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Semi-Macro Data

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Herd Behavior in the Japanese Loan Market: Evidence from Semi-Macro Data

Abstract

The aim of this paper is to examine whether herd behavior exists or not between different types of Japanese banks. Using data of loans outstanding by types of banks from 1980 to 2000, we investigate statistical causality between loans from different types of banks in Japan. Time-series analysis manifested the causality from city banks to regional banks, from long-term credit banks to city banks, and from trust banks to city banks. Consistent with historical events in Japan, these relationships have been found especially for loans to emerging industries and for those in the 1980s. We also conducted analysis to clarify possible causes of the detected herding. Among different stories behind herd behavior, the results are most consistent with that based on inference from other type of banks. The results between long-term credit banks and city banks, and those between trust banks and city banks are also consistent with the "Cowbell-like" effect.

Keywords: herd behavior, banks, loan market, Japan, Cowbell effect

JEL classification number: G21

1 Introduction

In Japan, the existence of herd behavior among banks has long been pointed out. Until early 1980s, capital markets were underdeveloped. Loans and bond issues underwritten by banks were the only sources of finance for a great number of firms. A large amount of funds flow in Japan had therefore been intermediated by banks.¹ Under such circumstance, competition among banks was less severe. It was often claimed that loans, fees, salaries, deposit rates, and so on had been set uniformly.

The situation has changed since the disintermediation prevailed. Due to the development of capital markets after the huge issue of government bonds in late 1970s, a wide variety of financing sources have become available for large companies in the 1980s and banks in Japan have been facing difficulty in finding alternative sources of income. Nevertheless, we can still find some casual evidence which might imply the existence of herding. For example, a conventional explanation for a fair amount of bad loans in Japanese banks is that in the bubble era they did not fully monitor their borrowers and herded to lend, for example, real estate industries. Herding between large and small banks which have close capital relationships is often claimed as well. In financial *keiretsu*, several banks granted loans under the coordination by *main banks*. In spite of these casual claims, however, there are almost no study that formally investigates whether herd behavior has been observed or not in the Japanese banking industry.

This paper is the first fact-finding study which attempts to examine whether herd behavior exists or not in the Japanese loan market. We use data on loans outstanding by types of banks from 1980 to 2000 to investigate herd behavior between different types of Japanese banks.

The analysis is based upon time-series technique and consists of two stages. First, we will investigate whether any statistical causality exists or not between loans from different types of banks, and in which direction, if any. If some causality is detected, we then proceed to the detection of the possible cause of herd behavior. Among possible stories behind herd behavior, we will focus on three stories which can be detected by semi-macro data analysis: (a) accidental herding resulting from the same action based on common information (herding based on common information), (b) intentional herding in which uninformed banks follow informed ones (inference from informed agents), and (c) herding based on causes other than (a) or (b) (other explanations).² Introducing macroeconomic variables as explana-

¹See Hoshi and Patrick[15] for more details.

²On possible causes of herding, see Section 2.

tory variables and checking if the detected causality is still significant, we determine which of the three stories is most likely to be relevant.

The analysis manifests the causality from city banks to regional banks, from long-term credit banks to city banks, and from trust banks to city banks. Consistent with the historical events in Japan, these relationships are most likely to be found for loans to emerging industries and for those in the 1980s. Furthermore, the results are most consistent with type (b) herding, herding based on inference from other type of banks. The results between long-term credit banks and city banks and those between trust banks and city banks are also consistent with the "Cowbell-like" effect of loans from long-term credit or trust banks.³

The analysis in the present study is similar to that in Jain and Gupta[16].⁴ Their study takes a similar method of approach using semi-macro time-series data. However, the focus of their study is different from ours. They examine herd behavior among U.S. banks with respect to the loans to Latin American countries from late 1970s to early 1980s. Furthermore, they focus only on whether any herd behavior would have existed or not, while we further try to identify which type of herd behavior would be the most relevant. Hence, the present study has technical advantage over theirs.⁵

So far, at least to the best of our knowledge, the only study which investigates herd behavior in the Japanese banking industry is Miyamoto[20, ch.8]. However, his focus is on the deposit market, and the analytical method is completely different from ours.⁶

The remainder of this paper is composed as follows. Section 2 summarizes the reason herd behavior can take place. In Section 3, we introduce the data and the method of approach employed in this paper. Section 4 reports the results. Finally, Section 5 concludes the paper.

³The original Cowbell effect is the effect that loans from the Japan Development Bank induced other banks' loans to the same borrower. This effect was first claimed by Higano[12]. See Section 3.3.1 for more detail.

⁴There are other studies which examine herd behavior in different situations. Examples are; herding among fund managers (Lakonishok et al.[17], Grinblatt, Titman, and Wermers[11], Wermers[26], *inter alia*), among security analysts (Graham[10], Hong, Kubik, and Solomon[14], *inter alia*), and among macroeconomic forecasters (Lamont[18], Laster, Bennett, and Geoum[19], *inter alia*). These studies use detailed individual data on managers, analysts, and forecasters, respectively. In contrast to these studies, the present study aims at detecting herding at a semi-macro level.

⁵In the terminology of the present paper, Jain and Gupta[16] estimated only the equations without macroeconomic variables.

⁶Following a method similar to Lamont[18], Ashiya and Doi[1] find herd behavior by Japanese macroeconomic forecasters.

2 Possible causes of herd behavior

In theoretical studies, a number of explanations have been given on herd behavior.⁷ Among others, the present paper will focus on the following three explanations, since these can be identified, at least to some extent, using semi-macro data.⁸

(a) Herd behavior based on common information According to this explanation, herd behavior takes place not by intention but by accident. Reacting to the same information, different agents can accidentally act in the same way. For example, prospective information about a certain industry may give rise to simultaneous increases in different banks' loans to that industry. Such information is not restricted to public one. Common private information may cause herd behavior. As indicated by Lakonishok, Shleifer, and Vishny[17], this type of herding may even be efficient.

(b) Inference from informed agents Agents with inferior information may follow those with superior ones. This type of herding is also likely to be observed in Japan. Banks in Japan had been segmented in their activities by the regulation on the segregation of business areas in financial industries. Small and large banks had had an advantage in lending to small and large firms, respectively, while long-term credit and trust banks in long-term finance. After the relaxation of this regulation, business area of each type of banks began to overlap. It is therefore possibly the case that banks of a certain type had started lending to a new class of customers by following banks of other type who already had advantage in lending that class.

⁷See Bikhchandani, Hirshleifer, and Welch[4], and Devenow and Welch[5] for survey.

⁸Other explanations can be given on herd behavior. First, Falkenstein[7] shows that herd behavior is observed among those mutual funds that have similar comparative advantage. By analogy of this reasoning, herd behavior can be found *among* banks with similar characteristics, i.e. banks of the same type. For example, long-term credit banks in Japan had had comparative advantage in long-term finance so that they might have shared a tendency to lend intensively to, for example, heavy industries. However, since the data to be used in this paper is aggregated by each type of banks, it is impossible to detect this type of herding in the present study.

Second, some kind of payoff externality may account for the reason herding takes place. Examples are: bank run (Diamond and Dybvig[6] *inter alia*), liquidity (Devenow and Welch[5]), and information production (Froot, Scharfstein, and Stein[8] and Hirshleifer, Subrahmanyam, and Titman[13]). However, it is not probable that this type of herding takes place between different types of banks.

Finally, in the presence of career concern by managers, herding may take place so as to obtain higher reputation (Scharfstein and Stein[22]). This type of herding should not be found in semi-macro data used in the present study, either.

(c) **Other explanations** If neither type (a) nor type (b) herding is detected, several explanations are possible. Since we will use semi-macro data, these explanations cannot be identified from each other. Thus, we collectively call them (c) other explanations. Included among them, for example, is so-called the *cascade* (Bikhchandani, Hirshleifer, and Welch[3] and Banerjee[2]). Consider a situation in which multiple agents have to make a similar decision sequentially based on private information as well as past records of decisions made by their predecessors. The authors show that agents of later turns tend to be more ignorant of their private information and more frequently mimic their direct predecessors.⁹ Also included is herding based on irrational behavior. Although explanations thus far are all based upon rational behavior, herding may be brought about simply by irrational behavior. This is indeed one of the most commonly indicated causes of herding in the finance literature.¹⁰

3 Data and Methodology

3.1 Data

We use data from Financial and Economic Statistics Monthly by the Bank of Japan, Financial Statements Statistics of Corporations by Industry (Quarterly) by the Ministry of Finance, Monthly Statistics Report by Tokyo Stock Exchange, some of which are obtained from Thomson Financial Datastream Database. The main data is quarterly "Loans and Discounts Outstanding by Industry" in Financial and Economic Statistics Monthly, by which we can identify the amount of loans granted to different industries by different types of banks.¹¹ The sample period is from 1980 to 2000. This includes the period of financial liberalization and the bubble period in Japan. Since some structural change may have taken place, we will focus mainly on two sub-sample periods, the 1980s and the 1990s.¹²¹³

⁹For more on the *cascade*, see Bikhchandani, Hirshleifer, and Welch[4] and Gale[9].

¹⁰This type of herding is also called "herding on noise". See, for example, Shiller[23].

¹¹One might wonder why we do not use "New Loans for Equipment Funds by Industry" (flow data). This data is available only after 1993 and only for broader industry classification. Furthermore even with stock data, we can detect herding in the adjustment of the stock of loans, which will be shown below.

¹²Although some data are available before 1980, they are insufficient to conduct analysis with regard to the whole 1970s. Furthermore, due to the reason to be explained in Section 3.3, it is appropriate to focus on the period from 1980 on, after which the *window guidance* by the Bank of Japan was alleviated.

¹³Note that since the beginning of the fourth quarter of 2000, the Bank of Japan has stopped collecting data on trust banks and long-term credit banks, because the conven-

Included in the types of banks are (i) city banks, (ii) regional banks, (iii) second regional banks, (iv) long-term credit banks, and (v) trust banks.¹⁴ City banks are large and operate nationwide. Regional banks and second regional banks are typically small- or medium-sized banks which usually focus on regional finance. Long-term credit banks and trust banks are (were) the banks that have (had) special aims: The former was for long-term finance and the latter for trust services. Both types of banks have often been characterized as the main providers of long-term funds in Japan. Note that this structure of banking industry in Japan has been changing drastically these days, especially following the financial system reform so-called the *big-bang* in the mid-1990s.¹⁵

The industries included are (1) manufacturing, (2) construction, (3) electricity, gas, heat supply and water (hereafter electricity), (4) transport and communication (hereafter transport), (5) wholesale, retail trade, eating and drinking places (hereafter wholesale), (6) finance and insurance, (7) real estate, (8) services, (9) local governments, (10) individuals, and (11) overseas yen loans and domestic loans transferred overseas.

Note that we do not use data of (9) local governments, since they are likely to be determined mainly by demand sides. Note also that we exclude data of (6) and (11) from the sample, since these are available only after the fourth quarter of 1988 and the second quarter of 1993, respectively. Instead, we include newly created data, "(12) other industries", which is residually defined as follows: "(12)=(Total)-(1)-(2)-(3)-(4)-(5)-(7)-(8)-(9)-(10)". It is expected that a large part of (12) consist of loans to finance and insurance industries.¹⁶

There have been two significant changes in the definition of loans outstanding. First, since the second quarter of 1993, they include overdrafts. Second, since the fourth quarter of 1993, loans outstanding by trust banks include those of trust banks that began their operation on October 1993. These changes are to be controlled in the estimation below.

tional classification of domestically licensed banks has broken down and became out of date. The sample periods for these banks are thus shorter by one quarter.

¹⁴Note that loans outstanding of trust banks consists, by definition, of those in the trust banks' banking accounts and those in the domestic banks' trust accounts.

¹⁵It should be noted that there had been some bank failures during the sample period, such as that of Hokkaido-Takushoku bank (a city bank). We conducted analysis with introducing dummy variables to control these failures but the results were unchanged.

¹⁶Data on (6) by *all* the types of domestic banks is available even before the third quarter of 1988. The figures are about 4.5 and 39 billion yen in the first quarter of 1980 and in the first quarter of 1990, respectively. In the same quarters, the corresponding figures for (12) are about 8.6 and 51 billion yen, respectively.

3.2 Traditional and emerging industries

In this subsection, we will demonstrate that it is appropriate to distinguish between traditional industries (manufacturing, construction, electricity, transport, and wholesale) and emerging industries (real estate, services, and individuals). In Figure 1, we represent the transition of the ratios of loans outstanding for each industry relative to the total loans outstanding. Lines marked in each data point are those for emerging industries and others. The vertical line on the second quarter of 1993 represents that it is the time when the definition of the data has been changed.¹⁷

Manufacturing and wholesale industries are traditionally dominant borrowers for banks in Japan until early 1980s. Nearly 30 and 25 percent of the total loans outstanding are for these industries, respectively. The reason behind their dominance is that they are industries of long history and composed of large corporations which had raised a lot of funds.

After the bubble period, these ratios dropped rapidly. Loans to these industries monotonically decreased to the level around 15 percent. This trend reflects financial liberalization in early 1980s. The Foreign Exchange Law was reformed in 1980, the New Banking Act was enforced in 1982, and different measures were put in action based on the report by the Japan-US Yen Dollar Committee in 1984. The liberalization prompted firms' access to different sources of funds.¹⁸ As a result, disintermediation had taken place. Banks had to give up relying on lending to traditional customers and could not help searching for new borrowers.

Construction, electricity and transport industries are also classified as traditional industries, since the ratios of loans outstanding to these industries have been unchanged. These ratios are not only stable but also marginal around several percentage.

Real estate, services and individuals can be called "emerging industries", since the amounts of loans to these industries increased rapidly after the financial liberalization. The ratios of these loans to the total loans outstanding began to increase in the first half of the 1980s and became comparable to those for manufacturing and wholesale industries by the bubble period. This reflects banks' needs to find new customers after the disintermediation. This also reflects increased loan demand from these industries due to their development and booming in the bubble era. When the bubble collapsed, the

¹⁷As noted above, overdrafts are included in these figures from the second quarter of 1993.

¹⁸Examples of individual measures are: the removal of the ban on CPs and impact loans, and the liberalization of the eligible standard of unsecured corporate debentures. See, for example, Suzuki and Okabe[24] for details.

ratios of the amounts of loans to these industries became stagnant. However, these three industries are still important customers for banks in Japan.

Based on these considerations, we will classify the industries as follows.

1. Traditional industries: manufacturing, construction, electricity, transport and wholesale
2. Emerging industries: real estate, services and individuals
3. Other industries

In the following, we calculate loans outstanding for each classification by aggregation.¹⁹ Based on the discussion thus far, herding is likely to be found in loans to emerging industries, which constitute banks' new customer base. On the contrary, it should be hard to find herding in loans for traditional industries, to which the priority of bank loans had decreased.

3.3 Method of estimation

3.3.1 Estimation equation

Basic model We will estimate a vector autoregressive model to detect statistical causality, similar to the Granger-causality, between different types of banks. Let X and Y be the natural logarithms of loans outstanding by two different types of banks, x and y , respectively. Then the equation to be estimated is as follows.

$$X_t = \mu + \sum_{i=1}^n \beta_i X_{t-i} + \sum_{i=1}^n \gamma_i Y_{t-i} + \epsilon_t. \quad (1)$$

In this equation, μ is a vector of deterministic components. It consists of a constant term, seasonal dummies, and two dummy variables to control the changes in the data definition in the second quarter of 1993 and in the fourth quarter of 1993. Note that the lagged series of the last two dummies are also incorporated in the equation since the changes in the data definition should also have affected the lagged explanatory variables.²⁰ The final term ϵ_t is an error term. The length of lags of the explanatory variables n is determined by AIC (Akaike information criterion).²¹

¹⁹Loans outstanding for "other industries" is calculated according to the procedure explained above.

²⁰Indeed the estimation results show that these lagged dummies are statistically significant.

²¹We did not use SBIC (Schwartz's Bayesian information criterion) since it often yielded very short length of lags which could not remove serial correlation in the error term.

If the sum of the coefficients $\sum_{i=1}^n \gamma_i$ is positive and significantly different from zero, then we obtain a statistical causality from Y to X . This can be interpreted as some evidence of herd behavior from type y banks to type x banks.²²

Estimation with macroeconomic variables If any causality relationship is detected by estimating equation (1), we will add macroeconomic variables with one-quarter lags, M_{t-1} , as explanatory variables. These variables are to represent publicly available information on borrowers' future performance, overall macroeconomic factors, and so on. By checking whether or not all the coefficients of these variables are significantly different from zero (F-test), we can infer causes of herd behavior.

Let the expression " \leftarrow " (" \mid ") mean the presence (absence) of the statistical causality. Based on the discussion in Section 2, the most natural way to interpret the results is as follows.

Both " $X \leftarrow M$ " and " $Y \leftarrow M$ ": type (a) herding

Either " $X \leftarrow Y \leftarrow M$ " or " $Y \leftarrow X \leftarrow M$ ": type (b) herding

Either " $X \leftarrow Y \mid M$ " or " $Y \leftarrow X \mid M$ ": type (c) herding

It should be noted that type (a) and type (b) herding can be induced not only by public information represented by M , but also by private information. However, we will discard the latter possibility on the following grounds: Although private information might cause this type of herding *among* a particular type of banks, it is improbable that such a relationship can be found *between* different types of banks. Furthermore, it is also improbable that herding based on private information that is different from public one had been consistently observed for twenty years. Note also that it is possibly the case that different types of herding are detected simultaneously.

We will use different macroeconomic variables in each analysis, of which detail is to be explained below. We will also use realized values of these variables and take natural logarithms of all the stock variables.²³

²²Although negatively significant estimates may also be interesting to pursue, we don't focus them, since they are out of our current interest. It should be noted that incorporation of the two lagged dummy variables explained above reduced the number of negatively significant estimates.

²³One might wonder if we should use *expected* rather than *realized* values of these variables, since the former is more suitable in representing banks' prospects. However, estimation results were unchanged even if we use the former.

Estimation period In addition to the estimations using the data for the full sample period, we also conduct estimations by dividing the sample into two sub-periods. They are the 1980s (from 1980 to 1989) and the 1990s (from 1990 to 2000). The aim of this division is to control the structural changes in Japan such as financial liberalization, disintermediation, and the asset bubble.²⁴

Types of banks We will not investigate herding between all the combinations of bank types. Since there has been the regulation on the segregation of business areas of financial industries in Japan, it is hard to expect the existence of herding between some types of banks whose borrowers are unlikely to overlap. For example, it is improbable to find herding between second regional banks and long-term credit banks. We will therefore focus mainly on the causality in which city banks are involved, since their scope of business is broader and likely to overlap with that of other types of banks.

It is worth noting here about so-called the "Cowbell" effect. Higano[12] claims that there had been an inducement effect in loans made by the Japan Development Bank (JDB), a government financial institution. According to Higano[12], loans made by JDB had put out two signals. The first is that the borrower is a good borrower, since the borrower had already gotten through monitoring process by JDB. The second signal is that the borrower might be able to get a favorable policy treatment, since JDB loans had been made based on policy needs. These signals might induce other banks to lend to those borrowers who had already obtained loans from JDB. This is so-called the Cowbell effect.²⁵

No pure Cowbell effect can be detected in the present analysis, since loans made by government financial institutions are not included in the sample. However, a Cowbell-*like* effect may be detected concerning loans made by long-term credit or trust banks. Although they are private banks, these banks had been providing long-term funds to those borrowers who were important in the post World War II development in Japan. It is highly possible that they had played a role similar to JDB. Amongst others, the Industrial Bank of Japan, which had been a government financial institution until 1950 and became one of the long-term credit banks afterwards, could have played the same role as JDB.²⁶ Either type (b) or (c) herding with long-term credit or trust banks as a leader can be interpreted as this "Cowbell-like" effect.

²⁴See Section 3.2.

²⁵Note that the Cowbell effect originally defined by Higano[12] refers only to the effect through the first signal. However, the word is often used to indicate the effects through both signals. We are following the latter approach.

²⁶See Packer[21] as a support of this view.

Finally we should note that we will use the sum of loans outstanding of regional and second regional banks and will not conduct separate analysis of them. This is because their scale and scope of operation have been similar on average. Indeed, separate analysis between city and regional banks and those between city and second regional banks has yielded similar results. In the remaining part of the present paper, the term "regional banks" refers to the union of regional and second regional banks. In summary, herding to be investigated are that between city and regional banks, that between city and long-term credit banks, and that between city and trust banks.

Industry classification As for the industry classification, we will take two approaches. First, we will use the data of total loans outstanding, paying no attention to industry classification. Herding should be found by this analysis if some type of banks had been determining total loans outstanding by referring to other type.

There is a fact that may support this type of strategy. In Japan, there had been the "window guidance". Each bank voluntarily submitted a future plan of total loans outstanding every quarter and limited the increase in loans as planned.²⁷ There is a possibility that bank managers might have made the plans drawing upon the plans of other banks' managers. Furthermore, although it was superficially a voluntary plan or a moral suasion, there is a possibility that this plan had worked as an implicit measure of the Bank of Japan to control the level of the total loans outstanding of all the banks.²⁸ If these suppositions are correct, herding should be found by this analysis of the total loans outstanding.

Macroeconomic variables to be used in this analysis are as follows: real GDP, collateralized overnight call rate, TOPIX, plant and equipment investment for all industries, and transactions value of Tokyo Stock Exchange.

On the other hand, based on the historical facts observed in Section 3.2, loans to traditional and emerging industries might have different tendency to herd. In addition to the estimation using the total loans outstanding, therefore, we will conduct three different estimations using loans outstanding of traditional, of emerging, and of other industries.

Macroeconomic variables to be used in the analysis for traditional industries are real GDP, collateralized overnight call rate, Large Stock Index of TOPIX (transformed from monthly data), plant and equipment invest-

²⁷See Takahashi[25] for more details.

²⁸In fact, before 1981 the plan was set not by each bank but by the Bank of Japan itself. After 1982, the guidance was reformed to take a form of a voluntary submission of the plan by individual banks. The regulation was completely lifted in 1991.

ment by manufacturing industries, and transactions value of Tokyo Stock Exchange. Those for emerging or other industries are real GDP, collateralized overnight call rate, Small Stock Index of TOPIX (transformed from monthly data), plant and equipment investment by non-manufacturing industries, and transactions value of Tokyo Stock Exchange.

4 Results and Interpretations

4.1 Herding between city and regional banks

In the beginning, we examine whether herd behavior between city and regional banks exists or not in the determination of *total* loans outstanding. The estimation results are shown in Panel A of Table 1. This panel consists of three parts, each of which represents the results for one of the three sample periods. The upper line in each part represents the results without macroeconomic variables, while the lower line represents those with macroeconomic variables. Figures in the " $X \leftarrow Y$ " (" $Y \leftarrow X$ ") columns demonstrate the results of the estimation with X and Y (Y and X) being the dependent and explanatory variables, respectively. The upper figures, e.g. 0.088 (-0.015), are the estimated sum of the coefficients for the explanatory variables Y (X), while the lower figures, e.g. 4% (69%), are respective p-values. Figures in the " $X \leftarrow M$ " or " $Y \leftarrow M$ " columns represent the F-values of the macroeconomic variables and respective p-values. Figures in the "Lag" and "AIC" columns are the lengths of lags and AIC statistics, respectively. In Table 1, X is the loans outstanding by city banks, while Y is by regional banks.

The estimates show the extent to which the total amount of loans outstanding had been adjusted. Since we are taking the natural logarithms of all the stock variables, the figures represent the percentage change caused by one percent increase in explanatory variables. For example, the estimate of $X \leftarrow Y$ in the 1980s, 0.088, implies that regional banks' one percent increase in the total loans outstanding leads to 0.088 percent increase in that of city banks. Table 2 shows that the average quarterly rate of increase in the total loans outstanding for city and regional banks are 2.31 and 1.99 percent, respectively. Thus, the estimate 0.088 implies that about 7.5 ($= (1.99 \times 0.088) / 2.31$) percent of city banks' new loans in one quarter were due to herding.

The main results are as follows. For two sub-sample periods, $X \leftarrow Y$ is positively significant at the 5% level only in the 1980s. This implies the causality from regional banks to city banks. For the full sample period (1980-2000), herding in the opposite direction is significant.

The results from the estimation with macroeconomic variables are shown in the lower line of Panel A. It is important to see that the detected causality is weakened. Especially, p-value of the causality of $X \leftarrow Y$ in the 1980s dropped out of a 5% significant level and instead $Y \leftarrow M$ is significant at the 5% level. This implies that the causality of $X \leftarrow Y$ in the 1980s is not robust and not reliable. In contrast, causality in the full sample period disappeared and the macroeconomic variables are significant for both X and Y . This could serve as evidence of type (a) herding in the determination of the total loans outstanding for the entire period. In summary, accidental herding for the total loans outstanding can be found as overall phenomena.²⁹

We then proceed to the results by each industry classification, which are shown in Panel B, of which structure is the same as Panel A except that it has the results for each industry classification. For the results without macroeconomic variables, $Y \leftarrow X$ for emerging industries was significant at the 5% level in the 1980s and in the full sample period. The opposite relationship is found in the 1990s. For loans to traditional industry, $X \leftarrow Y$ is found in the 1980s. It is interesting to find the relationship mainly in the 1980s, in which disintermediation was severe.

Looking at the lower lines of each classification, we can see that the causality detected for emerging industries in the 1980s and the full sample period is still significant even with the inclusion of the macroeconomic variables. Results in the 1980s can be considered as evidence of type (b) herding, since the macroeconomic variables affect X only. The result implies that 13.7 ($= (0.063 \times 4.1) / 1.88$) percent of regional banks' new loans were due to herding. For the full sample period, the macroeconomic variables had significant effects both on X and Y . Since $Y \leftarrow X$ is still significant, this implies that herding in the full sample period could be of both type (a) and type (b). In this case, 17.4 ($= (0.073 \times 2.36) / 0.99$) percent of regional banks' new loans might have been due to herding. Note that the former result for the 1980s is less suffering from problems caused by structural changes, while the latter result is derived from a larger number of samples.³⁰ Finally, the opposite direction causality in the 1980s for traditional industries can be interpreted as evidence of both type (a) and type (b) herding. We can see that 22.1 ($= (0.282 \times 0.87) / 1.11$) percent of city banks' new loans were due to herding.

Other interesting result to note is that no relevant causality is found for other industries. It is also worthwhile to note that the macroeconomic

²⁹In the full sample period, causality of $X \leftarrow Y$ was detected only when the macroeconomic variables were incorporated. This type of result is unreliable and difficult to interpret.

³⁰Causality of $X \leftarrow Y$ for emerging industries in the 1990s is not robust and unreliable because it disappeared by incorporating the macroeconomic variables.

variables are irrelevant for city banks in the 1990s.³¹

Comprehensively judging from the results so far, we should conclude that herding is observed mainly in the 1980s. With respect to loans for emerging industries the causality is from city to regional banks, while it is the opposite direction one with respect to traditional industries. They are most consistent with type (b) herding. This implies that regional banks had been following city banks in increasing loans to emerging industries, while the opposite relationship had been present in loans to traditional industries.

4.2 Herding between city and long-term credit banks

The results of herding between city and long-term credit banks are shown in Table 3. In this table, loans outstanding by city banks is represented by X , while that of long-term credit banks is by Y .

With respect to the total loans outstanding, the first line of Panel A shows the causality from long-term credit banks to city banks ($X \leftarrow Y$) for both sub-sample periods. In the 1980s, the causality in the opposite direction is found as well.

Looking at the second line of Panel A, mutual-direction causality for the total loans outstanding in the 1980s represents the possibility of type (c) herding. The figures show that 33.4 (63.9) percent of city (long-term credit) banks' new loans were due to herding.³² This implies that herding is observed only in the 1980s and it is not accidental. The result for the full sample period shows no evidence of herding. This may imply that the significant structural change has taken place across the two decades.

For emerging and other industries, Panel B demonstrates the causality from long-term credit banks to city banks in each sub-sample period except for the former industries in the 1990s. The results are clearer than those between city and regional banks. It is interesting to see that no relationship was still found for traditional industries.

The results are almost unchanged even if the macroeconomic variables are incorporated. Judging from the significance of the macroeconomic variables, emerging industries might reveal both type (a) and type (b) herding in the 1980s. About 11.6 percent of city banks' new loans might have been due to herding.³³ For other industries, there could have been herding of type (c)

³¹This result can be reinforced by the estimation results in the following subsections.

³²The causality from long-term credit banks to city banks in the 1990s is unreliable and will not be interpreted since it disappeared by incorporating the macroeconomic variables.

³³For emerging industries, causality of $X \leftarrow Y$ for emerging industries in the full-sample period and that of $Y \leftarrow X$ in the 1990s are difficult to interpret since no causality was detected without the macroeconomic variables.

and of type (b) in the 1980s and 1990s, respectively. All these results are also consistent with the story of the "Cowbell-like" effect of loans made by private long-term credit banks. Note that the macroeconomic variables had significant effects especially in the 1990s.

Summarizing the results, the causality between city banks' and long-term credit banks' loans has been found mainly in the 1980s. The causality is in mutual ways and shows the possibility of type (c) herding with respect to the total loans outstanding. With respect to loans for emerging and other industries, causality is from long-term credit banks to city banks. The former is consistent with type (a) and (b) herding and the latter with type (c) herding. These results are also consistent with the story of the Cowbell-like effect. It is also interesting that no evidence of herding has been observed with respect to loans to traditional industries.

4.3 Herding between city and trust banks

Finally, the results of herding between city and trust banks are shown in Table 4. Loans outstanding by trust banks is represented by Y and those by city banks is by X .³⁴

With respect to the total loans outstanding, the causality from trust to city banks is found only in the 1990s. This makes a clear contrast to the results in the former two subsections, in which significant relationships were most frequently observed in the 1980s. The second line of Panel B could serve as evidence of the existence of type (c) herding. This may reflect recent strengthening of ties between city and trust banks.

Results for each industry classification reveal contrasting results. The results in Panel B imply the existence of causality from trust to city banks in the 1980s rather than in the 1990s. This result is consistent with those in the former two subsections. This means that city banks had made different decision in *how much to lend* and *how to distribute it*.

Consistency is further strengthened in each lower line. First, no herding was found at all for traditional industries. Second, for emerging industries, the result in the 1980s shows the possibility of type (b) herding (12.4%). Finally, results for other industries show some evidence for both type (a) and type (b) herding in the 1980s (61.5%).

In summary, the causality from trust banks to city banks has been observed. With respect to the total loans outstanding, it is observed in the 1990s. Results by each industry classification show the same causality only

³⁴In this table, we obtained a larger number of negatively significant estimates than in Table 1 and Table 3. They could not be controlled technically.

with respect to loans for emerging and other industries and only in the 1980s. Most of the results are consistent with type (b) herding. They are also consistent with the story of the Cowbell-like effect.

5 Conclusion

In this paper, we have examined whether herd behavior exists or not between different types of Japanese banks. Although the existence of herding has long been pointed out, there has been almost no study that formally investigates it. Using data on loans outstanding by industry and by type of banks from 1980 to 2000, we conducted the first fact-finding analysis on herd behavior in the Japanese loan market.

We have obtained some support for the conventional view that Japanese banks had followed herd behavior. The results show the causality from city banks to regional banks, from long-term credit banks to city banks, and from trust banks to city banks. It is interesting that these relationships are more likely to be found in loans to emerging and other industries, in the 1980s, and in the form consistent with the story of "inference from other banks". These findings are consistent with historical events in Japan: In the 1980s, financial liberalization in Japan prompted disintermediation. Japanese banks were in urgent need to find a new customer base and had increased loans to emerging industries. In such a situation, it is probable that uninformed banks tried to get new customers by inferring from informed banks. Furthermore, results for long-term credit banks and city banks, and those for trust banks and city banks are also consistent with the story of the Cowbell-like effect in which these banks had served as a leader in making loans.

As a first study on herd behavior among Japanese banks, sufficient amount of new evidence could be obtained in the present paper. Because the analysis of the present paper is based on semi-macro data, however, it is difficult to conduct more detailed analysis. Among others, more precise identification of the cause of herding is necessary. Herding *among* each type of banks is also an interesting topic to examine. Further studies are necessary to clarify the nature of bank behavior in Japan.

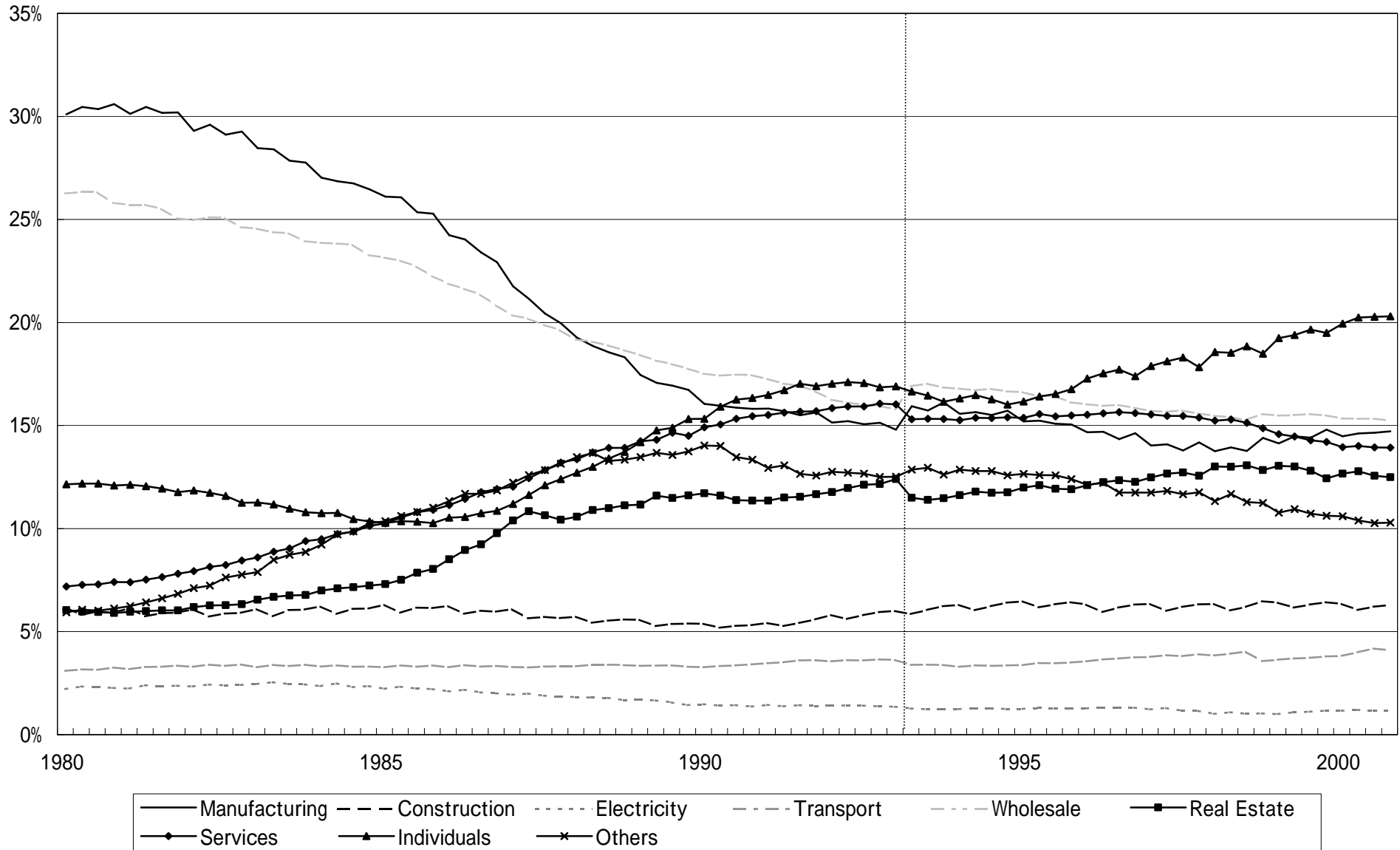
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Figure 1 Ratios of loans outstanding for each industry to total loans outstanding



Source: Financial and Economic Statistics Monthly (the Bank of Japan)

Table 1 Herding between city and regional banks

A) Estimation for total loan outstanding

	1980-1989						1990-2000						1980-2000											
	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC
All	2	0.088 4%		-135	2	-0.015 69%		-129	2	-0.087 23%		-127	1	0.084 24%		-145	3	-0.045 28%		-248	1	0.072 1%		-265
	2	0.123 6%	1.984 11%	-136	2	-0.171 7%	3.174 2%	-133	1	-0.229 20%	2.185 8%	-126	1	-0.042 69%	2.127 8%	-146	2	0.128 2%	11.308 0%	-263	1	0.071 11%	3.224 1%	-269

B) Estimation for loans by each industry classification

	1980-1989						1990-2000						1980-2000											
	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC
Traditionals	3	0.355 0%		-121	2	-0.338 0%		-123	2	-0.200 1%		-120	1	0.070 10%		-131	3	-0.021 44%		-238	2	-0.007 77%		-253
	2	0.282 3%	3.916 0%	-125	2	-0.494 0%	3.218 2%	-127	2	-0.351 7%	1.139 36%	-120	1	-0.083 42%	2.614 4%	-134	2	0.089 26%	2.003 8%	-236	2	0.014 81%	1.144 34%	-252
Emergings	2	0.018 72%		-118	1	0.057 0%		-140	1	0.094 3%		-145	1	-0.001 97%		-160	3	0.005 88%		-250	3	0.060 0%		-285
	2	-0.042 66%	2.526 5%	-121	1	0.063 3%	1.129 36%	-139	1	0.056 66%	0.966 45%	-143	1	-0.020 78%	2.678 4%	-162	3	-0.091 15%	3.635 0%	-255	1	0.073 0%	9.808 0%	-295
Others	1	0.041 58%		-82	1	-0.064 19%		-92	2	-0.001 98%		-82	2	0.131 12%		-99	2	-0.065 11%		-167	1	0.074 7%		-163
	1	0.104 37%	1.182 34%	-81	1	-0.062 31%	1.014 42%	-91	4	0.384 28%	2.128 10%	-83	1	-0.075 53%	3.884 0%	-100	2	-0.006 91%	2.903 1%	-170	1	0.002 95%	3.724 0%	-168

Remarks: X: city banks, Y: regional banks, M: macro variables. Columns "X<-Y" ("Y<-X") are to show the results of VAR estimation in which X and Y (Y and X) are explained and explanatory variables, respectively. Figures in these columns are the sum of the coefficients of the lagged explanatory variables and respective p-values. Figures in "X<-M" and "Y<-M" columns are F-values and p-values of the null hypothesis that all the macroeconomic variables are zero. The lengths of lags of explanatory variables determined by AIC criteria are represented in "Lag" columns and values of AIC statistics are in the "AIC" columns.

Table 2 Rate of increase in loans outstanding

A) Rate of increase in total loan outstanding

		1980-1989	1990-2000	1980-2000
All	city banks	2.31	0.53	1.40
	regional banks	1.99	0.69	1.34
	long-term credit banks	2.38	-0.79	0.77
	trust banks	2.14	-0.33	0.87

B) Rate of increase in loans by each industry classification

		1980-1989	1990-2000	1980-2000
Traditionals	city banks	1.11	0.33	0.71
	regional banks	0.87	1.33	0.45
	long-term credit banks	0.78	-0.29	0.25
	trust banks	0.25	0.21	0.24
Emergings	city banks	4.10	0.74	2.36
	regional banks	1.88	2.81	0.99
	long-term credit banks	3.73	-0.97	1.34
	trust banks	2.82	-0.26	1.25
Others	city banks	3.92	0.35	2.07
	regional banks	1.84	3.87	-0.31
	long-term credit banks	4.75	-1.36	1.60
	trust banks	5.37	-1.18	1.67

Table 3 Herding between city and long-term credit banks

A) Estimation for total loan outstanding

	1980-1989						1990-2000						1980-2000											
	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC
All	1	0.291 4%		-135	1	0.642 0%		-122	2	0.053 0%		-132	4	-0.363 25%		-104	3	-0.018 41%		-249	4	-0.235 0%		-216
	1	0.324 3%	1.394 25%	-134	1	0.658 0%	1.439 24%	-122	2	0.028 44%	0.943 46%	-130	4	-0.305 50%	2.652 5%	-110	2	-0.007 76%	10.880 0%	-260	4	-0.140 15%	4.437 0%	-224

B) Estimation for loans by each industry classification

	1980-1989						1990-2000						1980-2000											
	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC
Traditionals	1	0.058 47%		-118	1	0.038 45%		-133	2	-0.064 5%		-119	3	0.410 0%		-103	3	-0.051 4%		-238	2	-0.042 13%		-213
	2	0.021 88%	5.104 0%	-122	1	-0.014 80%	3.264 1%	-116	2	-0.079 28%	0.897 49%	-117	3	0.299 23%	1.990 12%	-105	2	-0.077 7%	1.811 12%	-238	2	-0.024 61%	3.35 0%	-217
Emergings	3	0.105 0%		-118	1	-0.074 2%		-111	1	-0.0008 92%		-142	4	-0.455 1%		-88	3	0.022 15%		-254	2	-0.067 4%		-186
	1	0.127 0%	2.916 3%	-120	1	-0.073 16%	2.676 4%	-114	1	0.019 33%	2.142 8%	-144	1	1.085 0%	4.716 0%	-91	1	0.059 0%	29.265 0%	-261	1	0.003 96%	2.477 4%	-186
Others	1	0.548 0%		-89	1	0.163 32%		-91	2	0.183 0%		-89	1	-0.114 44%		-86	3	-0.018 68%		-174	3	0.023 73%		-171
	1	0.731 0%	3.606 1%	-93	1	0.145 40%	1.498 22%	-91	2	0.196 2%	0.860 52%	-87	1	-0.041 80%	2.799 3%	-89	2	0.080 17%	4.036 0%	-172	2	0.027 70%	7.433 0%	-180

Remarks: X: city banks, Y: long-term credit banks. The other remarks are the same as those for Table 1.

Table 4 Herding between city and trust banks

A) Estimation for total loan outstanding

	1980-1989						1990-2000						1980-2000											
	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC
All	1	0.106		-134	1	-0.017		-122	2	0.066		-129	1	-0.387		-130	3	0.003		-247	3	-0.021		-252
		8%				83%				3%				0%				90%				39%		
All	4	-0.007	2.888	-136	1	0.135	1.821	-123	2	0.163	1.255	-129	1	-0.707	5.439	-139	2	-0.033	9.668	-258	1	0.018	3.493	-256
		93%	4%			50%	14%			2%	31%			0%	0%			35%	0%			74%	0%	

B) Estimation for loans by each industry classification

	1980-1989						1990-2000						1980-2000											
	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC	Lag	X<-Y	X<-M	AIC	Lag	Y<-X	Y<-M	AIC
Traditionals	1	0.125		-121	1	-0.070		-131	2	-0.099		-117	1	0.010		-118	3	0.004		-235	3	-0.010		-235
		1%				0%				10%				88%				90%				60%		
Traditionals	2	0.002	1.984	-121	1	0.205	3.673	-136	2	0.003	0.908	-115	1	-0.351	2.992	-122	2	-0.073	3.390	-235	1	0.024	4.931	-243
		99%	11%			8%	1%			97%	49%			3%	2%			29%	0%			58%	0%	
Emergings	1	0.185		-129	3	-0.039		-119	1	0.006		-141	1	-0.207		-123	3	0.017		-250	3	-0.013		-238
		0%				33%				69%				0%				44%				50%		
Emergings	1	0.180	1.125	-127	1	-0.320	6.330	-121	1	0.117	3.742	-147	1	-0.488	1.556	-124	1	0.135	29.199	-272	1	-0.186	3.778	-241
		0%	37%			0%	0%			2%	0%			3%	20%			0%	0%			0%	0%	
Others	1	0.220		-84	2	0.149		-89	2	0.100		-83	3	0.070		-89	2	0.045		-170	3	0.023		-185
		4%				28%				7%				68%				26%				62%		
Others	1	0.449	4.316	-90	1	-0.055	4.329	-93	1	0.201	1.261	-83	3	-0.467	2.437	-94	2	0.065	2.297	-171	3	0.160	2.440	-188
		0%	0%			68%	0%			9%	30%			8%	7%			37%	5%			4%	4%	

Remarks: X: city banks, Y: trust banks. The other remarks are the same as those for Table 1.