Are Foreign Banks in China Homogenous? : Classification of their Business Patterns

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Abstract

This study investigates the differences in the business patterns of foreign banks in China. Most previous studies examined the Chinese banking sector in the light of bank efficiency. This study sheds new light on foreign banks' activities. We investigate 30 foreign banks in China using detailed financial data collected in 2016. This investigation uses non-hierarchical X-means clustering, as this method automatically presents an optimal number of clusters and sorts the foreign banks into their appropriate clusters. The X-means clustering method indicates three business patterns among foreign banks. It also characterizes respective clusters and demonstrates that several banks are oriented toward localization strategies. Other banks focus on security investments and the rest depend on both interbank loans and loans including corporate loans.

1. Introduction

Ten years have passed since the full-fledged entry of foreign banks into China. Restriction on Renminbi business by foreign banks was fully abolished by the end of 2006. This opened up the banking sector further, after it had started to open up following China's accession to the World Trade Organization (WTO) in 2001. This regulatory change meant that competitive conditions for foreign banks became equal to those for local banks. However, full "opening-up" is only allowed to foreign banks that are incorporated locally. Based on this incentive, foreign banks have established locally incorporated subsidiaries to get a foothold in China. Over 10 years have elapsed since the first entry of locally incorporated subsidiaries of foreign banks. At present, over 30 foreign banks operate in the form of locally-incorporated banks.

Active entries by foreign banks have attracted academic researchers' interests, and exhaustive studies on the Chinese banking sector have been published. A majority of these studies pays attention to the efficiency of the banks. One group of previous studies computes the efficiency by types of banks: state-owned banks, joint stock banks, and city commercial banks. The other group compares efficiency before and after events, such as regulatory changes and changes in ownership structure. In this way, previous studies examined the changes in the Chinese banking sector caused by foreign banks' entry.

In contrast to the above-mentioned studies that have interests in the overall banking sector, this study focuses on foreign banks' activities and provide wide view of competition among foreign banks. Previous studies did not demonstrate business patterns of foreign banks because the interests of those studies were limited to efficiency. This study tries to present a competitive situation from a broader perspective and contributes to the research field of multinational banking.

This study aims to extract business patterns and present competitive positions of respective foreign banks in the Chinese market. We use detailed financial data, collected in 2016 of 30 foreign banks. This investigation uses non-hierarchical X-means clustering, as this method automatically presents an optimal number of clusters and sorts the foreign banks into their appropriate clusters.

The remainder of this paper is organized as follows. The next section briefly describes the recent development of foreign banks' activities in China. Section 3 surveys the literature regarding the Chinese banking sector from the viewpoint of efficiency. Section 4 explains the methodology (i.e., X-means clustering). Section 5 presents research findings and the interpretation of these results. Lastly, in Section 6, we summarize the investigation results, and explain the meaning of the results for future studies on multinational banking.

2. Foreign Banks' Entry
2.1. Regulatory Change

China entered into the WTO in December 2001, and committed to opening up its banking sector to foreign banks over the next five years. The process of gradual deregulation was completed in December 2016. Supervisions on foreign banks were conducted under the Regulations of the PRC on Administration of Foreign-funded Banks promulgated by the State Council and administrative instructions promulgated by the China Banking Regulatory Commission. These regulations have two essential points. The first point is that competitive conditions for foreign banks become the same as local banks. The restrictions on Renminbi business by foreign banks, which were restricted to 25 cities, were lifted. Any foreign bank can conduct Renminbi business throughout China by acquiring a banking license. Moreover, the restriction on the scope of customers was also lifted and foreign banks can conduct financial transactions with Chinese retail customers. The lifting of these restrictions enabled foreign banks to enter into the retail banking business, which is expected to have a high growth rate.

Foreign banks enjoy only merits and are exempted from deregulation. They are permitted to conduct full-fledged business, as local banks. On the other hand, an identical standard of supervisory regulations is applied to foreign banks. The minimum capitalization is raised from 30 million yuan to 1 billion yuan. This level of capitalization is equal to the standard applied to local banks. This steep increase of capital requirement may be an aim to stabilize the banking sector. The other demerit is the tax rate. Taxation on foreign banks was given preferential treatment previously, while business restrictions existed. The tax rate for local banks was 33% and that for foreign banks was 15%. Tax rate for both local and foreign banks has been made uniform to create a level playing field.

The second essential point of new supervisory regulation is the complete lifting of the ban on Renminbi business by locally incorporated subsidiaries of foreign banks. The 2006 annual report of China Banking Regulatory Commission included a policy where the regulatory authority recommended foreign banks, which have several offices in China, to set up locally incorporated banks and receive deposits on a significant scale and aim to expand their retail Renminbi business.

Regulations of the PRC on Administration of Foreign-funded Banks created an incentive mechanism that forces foreign banks to establish locally incorporated subsidiaries. If a foreign bank make an entry in the form of a branch, deposit taking is limited to fixed deposits of over 1 million yuan and the issuance of credit cards is prohibited. We can interpret this regulation as a policy that grants national treatment to locally incorporated banks only and locks out branches of foreign banks. Therefore, foreign banks switched from opening branches to opening locally incorporated banks because many of them showed considerable interest in retail business.

Four banks, such as HSBC, Standard Chartered Bank, Citibank, and Bank of East Asia got a head start in localizing their offices. These banks opened their businesses in the form of locally incorporated banks in April 2007. All of the four banks have a high profile in China and fall into a category among foreign banks with the densest network of offices. The second round of localization occurred in June 2007 and Mizuho Corporate Bank entered its name along with DBS, Hang Seng Bank, and Wing Hang Bank. As for Japanese banks, The Bank of Mitsubishi-Tokyo UFJ and Sumitomo Mitsui Banking Corporation established their locally incorporated banks in June 2007 and April 2009, respectively. Therefore, all of the three Japanese megabanks secured a foothold as locally incorporated banks.

Table 1 demonstrates the ranking of foreign banks in terms of total assets in China. The large presence of UK banks is attributed to the historical background. HSBC was originally established in Hong Kong in 1865 as Hong Kong and Shanghai Banking Company, and shortly thereafter, started business in Shanghai. It conducted overseas remittance and trade finance between the British Empire and its colonies, and became the largest bank in the Far East in the early days of twentieth century. However, it withdrew from the Chinese mainland by closing its branches after the formation of People's Republic of China. HSBC continued to play the role of a central bank in Hong Kong until 1993, when the Hong Kong Monetary Authority took office. Standard Chartered Bank is one of the issuing banks in Hong Kong along with HSBC. As for its relationship with China, one of its predecessors, Standard Bank, opened a branch in Shanghai in 1858. In those days, it aggressively developed trade finance involving with trilateral trade among India, China, and the UK. Bank of East Asia was established in Hong Kong in 1918, and is the largest bank of Chinese origin. It has already started branch establishments since the 1990s.

Table-1. List of foreign banks in China (Unit: million CNY)

Bank Name	Total Asset	Nationality	Bank Name	Total Asset	Nationality
HSBC	421,713	UK	Shinhan Bank	33,597	South Korea
Bank of East Asia	212,864	Hong Kong	Woori Bank	26,749	South Korea
Standard Chartered Bank	196,088	UK	Industrial Bank of Korea	19,667	South Korea
Citibank	173,050	USA	Societe Generale	17,149	France
Bank of Tokyo-Mitsubishi UFJ	164,736	Japan	Bangkok Bank	15,607	Thailand
Nanyang Commercial Bank	121,596	Hong Kong	Credit Agricole CIB	14,495	France
Mizuho Bank	108,496	Japan	Kookmin Bank	10,507	South Korea
Sumitomo Mitsui Banking Corporation	105,148	Japan	Metropolitan Bank	7,213	Philippines
DBS Bank	96,685	Singapore	BNP Paribas	5,825	France
Hang Seng Bank	89,005	Hong Kong	Bank SinoPac	5,484	Taiwan
Deutsche Bank	70,170	German	E.SUN Bank	4,807	Taiwan
Fubon Bank	68,154	Taiwan	UBS	2,838	Swiss
OCBC Wing Hang Bank	53,018	Hong Kong	Morgan Stanley Bank	2,644	USA
United Overseas Bank	52,386	Singapore	Bank of Montreal	1,215	Canada
JPMorgan Chase Bank	49,692	USA	CITIC Bank International	N.A.	Hong Kong
Australia and New Zealand Bank	46,997	Australia	Dah Sing Bank	N.A.	Hong Kong
Hana Bank	45,755	South Korea	Kasikorn Bank	N.A.	Thailand

Source: Website of China Banking Regulatory Commission
Note: This list excludes Sino-foreign joint venture bank.

As for the mother countries of foreign banks, Hong Kong is in the top position in terms of bank numbers. Six of the foreign banks come from Hong Kong. The second is South Korea from which five banks come. The third is jointly occupied by Japan and Taiwan, from which three foreign banks come. These top three countries have economical and geographical closeness with China.

2.2. Differences in Business Activities

We can observe differences in business patterns among foreign banks from news and media reports. Business classification of multinational banking proposed by Grubel (1977) is useful for our investigation. Multinational banking comprises three categories of business. The first is multinational service business. Banks advance overseas to correspond to globalization of sectors such as trade and foreign direct investment. These banks supply to the demands of financial services from home country companies in host countries. This category includes trade finance, foreign exchange business, and provision of working capital. The second category is multinational wholesale business. Banks in developed countries finance funds from Euro-currency markets and extend loans to newly industrialized countries in the form of syndicated loans. Large-scale international financial intermediation rapidly developed since the latter half of the 1960s and attracted significant interest from the banking industry as did different businesses from traditional international finance, such as trade finance. The third is multinational retail business, which has become prominent since the 1990s. Foreign banks operate retail banking such as mortgage loan and credit card businesses by utilizing the management technology and marketing know-how they possess.

Business patterns of foreign banks are divided into two groups: groups oriented toward multinational service businesses and groups oriented toward multinational retail businesses. The representatives of the former are Japanese banks. They make deals with mainly Japanese companies and deliver financial services. The core of these services includes deposits, payment and settlement operations, and trade finance. Japanese banks have established a footing by delivering advanced financial services such as forward transactions of foreign exchange, interest rate swaps, foreign exchange swaps and options for Renminbi. According to news reports, Japanese banks focus especially on payment and settlement operations. For example, in 2010, The Bank of Mitsubishi-Tokyo UFJ formed an alliance that specialized in settlement services with Bank of China. The aim of this alliance was to respond to the increasing needs for the strengthening of cash management between a group of companies and for streamlining collection of receivables from local companies. Utilizing the branch network and settlement infrastructure of Bank of China, The Bank of Mitsubishi-Tokyo UFJ was able to cope with the challenge of customer companies. Sumitomo Mitsui Banking Corporation formed an alliance with Industrial and Commercial Bank of China in 2010 and started to construct a system to streamline collection services and strengthen the management of trade receivables for Japanese companies that sell products in Renminbi.

On the other hand, UK banks follow a localization strategy. The UK banks focus on finance for individuals and small-and medium-sized enterprises (SMEs). For example, HSBC is developing the local market with over 7,000 staff. It has a branch network of more than 170 outlets across more than 50 cities. Moreover, HSBC started to support international businesses of customer companies that are located in the

Yangtze Delta and the Pearl River Delta by setting up a specialized team consisting of 150 staff in 2008. This team creates proposals tailored for respective customer companies, based on HSBC's global network and its experience of overseas businesses for SMEs. As for individual finance, in China, HSBC delivers HSBC Premier, which is a type of financial service for individuals. In addition, HSBC has started to provide HSBC Premier for families and delivers financial planning about loans for education, medical care, mortgage, and pension. Private wealth management, targeting customers with over 10 million yuan net worth, started from 2008 in Beijing, Shanghai, and Guangzhou.

Asian banks are also developing the local market. Bank of East Asia (BoEA), which has the second largest number of offices and 4,000 staff, has accelerated the pace of opening branches. BoEA opened two branches and 16 sub-branches only in 2010 and is keen on absorbing deposits to maintain the loan-to-deposit regulation of 75%. It also set up 10, 24 hours-operation self-service outlets, other than the sub-branches to prepare channels of services for individuals. Moreover, BoEA is oriented to a strategy to expand businesses with private asset management and wealth asset management as a driving force. As a part of this policy, the first issuance of credit cards, denominated in Renminbi by foreign banks, started.

According to qualitative information, such as media reports and press releases from banks, it is possible to infer differences in business patterns among foreign banks. This study aims to demonstrate the competitive situation of foreign banks by extracting these differences in an objective manner.

3. Literatures Review

Most of the existing literature about the Chinese banking sector is interested in bank efficiency. We can categorize previous studies regarding Chinese banks' efficiency into three categories in terms of research issues.

The first category investigated bank efficiency depending on bank types. Fu and Hefferson (2007) investigated the cost X-efficiency for the Chinese banking sector from 1985 to 2002 by employing the stochastic frontier approach. One of the objectives was to assess whether different ownership types affect X-efficiency. A two-stage regression model was estimated to identify the significant variables influencing X-efficiency. The results showed that joint stock banks are found to be more X-efficient than state-owned commercial banks on average.

Matthews and Zhang (2010) were also interested in differences in efficiency among bank types. However, their focus was productivity growth. The study considered nationwide banks in China and investigated a sample of city commercial banks for 10 years up to 2010. Using bootstrapped Malmquist indexes, estimates of the total factor productivity growth were constructed. The results demonstrated that efficiency gains were obtained through cost reduction and that technical innovation was associated with greater diversification of revenue, away from interest earnings.

The second category of literature investigated differences in efficiency among ownership structures. Investments to Chinese banks by foreign strategic investors became prominent after accession to WTO in 2001, and this new phenomenon gave rise to the issue whether strategic investment in banks contributed to their efficiency increase.

Berger et al. (2009) analyzed efficiency of Chinese banks from 1994 to 2003. The study computed efficiency scores using a stochastic frontier approach and the scores were regressed to explanatory variables comprising proxies of ownership structure at the second stage. Empirical results suggested that foreign banks were most efficient and that minority foreign ownership was associated with significantly improved efficiency. These results implied several credible mechanisms through which minority foreign owners may increase Chinese banks' efficiency.

Jaing et al. (2009) also investigated the relationship between efficiency and ownership structure. Their paper examined dynamic governance effects on bank efficiency for an 11-year period 1995 and 2005 by employing a stochastic distance function approach. The results showed that foreign acquisition may benefit domestic banks with efficiency gains in the long run, but privatization via initial public offerings appeared to have only some short-term effects.

The third category of existing studies focused on the relationships between efficiency and changes in the competitive environment. Lin et al. (2009) analyzed technical efficiency in China's banking system by comparing large and small city banks as well as pre-WTO and post-WTO accession periods. The study used an unbalanced panel dataset of 63 banks, collected from 1997 to 2006 and also employed the stochastic frontier function approach. The empirical results revealed that the efficiency score was found to have improved significantly after entry into the WTO, as a result of the competition effect. This competition effect was particularly relevant for small city banks.

Fungacova et al. (2013) investigated the relationship between bank competition and efficiency by computing Lerner indices and cost efficiency scores for a sample of Chinese banks over the period 2002-2011. Granger causality tests were performed in a dynamic GMM panel estimator framework to evaluate the direction of causality between them. They observed no increase in bank competition over the period, even though cost efficiency improved.

This study differs from the mainstream of existing literature in two ways. First, the interest of this study is not in overall Chinese banks, but foreign banks in China. Therefore, this study tries to contribute to the research field of multinational banking. Second, this study aims to present the differences in business patterns among foreign banks in contrast to previous studies in which the research angle was limited to bank efficiency. This study investigates business patterns by using a mix of indices to capture financial features of foreign banks.

4. Methodology

We use an analytical method to detect business patterns by the classifying foreign banks. Our method is not confirmatory data analysis, but rather exploratory data analysis, because we cannot establish a type and number of classifications beforehand. Therefore, we use objective criteria to discover a classification method that is difficult to subjectively recognize.

This investigation employs X-means clustering, a type of non-hierarchical clustering. This method can explore an optimal number of clusters and sort regional banks into respective clusters. The cluster analysis technique forms groups of variables with high similarity from a number of samples that comprise several variables. This statistical method defines a distance between samples, and classifies those samples by closeness of distance. Further, cluster analysis is divided into hierarchical and non-hierarchical clustering. The former recognizes respective samples as clusters at the beginning, and merges any sample with its closest sample to form a group that includes all samples. The result is generally demonstrated by a dendrogram, a tree diagram that indicates the hierarchical structure of links between samples.

Non-hierarchical clustering is appropriate for our study, as we do not need to demonstrate the hierarchical structure among samples. K-means clustering is often used as a non-hierarchical clustering method, as it establishes a preliminary number of clusters, k, and divides samples into k clusters. However, we may not obtain the appropriate clusters, depending on our choice of the starting value for the number of clusters, if no experimental information is necessary to establish an optimal number of clusters.

X-means clustering automatically calculates the optimal number of clusters by recursively executing K-means clustering from a starting value of 2. This repeatedly compares Bayesian information criteria (BIC) before and after the division, and continues this division until the information criteria does not further improve. In other words, X-means clustering is an algorithm to automatically determine the optimal number of clusters by using a progressive iteration of K-means clustering and division-stop criteria, including BIC. This differs from K-means clustering (which assigns a cluster number) as the cluster number to be conclusively determined in X-means clustering is indeterminate at the outset. This study employs the following algorithm proposed by Ishioka (2006).[1]

Step 1: We prepare p-dimensional data whose sample size is n.
Step 2: We set a sufficiently small initial number of clusters as k_0 (the default is 2, if not specified).
Step 3: We apply K-means to the sample data with setting $k = k_0$. Divided clusters are named:

$$C_1, C_2, \cdots, C_{k_0}.$$

Step 4: We repeat the procedure from Step 5 to Step 10 in the setting $i = 1, 2, \cdots, k_0$.
Step 5: We apply K-means to cluster C_i in the setting $k = 2$. Divided clusters are named:

$$C_i^{(1)}, C_i^{(2)}.$$

Step 6: We assume a p-dimensional normal distribution for the data $\mathbf{x}_i$ contained in C_i:

$$f(\theta_i; \mathbf{x}) = (2\pi)^{-p/2} |\mathbf{V}_i|^{-1/2} \exp\left[-\frac{1}{2}(\mathbf{x} - \mu_i)^t \mathbf{V}_i^{-1}(\mathbf{x} - \mu_i)\right]$$

Subsequently, we calculate the BIC as follows:

$$\text{BIC} = -2\log L\left(\hat{\theta}_i; \mathbf{x}_i \in C_i\right) + q\log n_i,$$

where $\hat{\theta}_i = \left[\hat{\mu}_i, \hat{\mathbf{V}}_i\right]$ is the maximum likelihood estimate of the p-dimensional normal distribution, μ_i is the p-dimensional mean vector, $\mathbf{V}_i$ is the variance-covariance matrix of $p \times p$ dimension, q is the number of the parameter dimensions, and $q = 2p$ if we ignore the covariance of $\mathbf{V}_i$. If we do not ignore them, $q = p(p + 3)/2$. $\mathbf{x}_i$ is the p-dimensional data contained in C_i and n_i is the number of data contained in C_i. L is the likelihood function and $L(\cdot) = \prod(\cdot)$. We choose to ignore the covariance of $\mathbf{V}_i$.

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[1] This algorithm is already developed as a function of R statistical software. The source code is available at http://www.rd.dnc.ac.jp/~tunenori/xmeans.html.

Step 7: We assume the p-dimensional normal distributions for $C_i^{(1)}, C_i^{(2)}$, and their parameters are defined as $\theta_i^{(1)}, \theta_i^{(2)}$, respectively. This two-division model has the following probability density function:

$$g\left(\theta_i^{(1)}, \theta_i^{(2)}; \mathbf{x}\right) = \alpha_i \left[f(\theta_i^{(1)}, \mathbf{x})\right]^{\delta_i} \left[f(\theta_i^{(2)}, \mathbf{x})\right]^{1-\delta_i},$$

where

$$\delta_i = \begin{cases} 1, \text{ if } \mathbf{x} \text{ is included in } C_i^{(1)} \\ 0, \text{ if } \mathbf{x} \text{ is included in } C_i^{(2)} \end{cases}$$

$\mathbf{x}_i$ is included in either $C_i^{(1)}$ or $C_i^{(2)}$. α_i is a constant that makes this equation a probability density function. We approximate α_i as follows[2]:

$$\alpha_i = 0.5/K(\beta_i),$$

where $K(\cdot)$ is a lower probability of the normal distribution function. β_i stands for a normalized distance between $f(\theta_i^{(1)}, \mathbf{x})$ and $f(\theta_i^{(2)}, \mathbf{x})$, shown by:

$$\beta_i = \sqrt{\frac{\|\mu_1 - \mu_2\|^2}{|\mathbf{V}_1| + |\mathbf{V}_2|}}$$

We calculate the BIC for this model as follows;

$$\text{BIC}' = -2\log L'\left(\hat{\theta}_i'; \mathbf{x}_i \in C_i\right) + q'\log n_i,$$

where $\hat{\theta}_i' = \left[\hat{\theta}_i^{(1)}, \hat{\theta}_i^{(2)}\right]$ is a maximum likelihood estimate of the two p-dimensional normal distributions. The dimension of the number of parameters becomes $q' = 2 \times 2p = 4p$, because there are two parameters of mean and variance for each p variable. L' is the likelihood function which indicates $L'(\cdot) = \prod g(\cdot)$.

Step 8: If $\text{BIC} > \text{BIC}'$, we prefer the two-divided model, and decide to continue the division. We set:

$$C_i \leftarrow C_i^{(1)}.$$

As for $C_i^{(2)}$, we push the p-dimensional data, the cluster centers, the log likelihood, and the BIC on the stack. We return to Step 5.

Step 9: If $\text{BIC} \leq \text{BIC}'$, we prefer not to divide clusters any more, and decide to stop the division of $C_i^{(1)}$. We extract the stacked data, which is stored in Step 8, and set:

$$C_i \leftarrow C_i^{(2)}$$

We return to Step 5. If the stack is empty, we return to Step 10.

Step 10: The two-division procedure for C_i is completed. We renumber the cluster identification such that it becomes unique in C_i.

Step 11: The two-division procedure for initial k_o divided clusters is completed. We renumber all cluster identifications such that they become unique.

Step 12: We note the outputs of the cluster identification, the center of each cluster, the log likelihood of each cluster, and the number of elements in each cluster.

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[2] If obtaining an exact value is required, we can use p-dimensional numerical integration. However, this computation is complicated.

5. Results and Discussion

5.1. Data

We conduct clustering analysis using bank-level financial statement data provided by Bank Focus, a financial database maintained by Bureau Van Dijk. Bank Focus is the largest database for banks' information in the world. Many existing studies such as Fungacova et al. (2013) used this database. Using Bank Focus enables us to conduct our clustering analysis based on micro data of foreign banks.

This study employs annual data of 2016 for 30 foreign banks that are locally incorporated[3] in China. We use a mix of four variables to capture the characteristics of the respective foreign banks. In general, it is very useful to use two variables and draw a scatter plot to show clusters or, in other words, business patterns. However, only two variables are insufficient to capture the features of each foreign bank.

We recognize business patterns of respective foreign banks by focusing on the asset sides of their balance sheets. We expect that major items in the asset side reflect banks' business patterns. For example, the bank that localizes its business by setting up a number of offices, provides a large amount of loans to local businesses. There are some banks, whose major business is security investment and trading. If a bank avoids taking the risk of corporate loans, it invests funds in the interbank market. In addition, there are some banks that possess cash and invest in central bank deposits to avoid risk-taking.

This study calculates the shares of four major asset items out of total assets to recognize business patterns. The four variables are as follows.

Cash & Central bank: This is the share of cash and central bank deposits to total assets.

Loans to bank: Loans to the interbank market is divided by total assets.

Security investment: This is the share of security investments to total assets.

Loans: Loans comprises mortgage loans, consumer loans, corporate loans, and other loans. This variable is also divided by total assets.

We conduct X-means clustering after normalizing these variables to obtain the zero mean and unit variance. This is because a variable with large dispersion strongly affects a classification result if the data values largely differ depending on the variables.

Table-2. Descriptive statistics

	Min	25% point	Median	75% point	Max	Skewness
Cash & Central bank	4.3	9.8	13.1	16.6	35.0	1.7
Loans to bank	6.1	16.0	25.5	39.5	61.7	0.6
Security investment	0.3	5.7	10.6	16.6	75.7	2.9
Loans	0.2	28.3	33.7	41.8	56.0	-0.5

Table 2 presents the descriptive statistics of the four variables. Loans represents the largest share of 33.3% measured as the median among the four variables. This share is smaller than our expected value, because we assumed that the growing China market attracts foreign banks due to increasing demands for corporate, consumer, and mortgage loans. Surprisingly, Loans to bank represents a 25% share, which is larger than that of Security investment. We assumed that Security investment offers promise for abundant profits. However, its share of 10.6% is smaller than that of Cash & Central bank. In summary, foreign banks currently cannot develop their loan businesses as we expected. We find a business structure that interbank loans compensate for the asset investments of foreign banks.

Next, we can examine distributions of these variables through the skewness index. Perfect symmetric distribution presents zero value of skewness. We find large positive values of skewness for Cash & Central bank and Security investment. These figures indicate right-skewed distributions. First, the skewness of Cash & Central bank implies that the bank has a high share of cash and central bank deposits that contribute little to its profits. Second, several banks are extremely dependent on security investments as indicated by the maximum value column in Table 2.

5.2. Empirical Findings

The result presents three clusters and the respective foreign banks are classified as follows:

Category 1: HSBC, Bank of East Asia, Standard Chartered Bank, The Bank of Tokyo Mitsubishi UFJ, Nanyang Commercial Bank, DBS Bank, Hang Seng Bank, OCBC Wing Hang Bank, United Overseas Bank, JPMorgan Chase & Co., ANZ, Hana Bank, Société Générale, Crédit Agricole Corporate and Investment Bank, and Fubon Bank

Category 2: Mizuho Bank, Sumitomo Mitsui Banking Corporation, Shinhan Bank, Woori Bank, Industrial Bank of Korea, Bangkok Bank, Kookmin Bank, Bank of Montreal, Metropolitan Bank, and E. SUN Commercial Bank

Category 3: Citibank, Deutsche Bank, BNP Paribas, UBS, and Morgan Stanley Bank

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[3] The database cannot provide financial data of all foreign banks. Therefore, empirical results about business patterns must be interpreted with care.

Table 3 demonstrates the average of four variables for three clusters to present the respective clusters' characteristics. We find a clear-cut classification of business patterns. The banks of category 1 are characterized as banks pursuing localization strategy. These banks have the largest share of loans among three categories. However, we cannot find a clear feature of these banks regarding their mother countries. Next, the banks of category 2 depend on both Loans to bank and Loans. The share of Loans to bank is the largest among the other categories and this means that these banks prefer to invest in safer assets in China. Their share of Security investment is minimum. Category 2 comprises mainly banks from South Korea and Japan. Lastly, the banks of category 3 comprise the Western banks. Their main business is Security investment as evident from their largest share, 35.1%. Therefore, we are able to present objective differences in business patterns among foreign banks using X-means clustering.

Table-3. Classification results

	Cash & Central bank	Loans to bank	Security investment	Loans	Sample
Category 1	14.2	22.8	11.4	39.7	15
Category 2	9.2	45.4	6.3	33.4	10
Category 3	21.4	12.1	35.1	18.4	5

Note: Figures indicate averages.

6. Conclusion

This study aimed to examine differences in the businesses of foreign banks in China. These differences in the business patterns have an important implication on forecasting success or failure of foreign banks' China businesses. Over 10 years have passed since foreign banks entered China in the form of locally incorporated banks. However, previous studies investigated the China business of foreign banks in light of bank efficiency. They did not highlight differences in the business of foreign banks. Hence, this study tried to classify foreign banks based on business patterns by using X-means clustering.

We can summarize our major findings as follows. First, we find a large difference in the total assets among foreign banks, as demonstrated in Table 1. This suggests there are differences among foreign banks on how they develop their respective China businesses. Second, reviewing descriptive statistics of asset items indicates that foreign banks, on average, have not increased their loan businesses as expected previously. Third, X-means clustering presents clear-cut differences in their business patterns. Some banks are oriented toward localization strategy by providing loans. Other banks focus on security investments. The rest of the banks depend on both loans and loans to banks.

Finally, we must continue to watch future developments in the performance of foreign banks. Several foreign banks are in the early stage of entry into China and they are not operating at full-scale. Moreover, we have not yet answered the question regarding the relationship between business types and bank performance, such as efficiency and profitability. We will revisit the success and failure of foreign banks' entry into China in the near future.

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