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Japanese Banks in the UK Project Finance Market: Observations through Social Network Analysis

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This study investigates the market position of Japanese banks in the UK project finance market. To this end, this study employs social network analysis, which enables us to understand the types of communities existing in the market and the characteristics of the networks constructed by Japanese banks. This study uses the data of the UK project finance transactions conducted in 2014. The main results indicate the existence of three groups in the market. All the Japanese banks belong to the largest group and play a central role in this group. The relationship strength of this group is stronger than those of the other two groups for several indices. The above-mentioned features of the network formed by the Japanese banks strengthen their competitiveness in the market.

JEL Codes: F34, G21, H54

Keywords: Project finance, Japanese bank, Social network analysis

1. Introduction

This paper investigates the market position of Japanese banks in the UK project finance market. Japanese megabanks occupied the top three positions in global project finance ranking for 2014, and their increasing overseas activities attract considerable interest from the banking industry. These megabanks participate in the UK project finance market, their main battlefield for overseas banking business. Specifically, Bank of Tokyo-Mitsubishi UFJ (BTMU) and Sumitomo Mitsui Banking Corporation (SMBC) are ranked first and second, respectively, while Mizuho Bank is ranked sixth. Overseas activities, including cross-border project finance, are very important for megabanks because overseas profits contribute to over 30% of their total profits.

Contrary to this importance, the overseas activities of Japanese megabanks have not been investigated in detail. Currently, project finance league tables are the only indicators of banks' market positions. This information is limited to arranger rankings, and the authors cannot observe detailed behaviors of banks in the market. Hence, this paper employs a method different from those of previous studies and demonstrates the market position of Japanese banks by investigating their behavior.

The rest of this paper is organized as follows. Section 2 discusses previous studies investigating syndicated loans and compares and contrasts those studies with this study. Section 3 introduces the basic concepts of social network analysis and poses two research questions. The first refers to community extraction from the project finance market using the fast greedy algorithm. Second, using centrality indices, this study identifies banks that occupy a central position in their respective communities. Section 4 studies the characteristics of the Japanese banking community using two methods. The

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first compares communities by their network structure indices. The second measures the strength of the syndication network within the respective communities. Finally, Section 5 summarizes the results of our investigation, and explains their implications for future studies.

2. Literature Review

Comparisons with the existing literature underline the contribution of this study. The authors divide the related literature on syndicated loans into three categories. The first type investigates factors affecting decision making, that is, whether a syndicate should be formed or not. Researchers have used the binary choice model, where the explained variable is a dummy variable that takes unity when a syndicate is formed to extend a loan. Dennis and Mullineaux's (2000) paper belongs to the first category. They studied the loan market in the US and examined how information asymmetry and loan terms affect syndicate formation. Using samples from 50 emerging markets Godlewski and Weil (2008) also investigated incentives encouraging the formation of syndicates.

The second category investigates the syndicate structure, primarily the size of the syndicate measured by the number of participating banks. This type of research analyzes the factors explaining the syndicate's structure. This investigation requires the application of a count data model because the number of participating banks is discrete and non-negative. Existing studies have employed the Poisson regression model to deal with count data. Lee and Mullineaux (2004) studied the US loan market by focusing on borrowers' credibility as a factor affecting the syndicate structure. Sufi (2007) also investigated the US loan market and demonstrated the effect of information asymmetry on the syndicate structure.

The third category examines differences in lending behavior by financial institution type. This research often investigates decisions about interest rate spreads to analyze lending behavior. Specifically, interest rate spreads serve as the explained variable in the estimation, and the explanatory variables comprise a dummy representing differences in loan terms and financial institution type. Harjoto, Mullineaux, and Yi (2006) studied 6,080 syndicated loans executed in the US from 1996 to 2003. They examined the differences in decision making pertaining to the interest rate spread between commercial banks and investment banks.

The similarities with and differences among the existing literature highlight the importance of our study in the research field of overseas banking. In terms of the research question being explored, our study falls in the third category because it investigates the differences between the lending behaviors of Japanese megabanks and other banks. Further, this study uses a novel analysis method: social network analysis (SNA). This method enables us to investigate the market structure from the viewpoint of syndicate network formation.

3. Analysis of the UK Project Finance Market Structure

3.1 Identifying Syndicate Groups

This study demonstrates the structure of the UK project finance market using community extraction. In this study, "community" refers to a group that shares common interests in the syndication network. Project finance requires syndicate formation because the loan amounts involved in such cases are generally larger than conventional corporate loans. The authors observe that some types of communities form syndicates repeatedly. Hence, community extraction is an effective method to investigate the market structure in the given context.

The following discussion regarding loan syndication explains the rationale for repeated syndicate formation. Arranger banks start their syndication process after a borrower gives them the mandate to do so. The mandate is a delegation agreement specifying that the borrower entrusts the syndicate formation to the arranger banks. Before awarding a mandate, the borrower might solicit bids from the arrangers. The banks will outline their syndication strategy and qualifications, as well as their view on the way the loan will price in market. The syndication strategy includes several issues such as syndicate size, hold amounts of the arranger, distribution methods, fee structure, appetite of participant banks, and client concern about the relationship banks. Developing the strategy is crucial for obtaining a mandate, and the existence of a community comprising possible arranger banks is rational because such a community facilitates the design of the syndication strategy.

Community extraction is a standard analytic method of SNA. This study first introduces the basic concepts of SNA before explaining community extraction. SNA investigates the market structure by drawing a graph representing relationships among economic agents by nodes and edges. Here, the term “nodes” to the respective banks, and the term “edges” expresses whether a syndication network exists or not. In other words, SNA can be used to understand the characteristics of economic agents and the process associated with the economic phenomena, by recognizing economic agents as nodes and analyzing their relationships as a graph. Furthermore, SNA can visualize relationships among economic agents and allows us to grasp the workings of the network structure.

The graph may be depicted using two expressions depending on the types of economic agents being investigated. A directed graph studies relationships with directional properties, while an undirected graph examines relationships without direction. This study uses the undirected graph because our database provides insufficient information with respect to agent–participant relationships. Furthermore, this study creates a weighted graph on the basis of the number of times a syndicate network is formed. This weighted graph enables us to observe the relationship strengths among banks.

An adjacency matrix is required to illustrate the network structure. The adjacency matrix, sometimes also called the connection matrix, of a simple labeled graph is a matrix with rows and columns labeled by graph nodes with a 1 or 0 in position (v_i, v_j), according to whether v_i and v_j are adjacent or not, respectively. For example, the information about syndication between bank A and bank B is allotted to matrix (a, b). This study represents the relationship strength between the banks in the graph, which is weighted by the number allocated to the syndication. Therefore, the syndication number (weighting) acts as an input for the adjacency matrix. The adjacency matrix is symmetric because this study produces an undirected graph.

This study uses the data obtained from Thomson Reuter’s DealScan, which is the largest database specializing in loan transactions. This database includes project finance transaction information. Thus, this study can ascertain which banks participated in the syndicate. This study investigates 23 transactions comprising 53 tranches conducted in 2014. This study period is appropriate for the investigation because the UK project finance market recovered from the global financial crisis and Japanese banks increased their existence by this year.

Table 1: Results of the community extraction

Group 1	Arranger ranking	Degree	Betweenness	Eigen
Sumitomo Mitsui Banking Corp *	2	13	21.78 (4)	0.97 (2)
Bank of Tokyo-Mitsubishi UFJ *	1	12	4.08 (12)	1 (1)
Credit Agricole	5	9	24.83 (1)	0.55 (3)
KfW-IPEX Bank	15	8	22.77 (3)	0.53 (4)
Lloyds Bank	14	8	4.83 (9)	0.344 (9)
Mizuho Bank *	6	8	4.3 (11)	0.51 (5)
Green Investment Bank	19	7	24.08 (2)	0.26 (11)
Nord LB	22	7	4 (13)	0.49 (6)
Sumitomo Mitsui Trust Bank *	10	7	4.47 (10)	0.33 (10)
Development Bank of Japan *	13	6	9.32 (6)	0.2 (12)
Siemens Bank	24	6	3.06 (14)	0.3471 (8)
Mitsubishi UFJ Trust *	52	4	11.75 (5)	0.107 (14)
Uni Credit	36	4	0 (16)	0.3474 (7)
Bayerische Landesbank	23	3	7.73 (7)	0.105 (15)
Macquarie Bank	47	3	0.25 (15)	0.14 (13)
Overseas Union Bank Malaysia	40	2	5.81 (8)	0.014 (16)
Gravis Capital	49	1	0 (16)	0.01 (17)
Group 2				
BNP Paribas	17	11	5.25 (2)	0.92 (3)
DNB Bank	17	11	5.25 (2)	0.92 (3)
HSBC	7	11	5.25 (2)	1 (1)
Societe Generale	3	11	5.25 (2)	1 (1)
ABN AMRO Bank	28	10	0.68 (6)	0.67 (5)
Bank of America Merrill Lynch	32	10	0.68 (6)	0.67 (5)
Danske Bank	27	10	0.68 (6)	0.67 (5)
Deutsche Bank	33	10	0.68 (6)	0.67 (5)
Skandinaviska Enskilda Banken	26	10	0.68 (6)	0.67 (5)
Spare Banken	29	10	0.68 (6)	0.67 (5)
Swedbank	25	10	0.68 (6)	0.67 (5)
Standard Chartered Bank	21	6	22.68 (1)	0.33 (12)
Barclays	42	2	0 (13)	0.31 (13)
Natixis	41	2	0 (13)	0.31 (13)
Group 3				
Commonwealth Bank of Australi	4	6	1 (2)	0.87 (4)
Scotia Bank	12	6	6 (1)	0.73 (5)
ING Bank	20	4	0 (3)	0.94 (2)
National Australia Bank	18	4	0 (3)	0.89 (3)
Royal Bank of Scotland	9	4	0 (3)	1 (1)
AXA Group	34	3	0 (3)	0.13 (6)
Hastings Capital Partners	35	3	0 (3)	0.13 (6)

Note: Figures in parentheses represent rankings in respective groups. Asterisks denote Japanese banks.

The extraction result shown in Table 1 presents three groups in the UK project finance market. The first group comprises the largest syndication network including 17 banks. Most importantly, the authors note that all the six Japanese banks belong to this group. The second group comprises 14 banks, all of which are major international banks from the UK, Germany, France, and Sweden. The third group is the smallest; only seven banks belong to this group. Considering group separations and arranger rankings, the authors find that the Japanese banks lead in the first group, and Societe Generale and Commonwealth Bank of Australia lead in the second and third group, respectively. As expected, this study observes groups that form syndicates repeatedly.

3.2 Identifying Banks That Play a Central Role

This section identifies the major banks in their respective groups by employing three centrality indices, which is a standard method in SNA. The first index is degree centrality, where the degree represents the number of edges that directly connect to a node. Degree centrality indicates the extent to which a node is connected via direct connections. The larger the value of network degree centrality for each bank, the more central the role played by that bank.

Table 1 presents banks that play a central role in their respective groups. SMBC and BTMU play central roles in the first group in terms of degree centrality. Mizuho Bank and Sumitomo Mitsui Trust Bank are positioned as second-tier banks. This group can be called the “Japanese bank group,” considering their larger degree centralities. Furthermore, degree centrality contrasts major banks with minor banks having lesser edges. Hence, this group clearly demonstrates the core-periphery structure of the network. Next, this study cannot identify which bank plays an important role in the second group from degree centrality, because the top 11 banks have almost the same number of edges. Barclays, Standard Chartered Bank, and Natixis have smaller degree centralities, hence, these banks are positioned in the peripheral part of the network. However, this study cannot find a distinct hierarchical network structure in this group. For the third group, Commonwealth Bank of Australia and Scotia Bank take the central positions as indicated by the degree centrality.

The second index, namely the betweenness index, indicates how well situated a node is in terms of the path. This index is based on a node’s significance in terms of its connections with other nodes. A higher betweenness index value indicates that a given node is more central in terms of connections with the other pairs of nodes. This is the most commonly used centrality measure and is suitable for syndication network analyses. Furthermore, this index identifies banks that bridge different groups.

In the first group, Credit Agricole, Green Investment Bank, and KfW-IPEX Bank have high values of betweenness centrality. The authors interpret this result in that these banks connect Japanese banks to other subgroups. Standard Chartered Bank takes the top position in the second group, indicating that Standard Chartered Bank is the most important node bridging the first and second-tier banks. For the third group, Scotia Bank plays a mediation role in syndicate formation.

The third index, the eigenvector centrality score, corresponds to the values of the first eigenvector of the graph adjacency matrix; this score may, in turn, be interpreted as arising from a reciprocal process in which the centrality of each bank is proportional to the sum of the centralities of those banks to which it is connected. In general, nodes with high eigenvector centralities are connected to many other nodes, which are, in turn, linked to many others.

Table 1 also demonstrates the ranking of the respective groups in terms of eigenvector centrality. For the first group, SMBC, BTMU, Credit Agricole, and KfW-IPEX Bank present high scores, and this result is quite similar to that of degree centrality. These are major banks in terms of degree centrality, and the reason they are ranked high with regard to eigenvector centrality is that these major banks have relationships each other. In the second group, the top four banks, BNP Paribas, DNB Bank, HSBC, and Societe Generale, are ranked high. This result is also similar to that of degree centrality. Meanwhile, the second-tier group with the degree of four demonstrates high eigenvector centrality scores. This marks a characteristic different from the other two groups.

In summary, the authors note that all the Japanese banks belong to one group and that they take major positions in that group.

4. Characteristics of the Japanese Bank Group

4.1 Community Comparisons

This subsection examines the characteristics of the Japanese bank group using the following network structure indices: degree distribution, average path length, density, and transitivity. Table 2 demonstrates the degree distributions for the three groups. The result of the second group draws our attention because it has a feature different from the other two groups. For the second group, the degree centrality scores remain mostly unchanged from the first quartile point to the maximum, indicating that most banks in this group have relationships with each other. Meanwhile, the quartile range of the first group is 4, which happens to be the maximum value among the three groups. For the third group, the authors observe a certain difference between the minimum and maximum. These results indicate the existence of several banks playing central roles.

Table 2: Degree distribution

	Minimum	1st quartile	Median	3rd quartile	Maxmum	Number of banks
Group 1	1	4	7	8	13	16
Group 2	2	10	10	10.75	11	13
Group 3	3	3.5	4	5	6	6

The second index is the average path length and serves as a global index for network structure. The average path length is defined as the average distance between all pairs of nodes in the graph. The first group presents the highest score because this group comprises the largest number of banks. The larger the number of network nodes, the higher the score of this index.

The third index, density, is the ratio of the actual number of edges to the total number of all possible edges. This index takes a value from zero to one. A complete graph takes the value one because all nodes have at least one edge. Meanwhile, an empty graph, which contains no edge, takes the value zero. This index represents whether the network is open or closed. The scores of the second and third groups are higher than that of the first. The high score means that the group is small, and its nodes have similar characteristics. The nodes of such group tend to share reliability and objectives. However, this type of group is not suitable for obtaining new information and resources. Meanwhile, the first group demonstrates a lower score. A low density means that the group is large and comprises diversified nodes, which means that such a group has a higher probability of encountering new loan transactions.

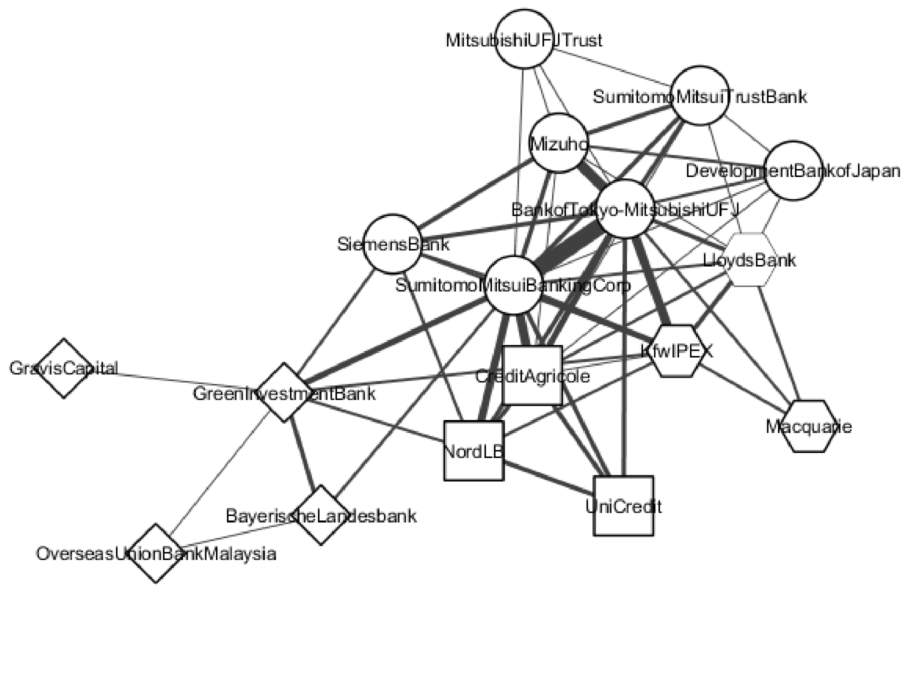
The last index is transitivity, the analyses unit of which is a triad, namely, subgraphs formed by three nodes. Transitivity in a relationship means that when there is a link from i to j, and also from j to h, then a link from i to h also exist. This index represents the degree to which transitive relationships hold as a ratio of transitive triads to potentially transitive traid. The value of this index lies between 0 and 1; it takes 1 for a transitive graph. Transitivity is related to the continuity of social relationships and agglomeration of groups. When a group is transitive, group connectivity becomes more robust (Scott 2000, 13-15). Table 3 demonstrates that the second group is a robust network, as indicated by the higher transitivity score.

Measuring the four indices of network structure reveals two major characteristics of the Japanese bank group. First, the degree distribution shows that the Japanese bank group has a clear core-periphery structure and that Japanese megabanks play a central role in this group. Second, the results for density demonstrate that the network of the Japanese bank group is more open compared to those of the other groups, implying that this group is more likely to encounter business opportunities.

4.2 Community Extraction

This section focuses on the Japanese bank group and examines the characteristics of its network structure by two means. First, similar to the previous section, this study extracts the communities from this group using the fast greedy method. The extraction result demonstrates the existence of four groups, as shown in Figure 1. The groups can be identified by their colors. The authors observe that the Japanese banks are connected to each other and form a subgroup. The width of an edge in Figure 1 represents the strength of the relationship, thus identifying the banks belonging to the same syndicate.

Figure 1: Graph showing community extraction for Group 1



Specifically, a bolder edge indicates a stronger syndicate relationship between a pair of banks. Figure 1 shows strong relationships among three megabanks: BTMU, SMBC, and Mizuho Bank. Specifically, BTMU and SMBC are connected with the boldest edge. Furthermore, these two banks act as a bridge for the Japanese bank subgroup and other subgroups. This result implies that megabanks play an important role in group formation.

Second, the authors observe the distribution of edge widths in order to identify the characteristics of the Japanese bank group. Table 3 presents interesting differences in network structure among groups. The weights of the edges for the second group are almost one, and thus indicating a weak syndicate relationship. The third group shows stronger relationships compared to the second group because the banks in the third group form a syndicate three or four times. The banks in the Japanese bank group share strong relationships, as demonstrated by the thicker edge widths. Notably, the authors observe collaborations among megabanks. Such repeated syndicate formations act a source of competitiveness for the megabanks, as demonstrated in the league tables.

Table 3: Distribution of edge widths

Edge weight	Group1	Group2	Group3
1	16	56	6
2	15	5	0
3	15	1	5
4	3	0	4
5	1	0	0
6	2	0	0
7	1	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	1	0	0

5. Conclusion

This study investigated the market position of Japanese banks in the UK project finance market. The banking industry shows a keen interest in the overseas activities of Japanese banks. However, to date, not much study has been devoted to this aspect. This study has attempted to shed light on this issue by investigating the behavior of Japanese banks in the UK project finance market. Previously, the only measure revealing the market positions of banks was the league table. While previous studies have focused on the lending behavior of Japanese banks in overseas markets, our study is different in that it examined another important aspect of behavior: syndicate formation. In other words, this study tried to investigate the market position of Japanese banks from a different viewpoint. To this end, this study employed SNA, an application of the graph theory, to analyze the social phenomena of banks in syndicates. SNA can highlight the communities existing in the market and reveal the characteristics of the network constructed by Japanese banks.

Our findings are as follows. Community extraction revealed the existence of three groups in the market. Japanese banks take core positions in the largest group. Furthermore, the relationship strength of this group is stronger compared to the other two groups for several indices. Japanese banks construct a subgroup with strong syndicate relationships within the largest group. This characteristic is advantageous in terms of syndication strategy. Moreover, this group is characterized as an open network, thus increasing its members' access to various loan originations. These features of the network formed by the Japanese banks increase their market competitiveness.

This study thus presented the characteristics of the network structure for the UK project finance market. However, the authors expect that network structures differ among markets. Investing the generality or variety of network structure could be a possible extension of this study.

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