

The Study of Location Strategy for Bank through the Analysis of Inter-regional Financial Transaction Network

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Abstract

In this paper, authors attempt to shed light on the factors that influence the locations of bank branches in establishing a bank's branch network from the angle of the network analysis. For this purpose, authors studied location strategy for bank through the analysis of inter-regional network using financial transaction data in Korea. The previous studies analyzed the locations of bank branches on the basis of their geographical characteristics. But, the significance of this study rests upon the fact that it endeavors to explore the location factors from a new perspective of the movement path of financial customers. For this analysis, the network between administrative districts, which form the unit of a location, was analyzed based on the financial transactional data. The important findings of this study are as follows. First, we found the factors that the income level, the spending level, the number of businesses, and the size of workforce in the pertinent region were influence to the size of a bank's market. Second, the network centrality index was found to have a significant effect on the locations of bank branches. The degree centrality was revealed to have a greater influence on the size of a bank's market than does the closeness centrality. The results of this study suggest the needs for a new approach from the perspective of network in furtherance of other factors that have been considered important in the previous studies of the branch location strategies.

Keywords: Location, Bank, Network, Channel

1. Introduction

Domestic banks have been opening new branches to establish competitive sales strategy. The rapidly increasing number of new branches verifies this claim recently. For example, by July of the financial year of 2007, the number of the newly established branches of several banks are the followings: 39 of the Industrial Bank of Korea, 38 of the National Agricultural Cooperative Federation, 26 of the Kookmin Bank, and 21 of the Hana Bank (The Korea Economic Daily, 2007). By the 2009, each number of branches of several banks are the following: 1197 of Kookmin Bank, 890 of Woori bank, 925 of Shinhan Bank, and 650 of Hana bank (Hankyoreh Daily, 2010). The banks' branch strategy takes two forms. One of them is establishing a new branch and the other is relocating an existing branch. But in both

cases, the question of location emerges as the most important issue. A branch is directly tied to the growth of bank, as it is the frontline of sales. Thus, when choosing a location for a branch, each bank takes various factors into account, such as the level of income, branch functions, competition, land value, growth potential, and the number of financial institutions (Nelson 1960; Chan-Seok, Park et al. 1993). Also, from the methodological perspective, each bank employs and develops various mathematical models or continuously strives to apply new methods. The recent introduction of Geographic Information System (GIS) can be viewed as an extension of such trend (Min Kim et al. 2004).

This study attempts to analyze the factors that influence the selection of branch location through network analysis, which is based on customer transaction data. The findings of this study are expected to contribute in the methodological expansion of previous studies. Network is the collection of nodes that are connected by lines (Newman, 2004). The nodes can be seen as persons, locations or functions, and the lines can be seen as the flow of information or physical channels between the nodes (Barabasi, 2002). Thus, the value of this study lies with the fact that it views the branch location as the networking channels of customer transactions. Furthermore, this study is also expected to contribute in establishing the future branch network strategies.

2. Theoretical Background

2.1 The study of factors in establishing bank's branch strategy

An increase in the potential sale becomes possible with a good location, as it could attract more customers (Pastor, 1994). The location theory, which considers an ideal location of a store in order to maximize the profit, was introduced in the early 20th century. The study of this theory became revitalized in the 1940's as the assessment of broad characteristics of a store's commercial zone and the measurement of market share within a city became the focus of the study. These studies experienced further rapid developments in the 1950's. Especially, many theories regarding the characteristics of customers' selections of retail stores were developed through the studies of the suburb shopping centers erected in the United States after World War II due to the decentralization of retail business. Based on these studies, Nelson (1960) identified the followings as the important factors in deciding the feasibility of a location: population, income, branch function, competition, land value, and future development potential, etc. In addition, The Huff model was introduced by David Huff in 1963 (Huff 1963). Huff suggested the traffic hours and the type of traded goods as the contributing factors. Also, Kim's study (Min Kim et al. 2004) evaluated the geographical characteristics of a location as another significant factor. As a result, GIS analysis was employed to include various geographical characteristics in the consideration of a location. Carol(1960) defined the central business district(CBD) as the area in which the highest central functions of specific settlement are located and found that theater and opera house also located in central business district.

As in the studies conducted on the banks, Sung-Ryong Lee (1985) viewed the customer characteristics and the branch characteristics as two significant location factors. With respect to the branch characteristics, in particular, the number of branches of other financial institutions in the region is an important factor. Chan-Seok Park and Yun-Young Lee (1993) analyzed the locations of bank branches by employing the GIS analysis based on the database. Hee-Yeon Lee and Eun-Mi Kim (1997) also used the GIS analysis. In doing so, they had first selected the regional economic foundation, the regional economic strength, and

the demand inductivity as the detailed location factors of a bank branch, which then formed the basis of the analysis. Through developing of algorithms based on mathematical models, Cornuejols (1979) attempted to achieve the methodological expansion of a branch selecting strategy.

2.2 The study of factors that affecting bank's profitability

As the parameters of measuring the profitability of bank divide into credits and deposits, Byung-Gil Lee (2006) assessed the branch networking efficiency by the size of credits and deposits. In a study of bank profitability, Sung-Ryong Lee (1985) concluded that a location of bank affects the size of deposits and the profit. Moreover, Lee (1985) found that as the number of branches of other financial institutions increases, the profitability of a bank branch in that region also increases. Ugg-Yeon Cho (1990) has attempted to explain whether a branch's profit and loss vary depending on its location and the density of branches in that region. In a study by Gi-In Song (2006), he has concluded that functional characteristics, such as customers' convenience, and brand image or psychological trust affect the continuous customer commitment.

In the studies pertaining to the images, the customers were found to form an image of a bank from various information sources, and such formed image had a significant influence on the profitability of the bank. Nakanish and Cooper (1974) have concluded that the branch image, level of service, value of products, and the building should be considered in the evaluation of a bank's profitability. Young Jun Kim and Yong Sik Nam (1997) expounded that, when choosing a bank, personal banking customers tend to place more emphasis on their attitude toward a bank's services and images than business banking customers do. In other words, personal bank customers tend to value the personal images they formed toward a bank and use these images as the grounds on which to continue their relationship with the bank. Myung Sik Lee (1993) agreed with the notion that a bank's image could have a positive influence on a continuous customer commitment to the bank. Furthermore, Kyung Kook Lee (2007) asserted that the greater positive image a bank establishes based on trust, the more likely it is to increase the customer satisfaction. Ki In Song (2006) confirmed such assertions by adjoining with the previous notions. He specifically suggested that customers are influenced by the functional characteristics such as convenience as well as the brand image and the psychological trust. Therefore, customers' image of a bank can be concluded as an important factor affecting the profitability of a bank.

Hence, a bank's profitability, measured by their sales or their customers' royalty, could vary depending on the factors such as its location or its image constructed by the customers. This study, however, attempts to focus on the location factor while eliminating the image factors from its analysis to put emphasis on the regional characteristics.

3. Study Methods

3.1 Research Data

This study is based on the data that was gathered in Seoul region at the end of 2004. The data can be classified into three types.

The first type of data relates to the characteristics of administrative district. Here, the information about the population, the number of businesses and employees, the income, and the spending patterns are included. Through the data, this study attempts to explore the

factors that influence a bank's profitability. This data was constructed by incorporating the data from the National Statistical Office and the consumer surveys.

The second type is the Inter-regional financial transaction data. This was produced by gathering and processing the financial transaction information between the administrative districts. This data indicates the frequency of financial transactional relationship between districts. The more detailed form of data takes the binary format, which indicates the existence of relationships between administrative districts. This data was gathered by analyzing the customer transaction logs for Bank A to understand the inter-district transaction patterns and to use it in building a branch strategy.

The third type of data includes information regarding the quantity and the size of banks within each administrative district. This data was conjectured by incorporating the data from the Bank's association and the consumer surveys.

3.2 The Studying Process

This study looks at the influence of location characteristics of a bank on the profitability from the network analysis perspective. In order to achieve this, the pre-existing studies regarding the effects of the statistical population characteristics and the economical characteristics on the banks' profitability within a district were carefully studied. Through this process, the factors that carried significant values in the previous studies were employed to parallel the implications of the network analysis. Thereafter, the factors that were extracted in the network analysis were analyzed in relations to the effects on the profitability.

Because the lowest level of statistics gathered by the National Statistics Office is done at the administrative district level, this study also selects the administrative district as the analytical unit to maximize the practicality.

4. The results of the study

4.1 The influence of an administrative district's characteristics on the market size

A close look at the major characteristics of administrative districts – the dependent variable used in this study – reveals the following statistical data: the average population per administrative district is approximately 19,489, the average monthly income per household is approximately 3.38 million Korean won, the average spending is approximately 1.69 million Korean won, and the average number of businesses is approximately 1,431.

Table 1. The effects of administrative characteristics on market size

Dependent variables	Independent variables				Adjusted R ²
	Income	Expenditure	#of company	#of employee	
Deposits	0.133**	-0.237**	-0.265**	0.911**	0.40
Credits	0.020	-0.022	-0.002	0.871**	0.74
Sum	0.115**	-0.201**	-0.221**	0.934**	0.48

All coefficients are standardized, ** denotes significance at .01 level, and * significance at .05 level.

Table 1 illustrates the results of an analysis of the effects that the major characteristics of an administrative district have on the market size. In this investigation, the sum of the estimated size of deposits and credits of banks in each administrative district in the area of Seoul were used as a subordinate variable. The result shows that the size of workforce has a

greater influence on the size of credits and the sum of deposits and credits than does the level of income. The size of workforce seems to indicate the degree of work-centeredness. Furthermore, the level of spending and the number of businesses were found to affect the wealth. Here, the number of businesses indicates the degree of consumption-centeredness of the pertinent region as it includes even the simplified businesses such as restaurants.

4.2 The effects of an administrative district's network characteristics on the market size

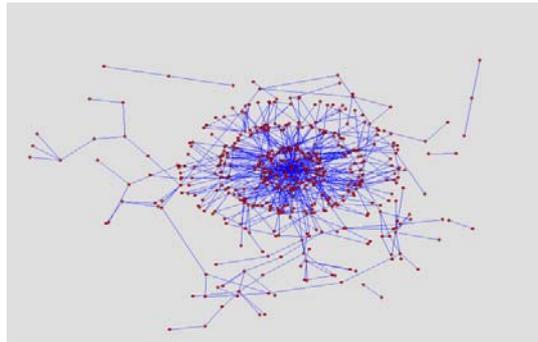


Figure 1. Visualization of Administrative Network

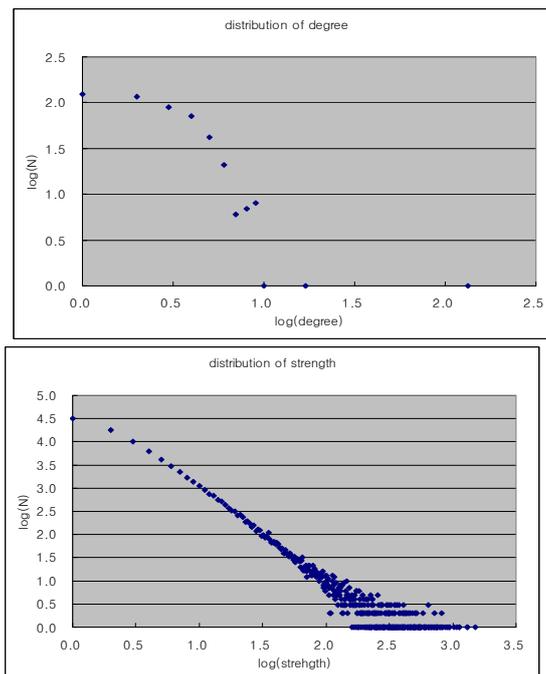


Figure 2. distribution of degree and strength

This section explores, in addition to the existing studies, the influence of an administrative district's network characteristics on the market size. For the purpose of the network analysis, a dichotomous relation matrix, which depicts the presence of relationship between administrative districts, were constructed. This matrix was then analyzed using Pajek, a

network analysis program. Figure 1 is a visualized result of such analysis. In this figure, the nodes represent administrative districts and the links represent the presence of financial transactional relationship between administrative districts. The administrative districts located at the center of the picture will have different levels of relative influence when compared to the ones in the outer range.

The graph on the left hand side of Figure 2 below shows the distribution of degree and the one on the right hand side shows the distribution of the strengths of links. The two distributions show similarities to the distribution of power law, another major characteristics of a network.

The nodes, which are important in the analysis of a network, are generally measured by two types of centrality indexes: the degree centrality and the closeness centrality. Degree centrality is defined as the number of links incident upon a node (i.e., the number of ties that a node has). And closeness centrality is defined as the mean geodesic distance (i.e., the shortest path) between a vertex v and all other vertices reachable from it. Centrality means the degree of how close to the center of a network a node is located. In other words, the greater influence a node has, the closer to the center it is located. More specifically, the degree centrality indicates how many other nodes a particular node is connected to, and the closeness centrality indicates how many steps are required for a node to reach another node.

Through the analysis of network characteristics, the correlation between the degree centrality and the closeness centrality was found to be 0.89 ($p < 0.01$). Therefore, in the subsequent regression analysis, the degree centrality and the closeness centrality were separately analyzed.

Table 2 illustrates the influence of the degree centrality on the market size. A careful study of the data reveals that the degree centrality has a meaningful influence on the size of credits and deposits as well as the sum of the credits and deposits. Such findings suggest that a new approach to the location factors from the perspective of network is necessary, in furtherance to the factors that have already been considered important in the previous location studies, such as the population, income and the number of workers.

Table 2. The effects of administrative district's degree centrality on the market size

Dependent variables	Income	Expenditure	Number of company	Number of employee	Degree centrality	Adjusted R ²
Deposits	0.120**	-0.254**	-0.380**	0.750**	0.320**	0.43
Credits	0.003	-0.046	-0.158**	0.652**	0.436**	0.79
Sum	0.100**	-0.220**	-0.348**	0.756**	0.355**	0.52

All coefficients are standardized, ** denotes significance at .01 level, and * significance at .05 level.

Table 3. The effects of administrative district's closeness centrality on market size

Dependent variables	Income	Expenditure	Number of company	Number of employee	Closeness centrality	Adjusted R ²
Deposits	0.133**	-0.245**	-0.356**	0.835**	0.202**	0.41
Credits	0.020	-0.043	-0.148**	0.749**	0.326**	0.78
Sum	0.114**	-0.216**	-0.326**	0.846**	0.234**	0.50

All coefficients are standardized, ** denotes significance at .01 level, and * significance at .05 level.

4.3 The achievement of banks and the network characteristics of administrative districts

Figure 3 represents the achievements and the location characteristics viewed from the perspective of network of four banks located in Seoul. (a) illustrates the average degree centralities and closeness centralities of the administrative districts in which the four banks' branches are located. As shown in the figure, Bank A and B have relatively advantageous locations than Bank C and D. (b) illustrates the average size of credits and debits of the four banks' branches. This figure, in turns, shows that the banks having more advantageous locations (Bank A and B) have maintained relatively higher profitability in comparison to Bank C and D. Therefore, these results insinuate that the network characteristics of the administrative districts in which the bank branches are located are closely related to the individual bank's profitability.

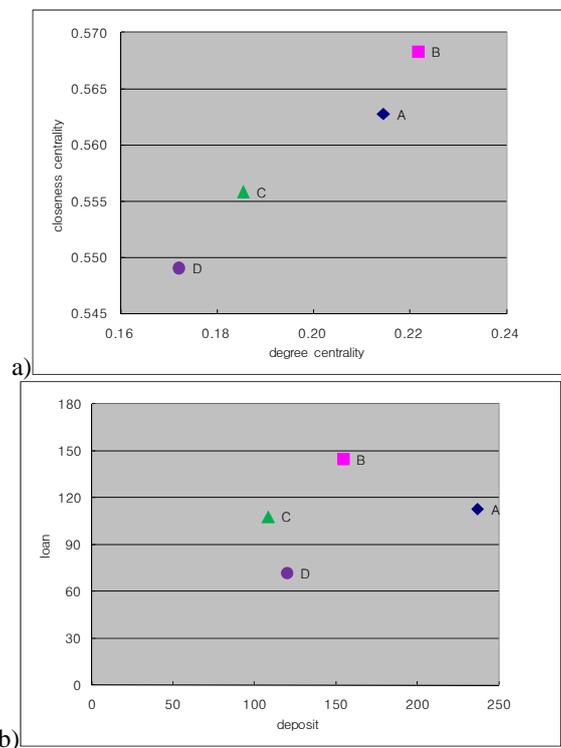


Figure 3. Network location characteristic and achievements

5. Conclusion and Suggestions

This study explored the factors affecting the locations of bank branches through the network analysis with the purpose of aiding in the selection of their locations. This selection of locations is a central issue that arises in the process of executing competitive branch strategies by either establishing new branches or relocating existing branches. In ascertaining a location strategy, the application of the network analysis is expected to provide a new insight to the study of location analysis. In order to accomplish such a goal, the relation matrix between the administrative districts was constructed using the transactional behavioral data of financial customers between administrative districts. From that matrix, the centrality index of each administrative district's network was extracted, and the extracted centrality

index was, in turn, utilized to make an important suggestion regarding the establishment of a location strategy.

As a result of the study, the factors such as the level of income, the level of spending, the quantity of businesses, and the number of workers were found to have a significant influence on the branch location selecting process as they did in the previous studies. Among these, the level of income and the number of workers had a positive influence, whereas the level of spending and the quantity of businesses had a negative influence. The most significant factor was found to be the number of workers.

In the study of the network approach between administrative districts, the degree centrality and the closeness centrality were found to have relatively bigger influence than the other factors, although less than the number of workers. Furthermore, the result of the network analysis of the four banks' branches revealed that the branches located in the districts of higher degree centrality and closeness centrality had achieved more than the branches in the lower degree of centrality and closeness centrality districts.

Thus, the value of this study lies with the fact that it has discovered the needs to develop a new approach from the network analysis perspective in furtherance to the pre-existing factors. The findings of this study are expected to provide practical applications to the openings and relocations of bank branches. However, because this study has not gathered the detailed data regarding the competition between financial institutions, it was insufficient to explaining the factors of selecting branch location from each branch's profitability outlook. To achieve this, the customer surveys of individual bank would have to be additionally attained. Furthermore, the future studies should consider the strength and direction of links and the relationship with neighbors.

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