	(0.0946)	(0.104)	(0.113)						
Expected Δ DepositHHI/DepositHHI							0.911***	0.811***	0.826***	0.760***	0.764***	0.791***
							(0.0415)	(0.0575)	(0.0706)	(0.0814)	(0.0913)	(0.0974)
Constant	0.00326***	0.00916***	0.0151***	0.0213***	0.0257***	0.0288***	0.00391***	0.0104***	0.0167***	0.0240***	0.0312***	0.0374***
	(0.000997)	(0.00136)	(0.00172)	(0.00205)	(0.00228)	(0.00248)	(0.000731)	(0.00102)	(0.00126)	(0.00147)	(0.00159)	(0.00170)
Observations	2,094	2,057	2,022	1,987	1,953	1,944	2,094	2,057	2,022	1,987	1,953	1,944
R-squared	0.158	0.089	0.056	0.038	0.028	0.022	0.187	0.088	0.063	0.042	0.035	0.033

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 15: Estimates of the extent to which expected HHI increases are reflected in the subsequent HHI (By loan HHI level in 2005, all financial institutions, by urban employment area)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dep var.:ΔLoanHHI/LoanHHI						Dep. var.:ΔLoanHHI/LoanHHI					
	UEA-year that satisfy HHI_Loan_2005>median						UEA-year that satisfy HHI_Loan_2005<=median					
	t	t+1	t+2	t+3	t+4	t+5	t	t+1	t+2	t+3	t+4	t+5
Expected Δ LoanHHI/LoanHHI	0.830***	0.743***	0.817***	0.785***	0.758**	0.549*	0.940***	0.902***	0.845***	0.795***	0.732***	0.723***
	(0.164)	(0.199)	(0.238)	(0.277)	(0.298)	(0.320)	(0.0432)	(0.0669)	(0.0869)	(0.105)	(0.118)	(0.128)
Constant	0.00238	0.00599***	0.00924***	0.0134***	0.0168***	0.0190***	0.00447***	0.0131***	0.0223***	0.0306***	0.0357***	0.0394***
	(0.00161)	(0.00197)	(0.00237)	(0.00275)	(0.00299)	(0.00321)	(0.00123)	(0.00193)	(0.00253)	(0.00309)	(0.00348)	(0.00382)
Observations	1,010	994	978	962	946	944	1,032	1,012	994	976	959	952
R-squared	0.025	0.014	0.012	0.008	0.007	0.003	0.315	0.153	0.087	0.055	0.039	0.032

	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
	Dep var.:ΔDepositHHI/DepositHHI						Dep. var.:ΔDepositHHI/DepositHHI					
	UEA-year that satisfy HHI_Deposit_2005>median						UEA-year that satisfy HHI_Deposit_2005<=median					
	t	t+1	t+2	t+3	t+4	t+5	t	t+1	t+2	t+3	t+4	t+5
Expected Δ DepositHHI/DepositHHI	1.026***	1.010***	1.136***	0.858***	0.811***	0.760**	0.892***	0.777***	0.773***	0.719***	0.720***	0.735***
	(0.130)	(0.178)	(0.221)	(0.263)	(0.278)	(0.297)	(0.0476)	(0.0661)	(0.0805)	(0.0921)	(0.105)	(0.111)
Constant	0.00301***	0.00808***	0.0130***	0.0191***	0.0254***	0.0303***	0.00489***	0.0127***	0.0204***	0.0290***	0.0370***	0.0445***
	(0.000937)	(0.00129)	(0.00162)	(0.00191)	(0.00204)	(0.00218)	(0.00114)	(0.00160)	(0.00197)	(0.00227)	(0.00250)	(0.00264)
Observations	1,010	994	978	962	946	944	1,032	1,012	994	976	959	952
R-squared	0.058	0.031	0.026	0.011	0.009	0.007	0.254	0.120	0.085	0.059	0.047	0.044

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

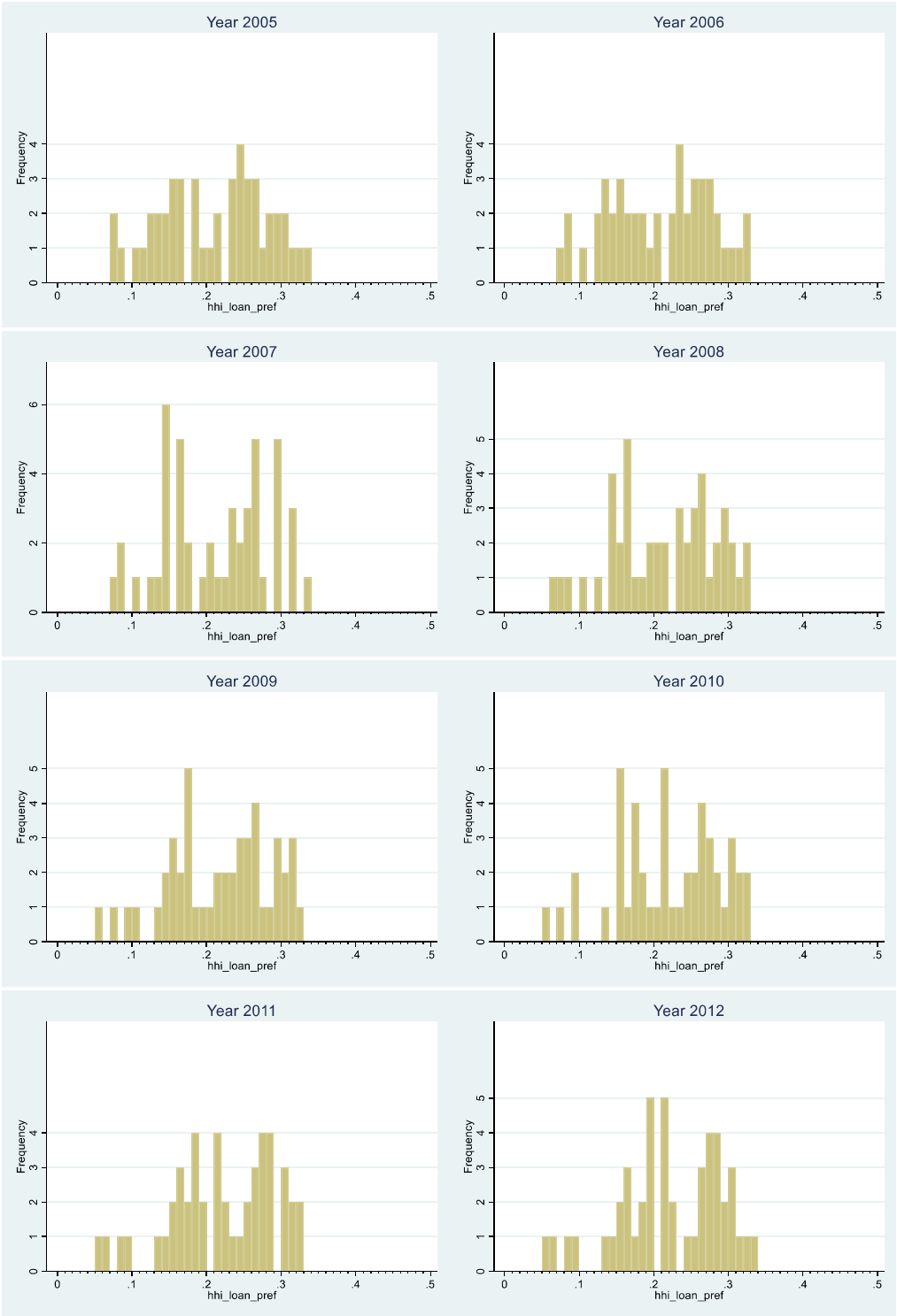
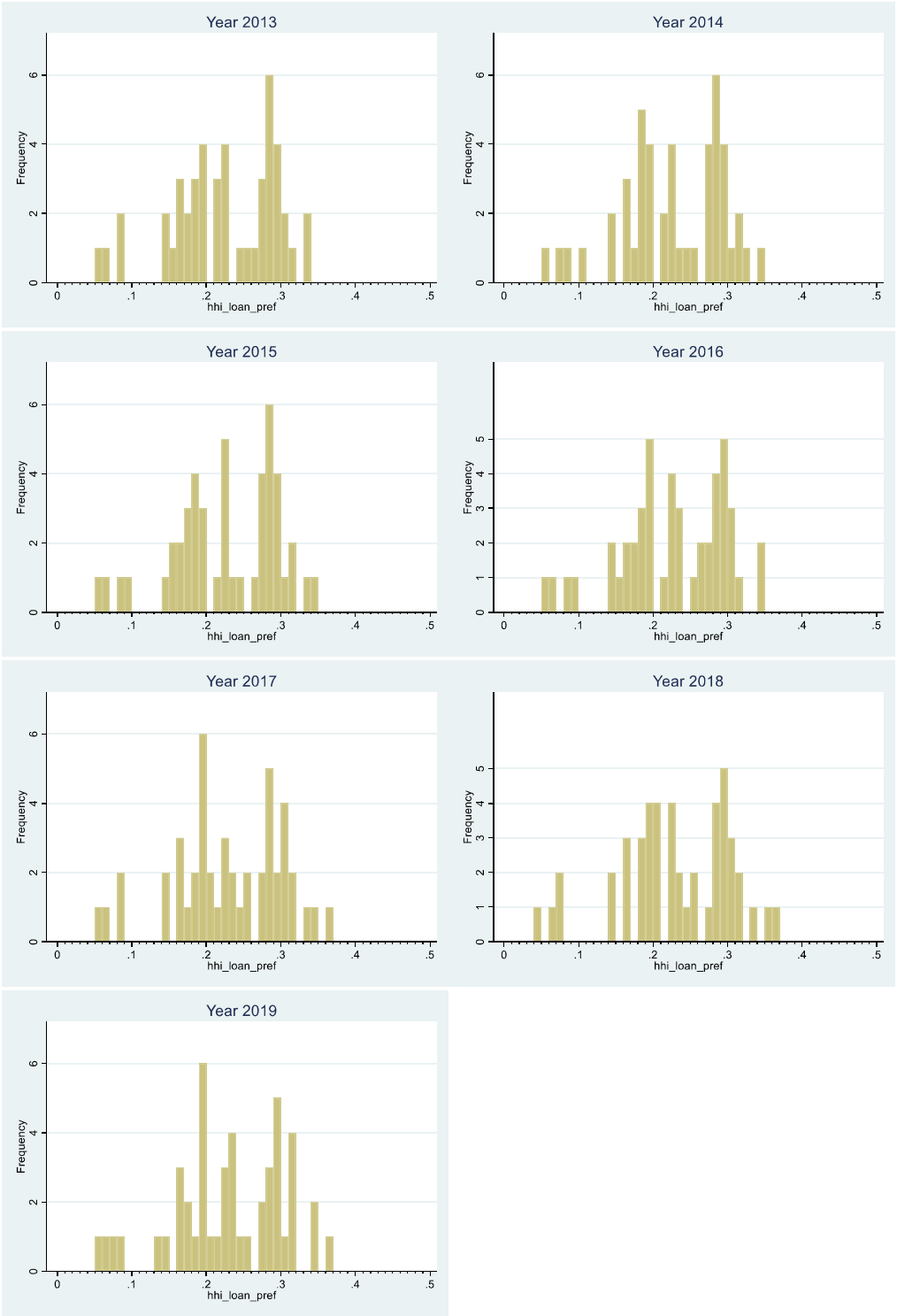


Figure 1. Distribution of loan HHI and deposit HHI (By prefecture, all financial institutions)

Loan HHI, by prefecture, all financial institutions


Year 2013
Year 2014
Year 2015
Year 2016
Year 2017
Year 2018
Year 2019
Frequency
hhi_loan_pref
0
.1
.2
.3
.4
.5

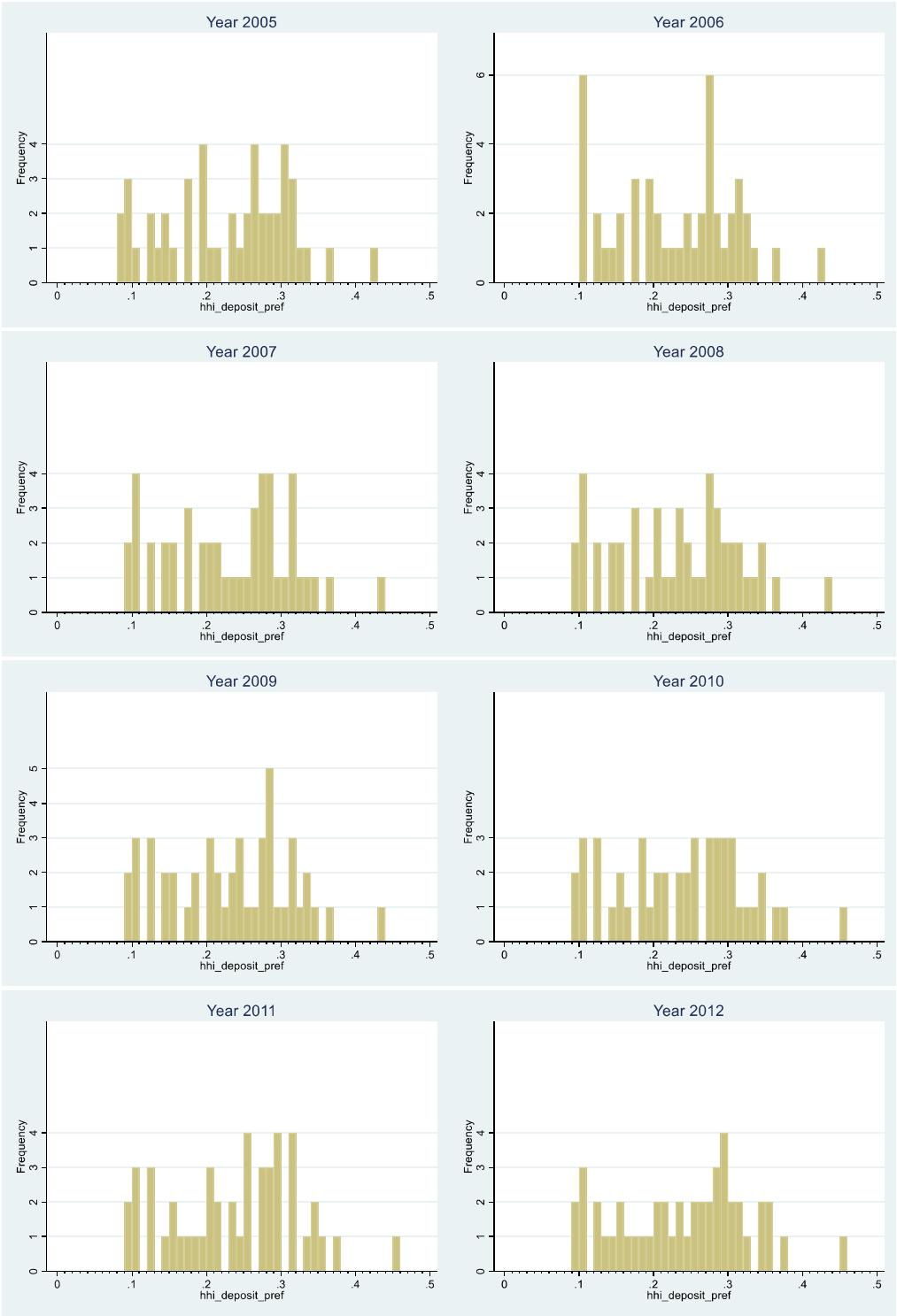


Figure 1. (cont'd) Distribution of loan HHI and deposit HHI (By prefecture, all financial institutions)

Deposit HHI, by prefecture, all financial institutions


Year 2013
Year 2014
Year 2015
Year 2016
Year 2017
Year 2018
Year 2019
Frequency
hhi_deposit_pref
0
.1
.2
.3
.4
.5

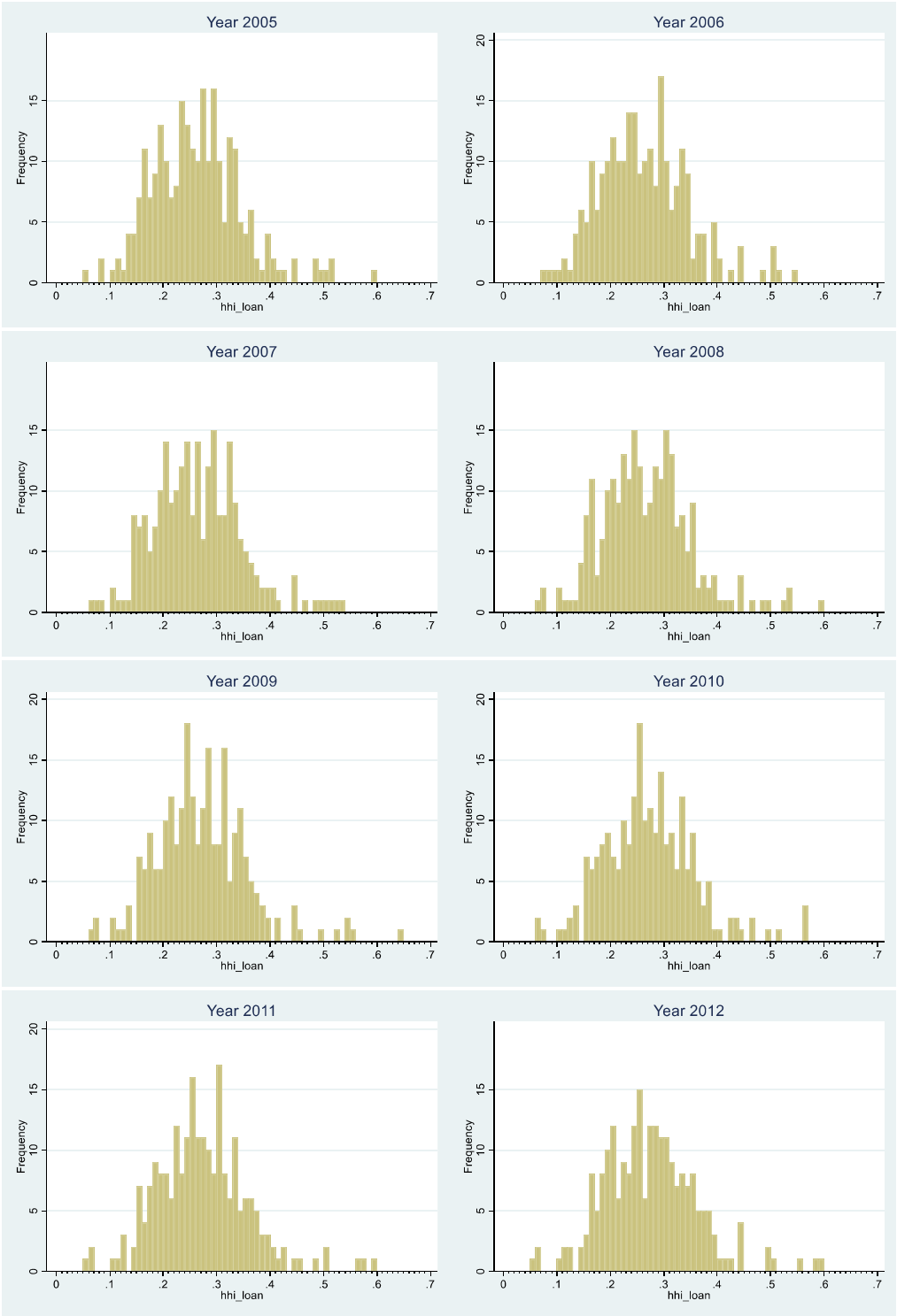
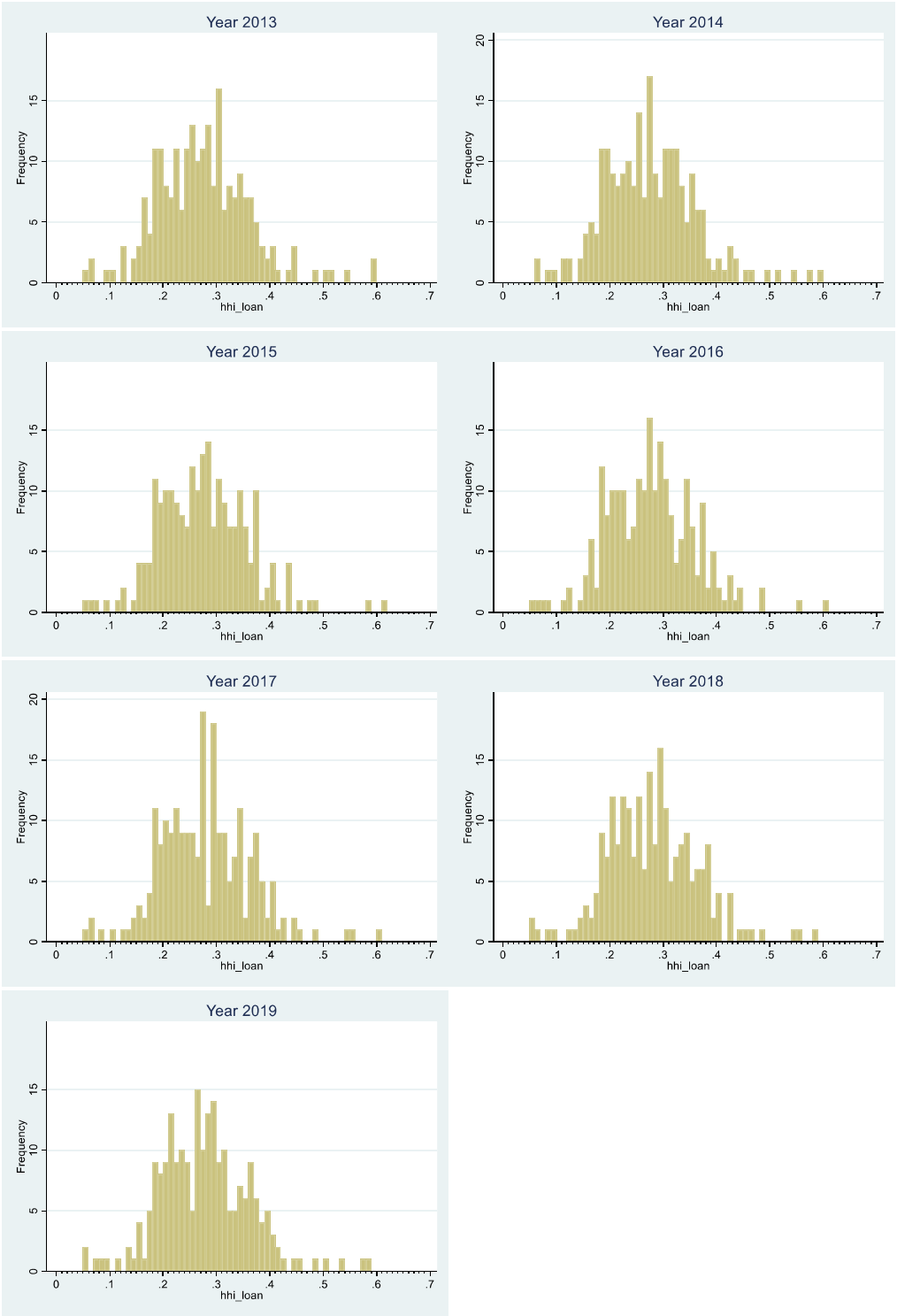


Figure 2. Distribution of loan HHI and deposit HHI (By urban employment area, all financial institutions)

Loan HHI, urban employment area, all financial institutions


Year 2013
Year 2014
Year 2015
Year 2016
Year 2017
Year 2018
Year 2019
Frequency
hhi_loan

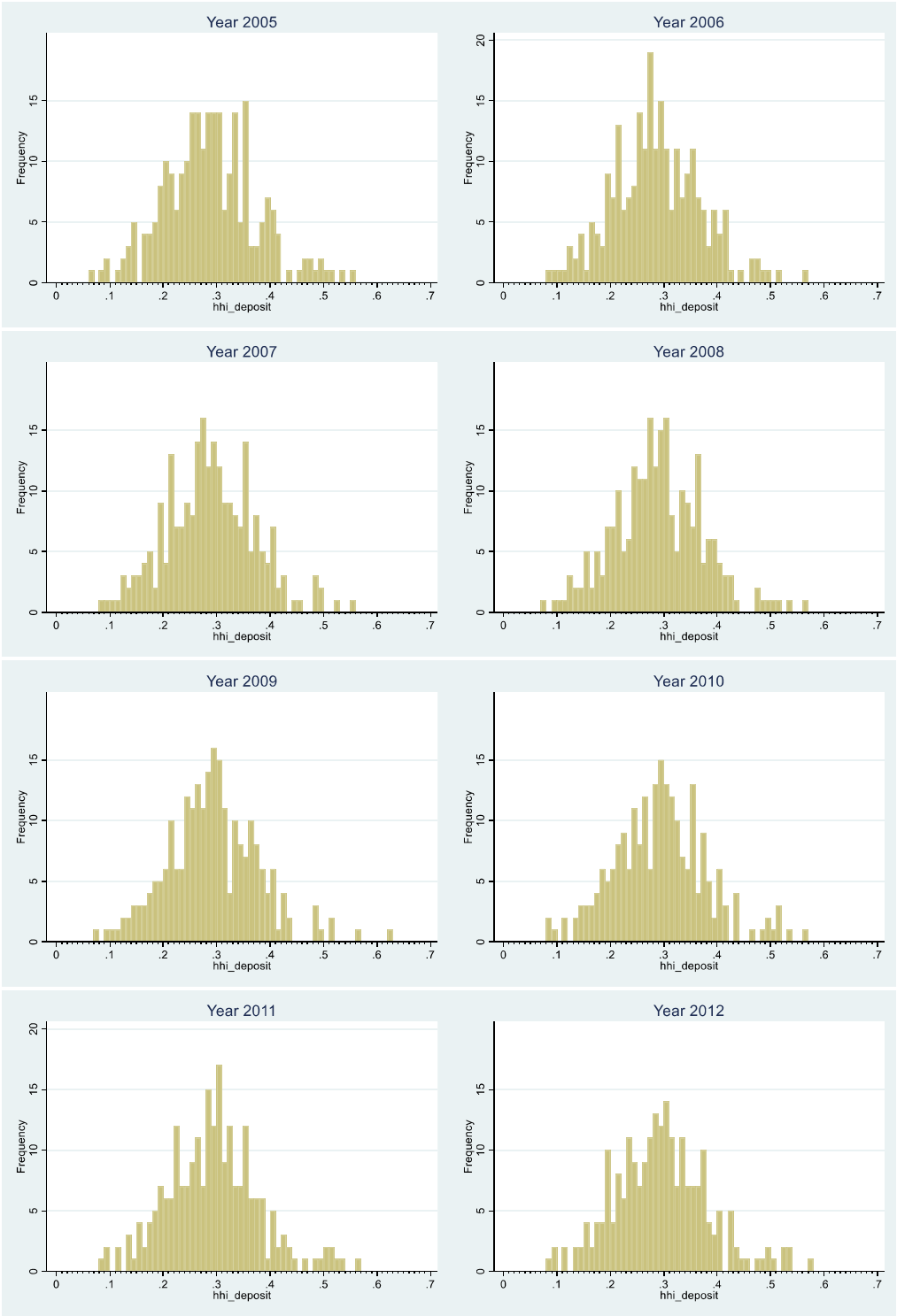
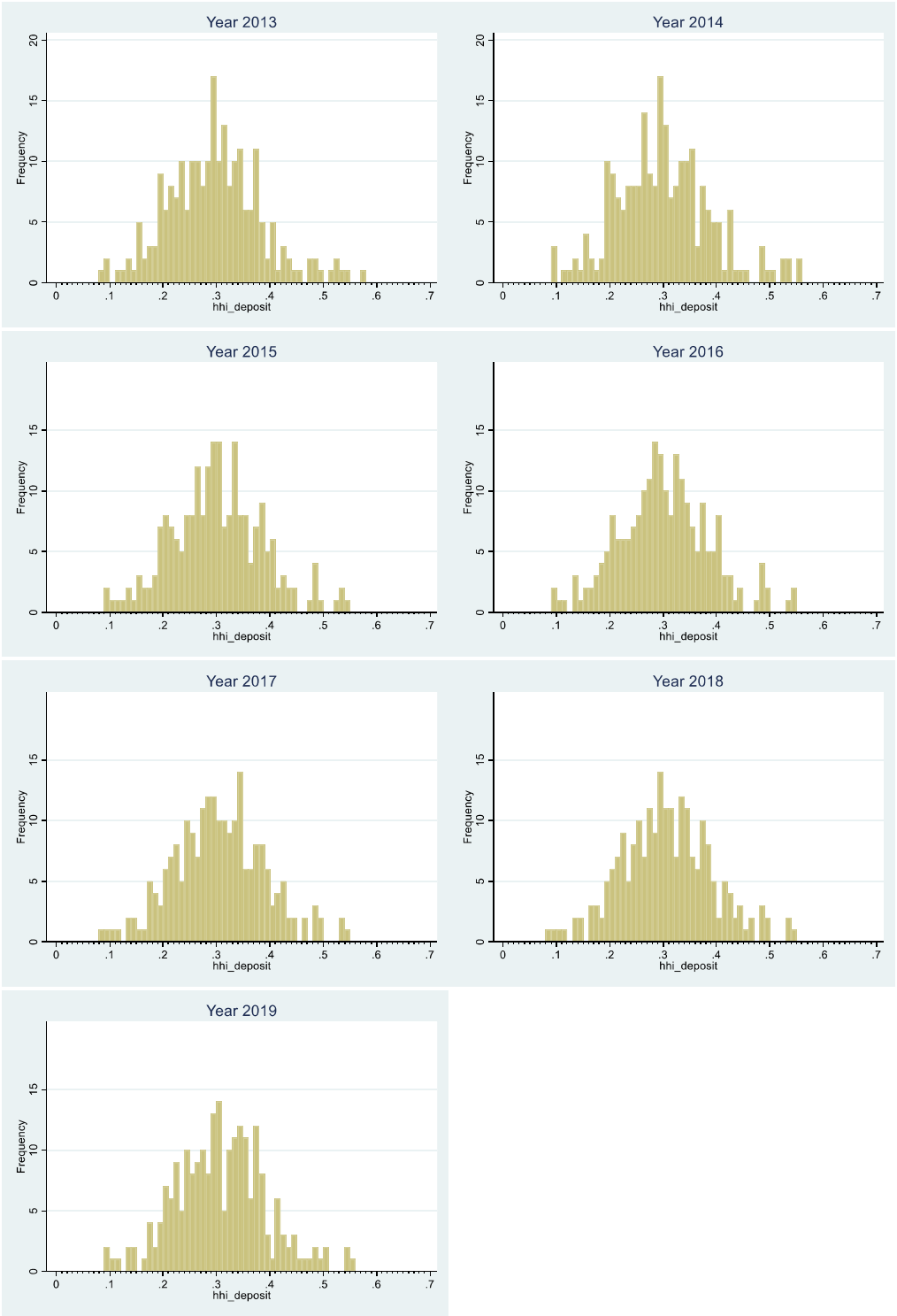


Figure 2. (cont'd) Distribution of loan HHI and deposit HHI (By urban employment area, all financial institutions)

Deposit HHI, by urban employment area, all financial institutions


Year 2013
Year 2014
Year 2015
Year 2016
Year 2017
Year 2018
Year 2019
Frequency
hhi_deposit
0
5
10
15
20
0
.1
.2
.3
.4
.5
.6
.7

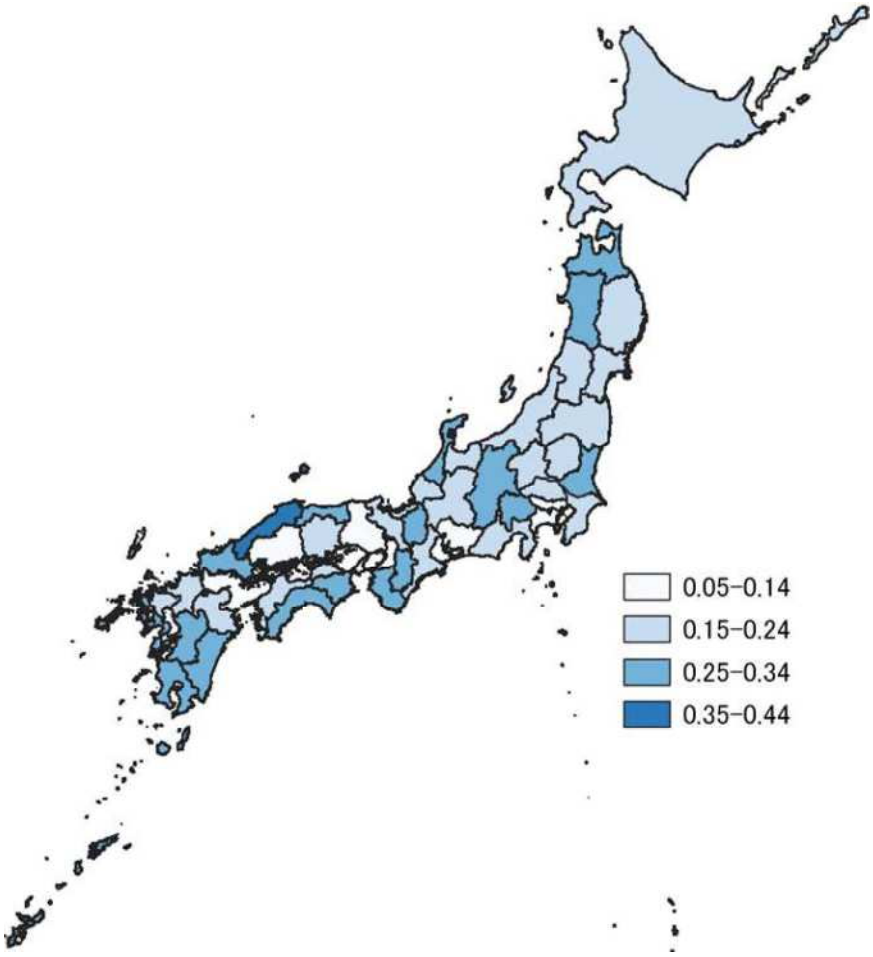


Figure 3. Loan HHI levels (2019, by prefecture, all financial institutions)

Note: The darker the blue, the higher the HHI; the lighter the blue, the lower the HHI.

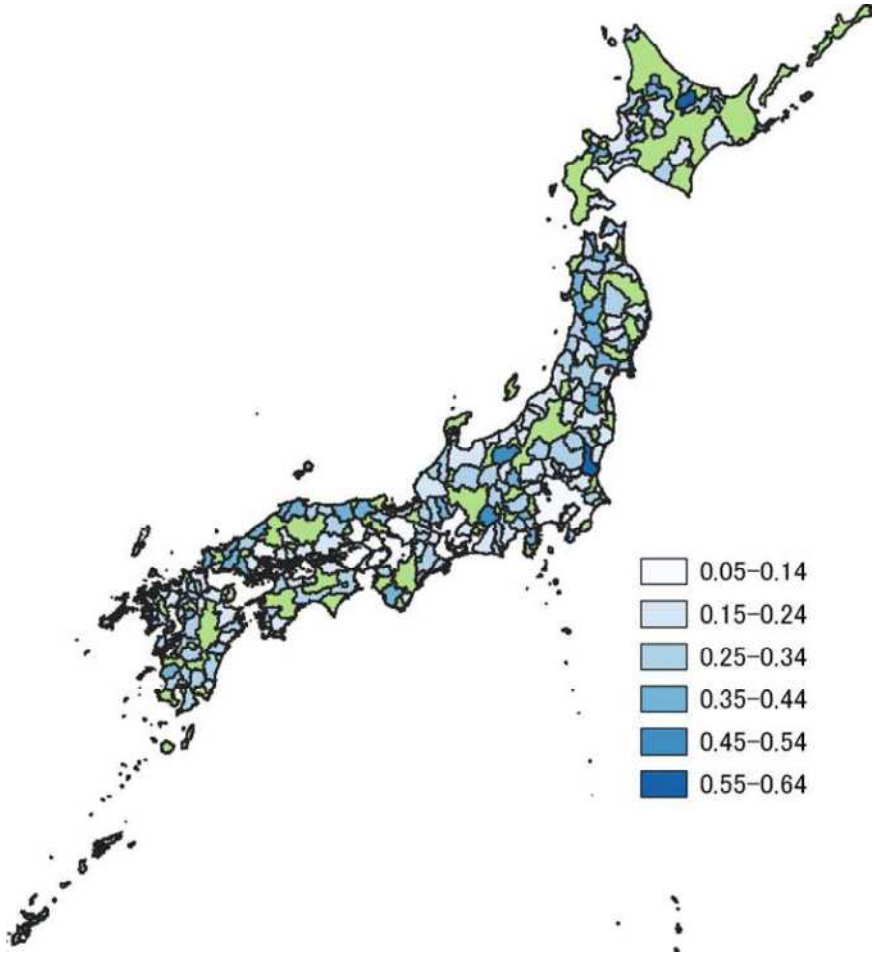


Figure 3. (continued) Loan HHI levels (2019, by urban employment area, all financial institutions)
Note: The darker the blue, the higher the HHI; the lighter the blue, the lower the HHI. Yellow-green areas are outside the city's employment areas.

References

Cetorelli, N. (1999) "Competitive analysis in banking: Appraisal of the methodology," *Economic Perspective*, 23, pp.2-15.

Hannan, T. (1997) "Market share inequality, the number of competitors, and the HHI: An examination of bank pricing," *Review of Industrial Organization* 12 (1), pp.23-35.

Harimaya, K. and Y. Ozaki (2017). "Impact of competitive environment among regional financial institutions on the entry and exit of establishments," RIETI Discussion Paper Series, 17-J-047 (in Japanese).

Kanemoto, Y. and K. Tokuoka. (2002) "Defining metropolitan areas in Japan," *Applied Regional Studies*, 7, 1-15 (in Japanese).

Maruyama, T. (2020) "Evolution of competition in the Japanese banking industry," mimeo. (in Japanese).

Nakata, M. and S. Adachi. (2006) "Why does the interregional gap of loan rates remain? An empirical study using the panel data of second-regional and shinkin banks," *Financial Review*, October 2006 Issue, 161-193 (in Japanese).

Ogura, Y. (2012) "Lending competition and credit availability for new firms: Empirical study with the price cost margin in regional loan markets," *Journal of Banking and Finance*, 36, pp.1822-1838.

Ogura, Y. (2020) "Intensified lending competition and search-for-yield under prolonged monetary easing", *Journal of the Japanese and International Economies*, 56, 101076.

Ojima, M. (2018) "Severer competition among regional financial institutions and financial stability," *Review of Monetary and Economic Studies*, 41, 1-18 (in Japanese).

Ono, A., Y, Saito, K.Sakai. and I. Uesugi. (2016) "Does geographical proximity matter in small business lending? Evidence from changes in main bank Relationships," HIT-REFINED Working Paper Series 40, Institute of Economic Research, Hitotsubashi University.

Uchida, H. and Y. Tsutsui. (2005) "Has competition in the Japanese banking sector improved?" *Journal of Banking and Finance*, 29, 419–439.

Financial Research Center（FSA Institute）
Financial Services Agency
Government of Japan

3-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8967, Japan

TEL: 03-3506-6000（ext. 3552）
FAX: 03-3506-6716
URL: https://www.fsa.go.jp/frtc/english/index.html