Bank mergers and alliances in differentiated markets

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Abstract
We study the incentives of banks to merge and to form alliances when they compete in differentiated markets. We introduce the idea of market definition by considering two distinct spaces of depositor’s characteristics. We find that the patterns of bank consolidation by means of mergers and by means of alliances are different. Regional merger is the equilibrium outcome when the proportion of banking services which are demanded in other regions is not high enough. If this condition does not hold, cross-border merger is the outcome of the game. Cross-regional alliances is the final outcome of the alliance game. Both ways of consolidation could be understood as substitutes in some bank activities: cross-regional alliances lower the cost of bank services in other areas and reduce the need of a cross-regional mergers.

Keywords: bank mergers, bank alliances, banking competition, market definition

JEL codes: G21, G34, L11, L41.

1 Introduction
Banking industry has experienced a high level of consolidation activity during the last decades. Generally speaking consolidation is a result of combining existing firms. There are two main alternatives for firms combining with each other: first, mergers and acquisitions, and second, joint ventures and strategic alliances. With mergers and acquisitions, two formerly independent firms become commonly controlled. Joint ventures and strategic alliances enable firms to work together without relinquishing control of its own operations and activities. In this case the level of collaboration is often focused on a well-defined set of activities, services or products. Research in banking and the financial sector in general shows that the reasons for consolidation are varied1. These reasons

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1 See for example Hunter and Wall (1989) and Berger, Demsetz and Strahan (1999) for a review of reasons for banks to merge.
have their origin in the driving forces of change in modern financial systems. These include, for instance, information technology, deregulation, disintermediation and the integration of international capital markets. In addition, the patterns of consolidation in the financial sector varies depending on several factors such as the market sectors, the relative size of the institutions and the size of the market.

The purpose of this paper is to study the motivations for consolidation in the banking sector when banks compete in (geographically) differentiated markets. Antitrust analysis of bank mergers demonstrates that market definition may often be crucial in evaluating the competition and the economic performance of the industry, then it should be considered a basic determinant of the motivations for banks to merge in terms of market power. The relevant geographic market is the territory including the firms that impose competitive constraints on each other: "the relevant geographic market comprises the area in which the undertakings concerned are involved in the supply and demand of products and services, in which the conditions of competition are sufficiently homogenous and which can be distinguished from neighbouring areas because the conditions of competition are appreciably different in those areas". In our opinion a precise delineation of the markets in which banks compete can contribute to a better understanding of the motivations of mergers and strategic alliances. Given that the geographical scope of banking services varies widely depending on the type of services and class of customers, relevant markets should be taken into account when studying the causes of consolidation and not only as a critical factor for the evaluation of the consequences of mergers on competition, efficiency and stability in the banking sector.

In spite of technological developments and changes in consumer habits it is not clear that the local market nature of some banking services or the basic bank-customer relationship have been altered: "markets for some bank products appear to remain local, while others are national or international in scope. Among the latter are the markets for large commercial loans and credit card loans, secondary loan markets and other wholesale markets, while the local markets include household and small-business transactions accounts, small business lending and some types of consumer lending" (Group of Ten, 2001, p.269). Amy Starr (2002) find that for checking accounts, saving accounts and CDs, 90% of services are still acquired within the local market. Biehl (2002) shows strong support for the local market hypothesis and suggests that competition may be increasingly centered on characteristics of the product offered. De Juan (2002) tests Sutton’s independent submarkets model with data on the spanish retail banking markets and finds results which are consistent with the predictions of the theoretical model. In the same direction of the argument, it is interesting to note that the bulk of bank merger and acquisition movements carried out in the European Union involved domestic bank mergers and acquisitions between

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2 For an overview of the patterns of financial consolidation, see Group of Ten (2001).
regional and smaller institutions (ECB, 2000 and Group of Ten, 2001). Berger et al. (2003) argue that "some banking services [...] may always be provided primarily by small, local institutions operating in the nation in which the services are demanded. Other services [...] are more likely to be provided by large, global institutions for which the home nations of these institutions are of much less consequence to the demanders of the services" (p.384).

Empirical literature on causes and effects of international consolidation in banking is focused on efficiency barriers such as geographical distance, different cultures, or regulatory structures (Berger et al. 2000). Focarelli and Pozzolo (2001) and Buch and De Long (2001) test the extent to which information costs and regulations influence back merger activity. Another studies are focused on firm characteristics such as relative efficiency of the acquirer and the target (Berger and Humphrey, 1992, and Vander Vennet, 1998).

In this paper we study the incentives of banks to merge and to form an alliance when they are competitors in the market for deposits. We introduce the idea of market definition into the analysis of the motivations for bank consolidation by considering two distinct spaces of depositor's characteristics. In this manner we represent the geographical scope of banking services both in supply and demand. The determinants of supply are given by the geographical specialization of banks in terms of the scope of their networks (branches, ATMs, POSs, etc.) and by the technical characteristics of the services. The determinants of demand are due to the capacity (essentially the costs) of substituting the provider of the service when the services are demanded in distant areas. Our model considers two different (and independent) games: in the first one, banks take decisions about mergers and, in the second one, banks form alliances with other banks. A merger implies that two independent banks become one single firm and an alliance consists of an agreement to cooperate in a given activity or service. In our case the agreement is a compatibility agreement of their ATM networks.

This paper is related to the literature on non-price strategic competition in the market for deposits, such as Nelson (1985), Matutes y Padilla (1994), Chiappori, Pérez-Castrillo and Verdier (1995), Bouckaert y Degryse (1995) and Degryse (1996). Another related paper is Greenhut (1995) who studies bank mergers applying spatial microeconomic theory.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 discusses the second stage deposit rate equilibrium for the merger game. Section 4 discusses the second stage deposit rate equilibrium for the alliance game. Section 5 presents some concluding remarks.

2 Preliminaries

We assume two cities I and II which represent two horizontally (i.e. geographically) differentiated markets. Each city is represented by a circumference where a continuum [0,1] of depositors are uniformly distributed. Each space of depositor’s characteristics reflects the idea of relevant market. Each market is defined
in terms of the capacity of substitution that depositors have. In this sense, it is assumed that representative depositor always chooses a bank located in their city and, more specifically in his/her neighborhood. However, not all the services are demanded in his home city but sometimes he/she demands some kind of bank services in the other city.

Following the usual characterization of the deposit market based on the Salop (1979) circle model (see for example, Matutes and Padilla (1994)). Each bank deposit is composed of two characteristics: first, the deposit rate paid to deposits net of charge commissions and other fees, \( r_i \), and second, a varietal characteristic which is represented by a location in a point on the circumference. Representative depositor values the location of the bank branches in a double way: first, he values the distance to the bank from his location (which represents his/her most preferred brand), represented by \( d_i \), and second, he takes into account the average distance to his bank given that he/she usually spends time at any location in any of the neighborhoods of both cities and demands banking services unexpectedly (i.e. needs cash).

The utility of a depositor of bank \( i \) will be given by \( r_i - d_i - k_i \) where the usual transport cost is normalized to 1 and \( k_i \) represents the expected cost of going to the bank when the depositor is travelling around the city or cities. This cost depends on the average distance to the bank of his bank and the opportunity cost of time and other associated costs in these circumstances, which we call \( s \). In our game we will assume four possible locations. The average distance for one location equals to 1, for two locations equals to 5/8 and 1/2 (respectively if the locations are next to each other or not). Let \( \alpha \) be the proportion of bank service a depositor demands in his own city \((0 \leq \alpha \leq 1)\). If a bank does not have a branch in a city, its customers would incur a cost \( K \), \( K > s \), if a particular banking service is needed in that city. For instance, in order to prevent an unexpected need of cash they would have to withdraw more cash from the bank at his city before travelling to the other city, and then they would incur in higher transaction costs, opportunity costs, risks of loss, etcetera. Then, in the case of a bank with one branch in only one city we have that: \( k_i = \alpha s + (1 - \alpha)K \).

We assume four banks symmetrically located in each city (A, B, C and D in city I, and E, F, G and H in city II). These locations define four neighborhoods in every city. The size of every neighborhood is normalized to one. Each bank has a single branch and competes for the deposits of the individuals located in two of these neighborhoods. Banks play a two stage game. At stage one, each bank proposes a merger or alliance with other bank. In our game there are three possibilities of consolidation depending on the characteristics of the banks which are involved in the process: first, two banks that compete in the same region and are neighbors, for instance, A and B, which will be represented by \( N \); second, two bank which compete in the same city and are not neighbors, that is, A and C, that we call \( S \); third, a cross-regional merger or alliance, which includes two banks which operate in different cities, for instance, A and E, that

\[^4\text{It should be noted that although this differentiation is usually understood as geographical or physical distance, it can also be thought in a more general sense.}\]
we will call $M$. We consider that four banks in each city is the smallest number of players which allows us to include all the possible combinations of mergers or alliances. In other words, if we consider, for instance, three players in each city we have that when two banks merge or establish an agreement in the same city the third bank in that city does not have the option of regional merger or regional alliance and then its options and the feasible outcomes of the game are limited.

In stage two, given the configuration that arises from the previous stage, banks simultaneously choose deposit rates. Banks invest the funds and obtain an identical rate of return $R$. The profit function will be given by $\pi_i = (R - r_i) \sigma_i$, where $\sigma_i$ represents the deposits obtained by bank $i$. We assume that each depositor invests on average one normalized unit of money at only one bank.

3 Merger game

Given the first stage decision about the choice of merger, we analyze the subgame perfect equilibrium of the pricing stage of the game. In this sense, mergers can be studied as a special kind of coalitions in which the members of the coalition become a single firm. We consider that a market configuration of merging banks will be stable if it is a coalition-proof Nash equilibrium (Bernheim et al. (1987)), that is "if it is Pareto efficient within the class of self-enforcing agreements" (see also Matutes y Padilla (1994)).

3.1 Second stage competition

There are eighteen possible merger configurations or proposals. This number is the result of combining the different kinds of mergers taking into account that eight players decide to merge or not simultaneously. The configurations can be classified in terms of the number of mergers:

- one merger: $N, S, M$. Note that when we consider the configurations $N$ and $S$ we are talking about the merger configuration in a given city independently of what happens in the other one. As we will see below, in these cases the market configuration of the city II does not affect the profits of the banks which compete in city I and vice versa. This is due to the fact that there exists competition between the banks which operate in different cities only if there exists a cross-regional merger.

- two mergers: $NN, SS, MM, NM, MS$ where for instance $NM$ represents that two neighbor banks merge (for example, A and B) and simultaneously two banks which operate in different regions merge (for example, C and E), and the other four players do not merge. In the subgames $NN$ and $MM$ we are also referring to the market configuration in a given city independently of the other one, because of the same reasons we have just mentioned.

- three mergers: $NMN, SMS, NMM, SMM, NMS, MMM$, that is, two players do not merge;
- four mergers: $NMMN, SMMS, NMMS, MMMM$, that is, all the players are involved in a merger.

Moreover we have the market configuration in which no merger is developed (we will represent this subgame with the superscript $\circ$). In this subgame we have the symmetric equilibrium where the market share of each bank is $1/8$, deposit rates are $r_i^{\circ} = R - 1$ and profits equal to $\pi_i^{\circ} = 1/8$ where $i = A, B, C, D, E, F, G, H$.

Depositors have four possible utility functions as a result of the different kind of merger in which his bank is involved:
- first: two neighbor banks merge the utility function is given by $U_i = r_i - d_i - (\frac{1}{8} \alpha s + (1 - \alpha)K)$ where $i$ represents the merged bank, for instance bank AB in city I or bank EF in city II.
- second, when two banks which are not neighbors and compete in the same region merge we have that the utility function for depositor is $U_i = r_i - d_i - (\frac{1}{2} \alpha s + (1 - \alpha)K)$ where $i$ represents the merged bank, for instance bank AC in city I or bank EG in city II.
- third, when two banks which operate in different regions merge we have that $U_i = r_i - d_i - s$ where $i$ represents the merged bank, for instance bank AE.
- finally, depositors of banks which do not merge have the following utility function: $U_i = r_i - d_i - (\alpha s + (1 - \alpha)K)$

### 3.2 Comparative analysis

As usual in this kind of models market shares for any competitor are determined by calculating the marginal consumer who is indifferent between the firms located in his/her neighborhood. The primary implication of considering two different regions or markets is that banks operating in distinct regions compete for different customers or, in other words, banks operating in distinct regions are competitors only if there exists a cross-regional merger. We can also see that idea by observing that equilibrium profits do not depend on $K$ if there is not a cross-regional merger.

Comparative analysis of equilibrium profits of the different subgames\(^5\) shows us that there exists two self-enforcing merger configurations which are the following: $NN$ (as we explained before, this means a $NN$ configuration in each city) and $MMMM$. Any other market configuration is not strategically stable because some of the players have incentives to deviate to another merger configuration. We have that if the configuration includes merged banks and non-merged banks there are incentives for some (or even all) of the non-merged bank to merge. If the case of configurations $NMMN$, $NMMS$ and $SMMS$ some of the banks can be better off by choosing another different merger taking the actions of its complements as fixed.

More specifically, if we call $\pi_j^i$ to the profits of bank $i$ when merger configuration is $j$ we have that $\pi_N^{NN} > \pi_M^{NMMN}$ if $\alpha > \frac{8(K-s) - 8.8685}{8K-5s}$. If this condition does not hold we have that $\pi_M^{NMMN} > \pi_N^{NN} > \pi_N^{NMMS}$ and then banks would

\(^5\)See Appendix 1 for the exact expressions of equilibrium profits.
prefer a cross-regional merger. Consequently the result is the configuration $MMMNN$ although it holds that $\pi_M^{MMMNN} > \pi_N^{NN}$. Banks will not deviate from this configuration because $\pi_M^{MMMNN} > \pi_N^{NM}$ if $\alpha < \frac{8(K-s)-8.685}{8K-5s}$.

Then we have the following result:

**Proposition 1** Regional merger of neighbor banks is the perfect Nash equilibrium if the cost of having access to a given service in other regions is small enough or, in any case, if the proportion of banking services which are demanded in other regions is small enough. Otherwise, cross-border mergers are the resulting equilibrium merger configuration.

Let us to discuss some important comparative statics at this point. First, type-$N$ merger lets the bank to use its monopoly power to charge a lower deposit rate. In this sense, note that a merger of neighbor banks makes the resulting bank to monopolize one of neighborhoods of the city. More specifically, we find that $\sigma^N < \sigma^M$ in any case and $\sigma^N < \sigma^{NMN}$ and $\sigma^N < \sigma^{MMM}$ for relevant values of $K, s, \alpha$.6

Second, $\sigma^N = \sigma^M$, that is, type-$N$ merger and type-$M$ merger give the same equilibrium market share. Moreover we have that $\sigma^N < \sigma^N < \sigma^{NMMN}$. These relationships reinforce the argument that the profitability of $N$-type merger is mainly based on the effect on prices (deposit rates).

Third, it can be easily seen that the market configuration which includes four cross-regional mergers is strategically stable if the services demanded in other region is costly and simultaneously the proportion of these services is high. However this configuration gives an equilibrium profits which are always smaller than the profits of mergers of neighbor banks.

A simple welfare analysis shows that regional merger of neighboring banks is not the first-best merger configuration. The kind of merger which makes that the expected costs ($k_i$) reach its lowest level is the cross-regional merger if $\alpha < 1 - \frac{s^2}{2K-5s}$ and regional merger of non-neighboring banks in other case. Expected costs ($k_i$) reach its highest level is the regional merger of neighbor banks, however a market configuration where all mergers are cross-regional is not an equilibrium outcome but the equilibrium outcome always implies the presence of a regional merger of neighbor banks.

It is also interesting to note that in the subgames where a regional bank and a cross-regional bank compete (for example, in subgame $NM$) the dominant strategy for non-merged banks is a regional merger if the same condition that Proposition 1 includes holds, that is, if $K$ is small enough or, in any case, if $\alpha$ is big enough.

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6 More specifically $\sigma^N < \sigma^{NM}$ if $\alpha > \frac{8(K-s)}{8K-5s}$ and $\sigma^N < \sigma^{MMM}$ if $\alpha > \frac{8K-s-32}{8K-5s}$. In both inequalities it is easy to see that the values of $\alpha, K$ and $s$ which do not hold the conditions (for instance, a very small $\alpha$ and a very high $K$).
4 Alliance game

As we explained above, we consider that the content of the alliance can be an agreement about, for example, the compatibility of ATM and/or POS in order to let the depositors of both banks to have access to a given service. That service is to withdraw and/or transfer their funds. In the simplest characterization of this problem we assume that the location of these points is the same that the branch location. In the alliance game we have the same possibilities of configuration than in the merger game.

Again given the first stage decision about the choice of alliance, we analyze the subgame perfect equilibrium of the pricing stage of the game. Let us to use the same notation that we have used in the previous section taking into account that in this section the meaning is different: N, S and M mean respectively an agreement of two banks which compete in the same city and are neighbors, an agreement of two banks which compete in the same city and are not neighbors and an agreement of two banks which compete in different cities.

In terms of the accessibility of bank services defined as the number of available locations, we consider that there is no difference from depositor’s point of view between a merger and an alliance\(^7\). Then we have again that depositors have four possible utility functions as a result of the different kind of alliances in which his/her bank is involved.

Comparative analysis of equilibrium profits of the different subgames\(^8\) shows us that there exists three self-enforcing alliance configurations which are the symmetric configurations: NN, SS (as we have explained before, this means NN or SS in each city), MMMM and the three configurations give the same equilibrium profit (\(\pi^N_N = \pi^N_S = \pi^S_S = \pi^M_M = \frac{1}{2}\)). In the alliance game NMMN is not a self-enforcing configuration because in that market configuration we have that, if \(\alpha < 1 - \frac{3s}{3K-5s}\) banks involved in a cross-regional agreement would increase their profits by forming a regional agreement, and conversely, if \(\alpha > 1 - \frac{3s}{3K-5s}\) banks involved in a regional agreement would prefer a cross-regional agreement. Because of the same reason SMMS is not a self-enforcing market configuration. Then we can write the following result:

**Proposition 2** Three symmetric equilibriums are the outcome in the alliance game: regional agreement of neighbor banks, regional agreements of non-neighbor banks and cross-regional agreements.

This (somehow) disappointing result of three symmetric solutions can be clarified if we let the coalitions keep on playing. That is, if we consider now

\(^7\)Obviously the differences could not be ignored if we dealt with another aspects of bank activity such as reputation, efficiency, or stability, among many others. Moreover the differences can also be motivated by the existence of fees which are charged to depositors when having access to the services through other banks. This cost are considered here only in an implicit way by understanding (as usual) that \(r_i\) is defined as the rate paid to depositors net of charge commissions and other fees. For an explicit consideration of these prices and their effects on the equilibrium outcome, see Section 3.4 and Appendix B in Matutes and Padilla (1994).

\(^8\)See Appendix 2 for the detailed expressions of equilibrium profits.
the possibility of establishing new agreements between the “already created” alliances, we have two alternatives:

- first, agreements with a regional scope, \( \mu \): they can be the result of an agreement between, either \( N \) and \( N \) in the same city, or \( S \) and \( S \) in the same city;

- second, cross-regional agreements, \( \xi \): they can be the result of an agreement between \( M \) and \( M \), or between two \( N \)-type agreements of different cities, or two \( S \)-type agreements of different cities.

Again we obtain the equilibrium profits corresponding to every subgame. By comparing them we find that if \( \alpha < 1 \) then the final equilibrium outcome of the game is \( \xi \), that is, two cross-regional agreements or two regional agreements of different cities. It is important to note that \( \pi^\xi = \frac{1}{2} = \pi^\mu \) but \( \mu \mu \) is not an equilibrium outcome because it implies the same profits independently of what the other players do (\( \pi^\mu = \pi^\mu \)). Profits of alliance \( \mu \) are independent of the other regional alliance because they are located in the other city. As we explained in the merger game it there is no cross-regional alliance both cities remain as independent markets from the point of view of banking competition. However the configuration \( \xi \) is the Nash equilibrium because \( \pi^\xi > \pi^\xi \) (being \( \pi^M_M = \pi^N_N = \pi^S_S \)). Conversely, only if \( \alpha = 1 \) the symmetric solutions prevail and no further alliance is formed. Then we have the following result:

**Proposition 3** The final outcome of the alliance game is the coexistence of cross-regional alliances if \( \alpha < 1 \). Only if depositors demand all the services in their home city the symmetric solutions prevail.

This result is conjectured by Matutes and Padilla (1994, p.1124, note 22) and it have to do with the number of players that we have considered. Similar to that work, total compatibility is not an equilibrium outcome in our model. However, in our model total incompatibility does not prevail in any case because an incompatible bank losses if their competitors are compatible. Similar to a prisoner’s dilemma, the dominant strategy for banks it to form alliances in order to protect their market positions, that is \( \pi^N < \pi^NN = \pi_i^O < \pi^N_N \), where superscripts denote the market configuration and the subscripts represent the bank: \( N \) represents a bank which is involved in a \( N \)-type alliance and \( i \) represents an independent bank.

It is interesting to note that the subgames \( NMN \) and \( SMS \) could be understood as a game where regional banks compete with cross-regional banks (bank which have branches in both cities). In that case the solution is always an agreement between regional banks because the substitution effect is zero and regional banks simply benefit from a network externality. Incentives of regional banks to form an alliance are higher than the incentives of banks which compete in serveral regions.
5 Concluding remarks

The usual discussion about the motivations and effects of consolidation in the banking sector takes as given the definition of the relevant market. We investigate the motivations for mergers and alliances when banks operate in differentiated markets, that is, when they compete in distinct spaces of depositor’s characteristics. We find that the patterns of bank consolidation by means of mergers and by means of alliances are different. Regional merger is the equilibrium outcome when the cost of having access to a given service in other regions is small enough or, in any case, when the proportion of banking services which are demanded in other regions is small enough. Cross-regional merger is an outcome if these conditions do not hold. The motivation for regional mergers is essentially to increase market power. Cross-regional alliances are the equilibrium outcome of the alliance game. Neither universal agreements are a equilibrium outcome nor the inexistence of agreements. In this sense, both ways of consolidations could be understood as substitutes for some bank activities: cross-regional agreements lower the cost of bank services in other geographical areas and reduce the need of a cross-regional merger. In our model the motivation for alliances is to protect market share (similar to a prisoner’s dilemma): forming an alliance is the dominant strategy because a bank which does not form an alliance loses if their competitors agree to cooperate although the resulting equilibrium profits are equal to the initial profits.

The results are also consistent with the recent evolution of banking systems in developed countries. In a national perspective, we have seen that mergers of regional banks (for instance, saving banks) usually involve banks which compete in the same geographical area. In a wider perspective, cross-border bank mergers and acquisitions have not been frequent and most of this activity has been carried out in a domestic level. Moreover the evidence shows that cross-regional mergers are less frequent in banking services where demand have a local scope (for example, retail banking) than in other areas where customers have a wider scope when demanding services (for example, because they are firms with an international activity) and the provision of these services in other regions is costly for a customer of a regional bank. However alliances have a long tradition in a national perspective (for example, cross-regional ATM network compatibility) and at the same time cross-border strategic alliances are more common than cross-border mergers.

Some of the subgames of the alliance game can be also understood as similar to a scenario of competition between regional banks and national banks banks which compete in more than one region). In these cases agreements between regional banks are always the dominant strategy. This could be an explanation to the early formation of compatibility agreements of ATM networks of saving banks in some countries (Spain, for example) during the 80’s when branch expansion was still restricted by regulation. Agreements between regional banks have low or even zero substitution costs and high network effects. In other words, regional banks had more incentives to compatibility agreements than national banks. Similarly, some of the subgames of the merger game show us
that the dominant strategy for non-merged banks when there exist regional and cross-regional banks is regional merger if the provision of services in other regions is cheap enough for depositors or, in any case if the most of services are demanded in the home region. In other words, under certain conditions the maintenance of a regional dimension can be a good strategy for a bank even if it competes with banks which have a wider geographical scope.

References


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APPENDIX 1

The equilibrium profits of the merger subgames are the following:

Subgame $N$

\[
\pi^N_N = \frac{1}{3200} (32 + 3ax)^2 \\
\pi^N_i = \frac{9}{12800} (16 - ax)^2 \quad \text{where } i \text{ represents every bank which does not merge.}
\]

Subgame $NN$

\[
\pi^{NN}_N = \frac{1}{2}
\]

Subgame $NMN$

\[
\pi^{NMN}_N = \frac{1}{3200} (32 + 4s - 4ax - 4K + 4Ka)^2 \\
\pi^{NMN}_M = \frac{1}{6400} (48 - 16s + 13ax + 16K - 16Ko)^2 \\
\pi^{NMN}_i = \frac{1}{12800} (48 + 8s - 11ax - 8K + 8Ko)^2 \quad \text{where } i \text{ represents every bank which does not merge.}
\]

Subgame $NMNN$

\[
\pi^{NMNN}_N = \frac{1}{3200} (32 + 8s - 5ax - 8K + 8Ka)^2 \\
\pi^{NMNN}_M = \frac{1}{6400} (48 - 8s + 5ax + 8K - 8Ka)^2 \\
\pi^{NMNN}_i = \frac{1}{12800} (48 + 8s - 11ax - 8K + 8Ka)^2 \quad \text{where } i \text{ represents every bank which does not merge.}
\]

Subgame $SS$

\[
\pi^S_S = \frac{1}{144} (6 + ax)^2 \\
\pi^S_i = \frac{1}{288} (6 - ax)^2 \quad \text{where } i \text{ represents every bank which does not merge.}
\]

Subgame $SMS$

\[
\pi^{SMS}_S = \frac{1}{144} (6 + s + aK - K)^2 \\
\pi^{SMS}_M = \frac{1}{576} (12 - 5s - 5axK + 5K + 3as)^2 \\
\pi^{SMS}_i = \frac{1}{1152} (-12 - s - aK + K + 3as)^2 \quad \text{where } i \text{ represents every bank which does not merge.}
\]

Subgame $SMSM$

\[
\pi^{SMSM}_S = \frac{1}{144} (-6 - 2axK - 2s + 2K + ax)^2 \\
\pi^{SMSM}_M = \frac{1}{576} (6 - 2aK - 2s + 2K + ax)^2 \\
\pi^{SMSM}_i = \frac{1}{1152} (-12 - s - aK + K + 3as)^2 \quad \text{where } i \text{ represents any bank which is next to bank } M \text{ and competes directly with it.}
\]

Subgame $M$

\[
\pi^M_M = \frac{1}{576} (12 + 5K - 5axK - 5s + 5as)^2 \\
\pi^M_i = \frac{1}{576} (-6 + K - Ko - s + ax)^2 \quad \text{where } i \text{ represents any bank which is next to bank } M \text{ and competes directly with it.}
\]
\[\pi_j^M = \frac{1}{172} (-12 + K - K\alpha - s + \alpha s)^2\] where \(j\) represents any bank which is not next to bank \(M\) and does not compete directly with it.

Subgame \(MM\)
\[
\begin{align*}
\pi_{1}^{MM} &= \frac{1}{172} (4 + \alpha s - s + K - K\alpha)^2 \\
\pi_{1}^{MM} &= \frac{1}{172} (-4 + \alpha s - s + pK - pK\alpha)^2
\end{align*}
\]

Subgame \(MMM\)
\[
\begin{align*}
\pi_{1}^{MMM} &= \frac{1}{172} (6 + \alpha ps - s + pK - pK\alpha)^2 \\
\pi_{1}^{MMM} &= \frac{1}{172} (12 + \alpha ps - s + pK - pK\alpha)^2 \\
\pi_{1}^{MMM} &= \frac{1}{172} (-12 + 5\alpha ps - 5s + 5pK - 5pK\alpha)^2
\end{align*}
\]

Subgame \(NM\)
\[
\begin{align*}
\pi_{1}^{NM} &= \frac{1}{144} (624 + 211\alpha s + 232K - 232K\alpha - 232s)^2 \\
\pi_{1}^{NM} &= \frac{1}{144} (-2224 + 49\alpha s + 280K - 280K\alpha - 280s)^2 \\
\pi_{1}^{NM} &= \frac{1}{144} (3312 + 737\alpha s + 560K - 560K\alpha - 560s)^2
\end{align*}
\]

Subgame \(NMM\)
\[
\begin{align*}
\pi_{1}^{NMM} &= \frac{1}{144} (-292 + 51\alpha s + 48K - 48K\alpha - 48s)^2 \\
\pi_{1}^{NMM} &= \frac{1}{144} (-192 + 17\alpha s + 16K - 16K\alpha - 16s)^2 \\
\pi_{1}^{NMM} &= \frac{1}{144} (-292 + 51\alpha s + 48K - 48K\alpha - 48s)^2
\end{align*}
\]

Subgame \(MN\)
\[
\begin{align*}
\pi_{1}^{MN} &= \frac{1}{144} (576 + 144\alpha s + 645K - 645K\alpha - 645s)^2 \\
\pi_{1}^{MN} &= \frac{1}{144} (-1624 + 47\alpha s + 56K - 56K\alpha - 56s)^2 \\
\pi_{1}^{MN} &= \frac{1}{144} (246016 + 9\alpha s + 16K - 16K\alpha - 16s)^2
\end{align*}
\]
\[ \pi^{MNM} = \frac{1}{2592} (-256 + 64K - 64K\alpha - 64s + 67\alpha s)^2 \]

where \( i \) represents every bank which does not merge.

Subgame \( MS \)
\[ \pi^M_S = \frac{1}{1000} (-12 - 5K + 5K\alpha + 5s - 4\alpha s)^2 \]
\[ \pi^S_M = \frac{1}{7056} (42 - 7K + 7K\alpha + 7s + \alpha s)^2 \]
\[ \pi^M_S = \frac{1}{50448} (84 - 7K + 7K\alpha + 7s - 20\alpha s)^2 \]

where \( i \) represents the banks which compete with \( M \) and \( S \).

Subgame \( MNS \)
\[ \pi^N_M = \frac{1}{1000} (34 + 10K - 10K\alpha - 10s + 7\alpha s)^2 \]
\[ \pi^M_S = \frac{1}{40464} (-34 + 12K - 12K\alpha - 12s + 5\alpha s)^2 \]
\[ \pi^N_S = \frac{1}{9248} (-34 + 8K - 8K\alpha - 8s + 9\alpha s)^2 \]

where \( i \) represents every bank which does not merge.

Subgame \( NMS \)
\[ \pi^N_M = \frac{1}{3072} (96 + 24K - 24K\alpha - 24s + 13\alpha s)^2 \]
\[ \pi^M_S = \frac{1}{12288} (-184 + 64K - 64K\alpha - 64s + 31\alpha s)^2 \]
\[ \pi^N_S = \frac{1}{6192} (-136 + 32K - 32K\alpha - 32s + 21\alpha s)^2 \]

APPENDIX 2

The equilibrium profits of the alliance subgames are the following:

Subgame \( N \)
\[ \pi^N_N = \frac{1}{8} (3\alpha s + 32)^2 \]
\[ \pi^N_S = \frac{1}{64} (32 - 3\alpha s)^2 \]

where \( i \) represents every bank which does not cooperate with other bank.

Subgame \( NN \)
\[ \pi^N_N = \frac{1}{8} \]

Subgame \( NNM \)
\[ \pi^N_{NM} = \frac{1}{37328} (96 + \alpha s - 8K + 8K\alpha + 8s)^2 \]

where \( n_1 \) represents the bank which forms an regional alliance and competes with banks which do not form an alliance.

\[ \pi^N_{NM} = \frac{1}{37328} (-96 + 7\alpha s + 16K - 16K\alpha - 16s)^2 \]

where \( n_2 \) represents the bank which forms an regional alliance and competes with banks which form an alliance.

\[ \pi^N_{NM} = \frac{1}{37328} (96 + 31\alpha s + 40K - 40K\alpha - 40s)^2 \]
\[ \pi^N_{NM} = \frac{1}{37328} (-96 + 25\alpha s + 16K - 16K\alpha - 16s)^2 \]

where \( i \) represents every bank which is not involved in agreement \( M \).

Subgame \( NMNM \)
\[ \pi^N_{NMNM} = \frac{1}{512} (32 + 5\alpha s - 8s + 8K - 8K\alpha)^2 \]
\[ \pi^N_{NMNM} = \frac{1}{512} (-32 + 5\alpha s - 8s + 8K - 8K\alpha)^2 \]

Subgame \( S \)
\[ \pi^S_S = \frac{1}{256} (6 + 8\alpha s)^2 \]
\[ \pi^S = \frac{1}{2s} (6 - \alpha s)^2 \]

Subgame SS
\[ \pi^S_S = \frac{1}{2} \] where \( s \) represents every bank which is involved in agreement \( S \).

Subgame SMS
\[ \pi^S_{NM} = \frac{1}{2s} (6 - K + K\alpha + s)^2 \]
\[ \pi^S_{MM} = \frac{1}{2s} (3\alpha s + 5K - 5K\alpha - 5s + 12)^2 \]
\[ \pi^S_{SMS} = \frac{1}{2s} (-12 + 3\alpha s + K - K\alpha - s)^2 \] where \( i \) represents any bank which is not involved in any alliance.

Subgame SMMS
\[ \pi^S_{NMS} = \frac{1}{2s} (-6 + \alpha s + 2K - 2K\alpha - 2s)^2 \]
\[ \pi^S_{MM} = \frac{1}{2s} (6 + \alpha s + 2K - 2K\alpha - 2s)^2 \]

Subgame M
\[ \pi^M_M = \frac{1}{2s} (12 + 5\alpha s - 5s + 5K - 5K\alpha)^2 \]
\[ \pi^M_i = \frac{1}{2s} (-6 + \alpha s - s + K - K\alpha)^2 \] where \( i \) represents any bank which is next to bank \( m \) and competes directly with it.
\[ \pi^M_m = \frac{1}{2s} (-12 + \alpha s - s + K - K\alpha)^2 \] where \( m \) represents any bank which is not next to bank \( m \) and does not compete directly with it.

Subgame MMM
\[ \pi^M_{MM} = \frac{1}{2s} (4 + \alpha s - s + K - K\alpha)^2 \]
\[ \pi^M_{E-BF} = \frac{1}{2s} (-4 + \alpha s - s + K - K\alpha)^2 \]

Subgame MMMM
\[ \pi^M_{MMM} = \frac{1}{2s} (6 + \alpha s - s + K - K\alpha)^2 \]
\[ \pi^M_{MM} = \frac{1}{2s} (12 + \alpha s - s + K - K\alpha)^2 \]

Subgame NMS
\[ \pi^N_{NMS} = \frac{1}{1472} (\alpha s + 96 - 8K + 8K\alpha + 8s)^2 \] where \( n1 \) represents any bank which is involved in a \( N \)-type alliance and competes with one bank which is not involved in an alliance.
\[ \pi^N_{NMS} = \frac{1}{1472} (-96 + 7\alpha s + 16K - 16K\alpha - 16s)^2 \] where \( n2 \) represents any bank which is involved in a \( N \)-type alliance and competes with one bank which is not involved in a \( M \)-type alliance.
\[ \pi^N_{NMS} = \frac{1}{1472} (96 + 31\alpha s + 40K - 40K\alpha - 40s)^2 \] where \( m1 \) represents any bank involved in type-\( M \) alliance and located in city I.
\[ \pi^N_{NMS} = \frac{1}{1472} (-96 + 25\alpha s + 16K - 16K\alpha - 16s)^2 \] where \( i \) represents any bank which is not involved in an alliance and is located in city II.
\[ \pi^N_{NMS} = \frac{1}{1472} (-13 + 3\alpha s + K - K\alpha - s)^2 \] where \( j \) represents any bank which is not involved in an alliance and is located in city II.
\[ \pi^N_{NMS} = \frac{1}{1472} (7 - K + K\alpha + s)^2 \] where \( n3 \) represents any bank which is involved in a \( N \)-type alliance and competes with banks which are not involved in an alliance.
\[ \pi^N_{NMS} = \frac{1}{1472} (19 + 5K - 5K\alpha - 5s + 3\alpha s)^2 \] where \( m2 \) represents any bank involved in type-\( M \) alliance and located in city II.

Subgame NM
\[ p_{m1}^{NM} = \frac{1}{128} (96 + 31\alpha s - 40s + 40K - 40K\alpha)^2 \] where \( m1 \) represents any bank involved in type-\( M \) alliance and located in city I.

\[ p_{m1}^{NM} = \frac{1}{128} (-96 + 7\alpha s - 16s + 16K - 16K\alpha)^2 \] where \( n1 \) represents any bank which is involved in a \( N \)-type alliance and competes with a bank which is involved in \( M \)-type alliance and with a bank which is not involved in any alliance.

\[ p_{n2}^{NM} = \frac{1}{128} (96 + \alpha s + 8s - 8K + 8K\alpha)^2 \] where \( n2 \) represents any bank which is involved in a \( N \)-type alliance and competes with a bank which is not involved in any alliance and competes with banks which do not form an alliance.

\[ p_{i}^{NM} = \frac{1}{128} (-96 + 25\alpha s - 16s + 16K - 16K\alpha)^2 \] where \( i \) represents a bank which is not involved in any alliance and competes with banks which do not form an alliance.

\[ p_{m2}^{NM} = \frac{1}{128} (12 + 5\alpha s - 5s + 5K - 5K\alpha)^2 \] where \( m2 \) represents any bank involved in type-\( M \) alliance and located in city II.

\[ p_{j}^{NM} = \frac{1}{128} (-6 + \alpha s - s + K - K\alpha)^2 \] where \( j \) represents a bank which is not involved in any alliance and competes with \( M \)-type alliances.

\[ p_{k}^{NM} = \frac{1}{128} (-12 + \alpha s - s + K - K\alpha)^2 \] where \( k \) represents a bank which is not involved in any alliance and competes with banks which are not involved in any alliance.

Acuerdo \( MNM \)

\[ p_{m1}^{MN} = \frac{1}{128} (32 + 5\alpha s - 8s + 8K - 8K\alpha)^2 \] where \( m1 \) represents any bank involved in type-\( M \) alliance and located in city I.

\[ p_{n}^{NM} = \frac{1}{128} (-32 + 5\alpha s - 8s + 8K - 8K\alpha)^2 \]

\[ p_{m2}^{NM} = \frac{1}{128} (4 + \alpha s - s + K - K\alpha)^2 \] where \( m2 \) represents any bank involved in type-\( M \) alliance and located in city II.

\[ p_{i}^{MN} = \frac{1}{128} (-4 + \alpha s - s + K - K\alpha)^2 \]

Acuerdo \( MS \)

\[ p_{M}^{MS} = \frac{1}{256} (6 - K + K\alpha + s)^2 \]

\[ p_{m1}^{AC-BF} = \frac{1}{128} (12 + 3\alpha s + 5K - 5K\alpha - 5s)^2 \] where \( m1 \) represents a bank which is involved in type-\( M \) alliance and competes with \( N \)-type alliance.

\[ p_{i}^{AC-BF} = \frac{1}{128} (-12 + 3\alpha s + K - K\alpha - s)^2 \] where \( i \) represents a bank which is not involved in any alliance and competes with \( N \)-type and \( M \)-type alliances.

\[ p_{j}^{AC-BF} = \frac{1}{256} (-6 + \alpha s - s + K - K\alpha)^2 \] where \( j \) represents a bank which is not involved in any alliance and competes with \( M \)-type alliances.

\[ p_{m2}^{AC-BF} = \frac{1}{128} (5\alpha s - 5s + 5K - 5K\alpha + 12)^2 \] where \( m2 \) represents a bank which is involved in type-\( M \) alliance and competes with banks which do not form an alliance.

\[ p_{k}^{AC-BF} = \frac{1}{128} (-12 + \alpha s - s + K - K\alpha)^2 \] where \( j \) represents a bank which is not involved in any alliance and competes with banks which do not form an alliance.

Subgame \( MSM \)

\[ p_{M}^{MSM} = \frac{1}{256} (6 - \alpha s - 2K + 2K\alpha + 2s)^2 \]

\[ p_{m1}^{MSM} = \frac{1}{256} (-6 - \alpha s - 2K + 2K\alpha + 2s)^2 \] where \( m1 \) represents any bank involved in type-\( M \) alliance and located in city I.
\[ \pi^M_{SM} = \frac{1}{256} (-4 - \alpha s + s - K + K\alpha)^2 \] where \( m2 \) represents any bank involved in type-\( M \) alliance and located in city II.

\[ \pi^M_{SM} = \frac{1}{256} (4 - \alpha s + s - K + K\alpha)^2 \]

Subgame \( M_{SMN} \)

\[ \pi^M_{SMN} = \frac{1}{256} \left( 6 - \alpha s - 2K + 2K\alpha + 2s \right)^2 \] where \( m1 \) represents any bank involved in type-\( M \) alliance and located in city I.

\[ \pi^M_{SMN} = \frac{1}{256} \left( -6 - \alpha s - 2K + 2K\alpha + 2s \right)^2 \]

Subgame \( \xi \)

\[ \pi^\xi_i = \frac{1}{256} \left( 5\alpha s - 5s + 8K - 8K\alpha + 32 \right)^2 \] where \( i \) represents any bank which is involved in alliance \( \xi \).

\[ \pi^\xi_j = \frac{1}{256} \left( -32 + 5\alpha s - 5s + 8K - 8K\alpha \right)^2 \] where \( j \) represents any bank which is not involved in alliance \( \xi \).

In Subgames \( \mu, \mu \mu \) and \( \xi \xi \) equilibrium profits equal to \( \frac{1}{8} \).