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Abstract

In a two-stage game, we study under what conditions banks offer phonebanking (first stage). In the second stage, they are competitors in the market for deposits. Offering the phone option creates two opposing effects. The first is a demand effect as depositors strictly prefer to manage some of their financial transactions by phone. The second (strategic) effect is that competition is increased as transaction costs are lowered. Universal phonebanking prevails when the demand effect dominates the strategic effect. Specialization can occur in that one bank offers the phone option while the other does not.

Keywords: Banking competition; Industrial organization; Applied microeconomics

JEL classification: D21, D42, D43

1. Introduction

Technological innovation over the past decade redesigned the art of competition in banking. Recently, the innovation 'phonebanking' appeared as a "banking facility which can be accessed remotely by a customer via his or her telephone"

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(Essinger, 1992, p. 152). Phonebanking facilities include, for example, statement and check book ordering, third party payments and up to date account information. [1] The number of banks offering this kind of access has increased substantially during the recent past. In Belgium, France, Germany, the United Kingdom and Sweden, virtually all major banks offer phonebanking. The percentage of these banks' depositors using this innovation ranges from 2 to 15 for Belgium, 3 to 50 for France and 3 to 100 for the United Kingdom. [2]

In our model, depositors value a phonebank since it facilitates access to their account. Using the phone option reduces their *transaction* costs to manage their account. For example, it may lower their travelling costs. Therefore, depositors are willing to accept lower deposit rates in order to become clients at a phonebank. [3]

The paper considers a spatial duopoly. It analyzes whether banks will offer phonebanking to their clients or not and what the effects upon their market shares, deposit rates, and profits will be. A deposit market with related financial services is modelled as a two-stage game. In the first stage, banks decide whether to introduce the phone option or not. In the second stage, banks compete in deposit rates. We apply a model related to the Salop (1979) circle model. At a phonebank, depositors can exercise some financial transactions by phone. Using the phone option has the same cost for every depositor. Graphically, the phone option can be modelled as the center of a circle: the distance from the center is the same for every point on the circle. [4] Each depositor, being a client at a phonebank, has the opportunity to exercise some of his or her transactions at a fixed cost. [5]

Offering the phone option has two opposite effects. First, it makes the bank offering that option more attractive to depositors (demand effect). Second, it encourages competition among banks as it implies lower transaction costs (strategic effect). Banks do not offer the phone option (*no phonebanking*) if the strategic effect dominates. Only one bank offering the phone option (*specialization*) requires a relatively large demand effect and a moderate strategic effect. Two phonebanks (*universal phonebanking*) appear if the demand effect overwhelms the strategic effect. Since universal phonebanking implies lower transaction costs, it leads to tougher competition than no phonebanking.

[1] A formally equivalent idea has already been in existence for some time: depositors use envelopes to order their financial transactions by mail.

[2] For an overview of the importance of phonebanking, see BEUC (1992) and BIS (1993).

[3] Heffernan (1992) computes the interest equivalence for a list of nonprice characteristics of bank products but excludes the phone option.

[4] Henriet and Rochet (1991) consider a similar framework to analyze competition in the distribution of insurance. Insurance intermediaries are located along the circle and a direct writer is located at the center of the circle. The cost to approach the direct writer is uniformly high for all buyers of insurance (represented by the length of the radius).

[5] Some banks introduced a phone number per phone area. Therefore, the cost for a depositor to use the phone option is the same for all depositors irrespective of their location.

Silber (1983) offers an overview of the process of financial innovations. His main hypothesis is that "new financial practices are innovated to lessen the financial constraints imposed on firms" (p. 89). Both external and internal constraints are at the origin of their innovative activity. This paper studies the competitive effects of phonebanking as an option for clients to execute their financial transactions when banks are competitors in the market for deposits. In this way, innovation in the financial services industry is the result of *strategic* positioning.

Matutes and Padilla (1994) address the effect of ATM compatibility on banking competition in the deposit market. They show that either full incompatibility or partial compatibility occurs. Full compatibility never constitutes a Perfect Coalition-Proof Nash equilibrium in pure strategies. A coalition of two compatible banks vetoes full compatibility since the competitive effects dominate the increase in network effects. Phonebanking however, contains *no* network effects, since the cost of exercising a transaction by phone is independent of the number of banks offering the phone option. Therefore, we do not need more than two banks for the analysis.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 offers the solution of the game and interprets the results. Section 4 concludes.

2. A model of spatial phonebanking competition on the circle

Two banks A and B, each consisting of a single branch, are located on a circle with unit circumference. [6] By convention, they are located at distance $1/2$ from each other. [7] (See Fig. 1.)

Banks compete for the deposits of individuals located along the circle. Competition is modelled as a two-stage game. At stage one, banks simultaneously decide whether to offer their depositors the phone option or not. The introduction of this technology is costless for both banks. We assume that the processing cost for the bank of a transaction executed by phone or at a branch is the same. This cost is normalized at zero. At stage two, given the decision by the two banks about stage one, they simultaneously set deposit rates r_i, with $i = A, B$. Deposits are invested and generate a fixed return $R \geqslant r_i$. [8] The profit of bank i is $\pi_i = (R - r_i)y$ with y the amount of deposits attracted.

[6] One could think of a town or a district where a bank opens only one branch.

[7] This specific location setting will generate analogous conclusions as in a traditional Hotelling model where banks A and B are located at 0 and 1, respectively.

[8] The paper takes the existence of the banking firm as a given and focuses only on its liability side.

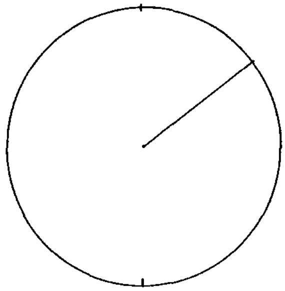

Fig. 1. The circle model.

Table 1
Overview of financial transactions

	Location-specific	*Non-location-specific*
Branch-specific	H	M
Non-branch-specific	h	m

Depositors are uniformly distributed with density one along the circle and competition is such that all depositors open a deposit account. Each depositor invests on average one normalized unit of money at only one of the two banks.

Depositors exercise a fixed number of four different financial transactions (see Table 1). [9]

The first two kinds arise when the depositor is at his home location. We call these *location-specific*. Each depositor has a well-defined location (i.e. his home location) and from this point he exercises H *branch-specific* and h *non-branch-specific* transactions. Examples of *branch-specific* transactions are deposits or withdrawals of cash which clearly need a visit to the branch. A depositor located at z visits its branch always via the shortest arc length implying a transportation cost $k + tz$, with $k > 0$ as the constant term and $t > 0$ the per-unit distance parameter. An economic interpretation for k is the average cost in waiting time that every depositor incurs before getting served at the bank desk. Examples of *non-branch-specific* transactions include provisions, transfers, and payments which do not need a visit to the branch. If a bank offers its depositors the phone option, two possibilities exist for the exercise of *non-branch-specific* transactions: depositors either phone their bank at a fixed cost $\tau > 0$, or visit their bank and face the above transportation cost k plus t per-unit distance. We will assume throughout

[9] We assume that the number of each type of transaction is already the result of an optimization procedure. Their fixed character, however, simplifies calculation.

the analysis that $k \geqslant \tau$. This implies that all depositors prefer the phone option for the *non-branch-specific* transactions. [10]

The other two transactions are *non-location-specific* and occur during travelling time. The notion of *non-location-specific* means that if a depositor travels to some point on the circle, he can execute financial transactions from that point. We assume that the depositors arrive at some place on the circle, according to the uniform distribution. [11] Again, there are *branch-specific* and *non-branch-specific* transactions. Then, the expected cost for M *branch-specific* transactions equals $M(k+t/4)$, since the expected distance to the depositor's bank is $1/4$. The expected cost for m *non-branch-specific* transactions in case no phone option is available, is obtained in a similar fashion. If the phone option is available, all depositors prefer it, since $k \geqslant \tau$.

If x is bank A's market share, the depositor who is indifferent between two non-phonebanks A and B is located at $x/2$ such that

$$r_A - (H+h)\left(k+t\frac{x}{2}\right) - (M+m)\left(k+\frac{t}{4}\right) = r_B - (H+h)\left(k+t\frac{(1-x)}{2}\right) - (M+m)\left(k+\frac{t}{4}\right). \quad (1)$$

In Eq. (1), the *non-location-specific* transactions cancel out. In other words, banks are perfect substitutes for these transactions.

The depositor who is indifferent between phonebank A and non-phonebank B is located at $x/2$ such that

$$r_A - H\left(k+t\frac{x}{2}\right) - h\tau - M\left(k+\frac{t}{4}\right) - m\tau = r_B - (H+h)\left(k+t\frac{(1-x)}{2}\right) - (M+m)\left(k+\frac{t}{4}\right). \quad (2)$$

In Eq. (2) m-transactions do not longer cancel out. In addition, the *non-branch-specific* transactions imply a lower cost at the phonebank. These differences in transaction costs have an impact on the marginal depositor.

The depositor who is indifferent between two phonebanks A and B is located at $x/2$ such that

$$r_A - H\left(k+t\frac{x}{2}\right) - h\tau - M\left(k+\frac{t}{4}\right) - m\tau = r_B - H\left(k+t\frac{(1-x)}{2}\right) - h\tau - M\left(k+\frac{t}{4}\right) - m\tau. \quad (3)$$

[10] In other words, offering the phone option is a quality improvement. In case $k < \tau$, best-response functions become kinked and discontinuous such that the existence of a Subgame Perfect Nash Equilibrium (SPNE) in pure strategies is not ensured.

[11] Matutes and Padilla (1994) introduce similar transactions; in their model, depositors need cash unexpectedly when 'travelling' around the city.

The terms concerning h-, m- and M-transactions disappear. Their fixed cost character explains this result. The market shares x and $1-x$ between two phonebanks are determined by the deposit rates and the H-transactions.

Some additional notation is introduced before moving to the following section. Denote by P_i phonebank i and by N_i non-phonebank i.

3. Solution of the game

We solve the game for its Subgame Perfect Nash Equilibria in pure strategies by the method of backward induction. Subsection 3.1 focuses on the equilibria for the game in stage two, given the decisions by the two banks taken in the first stage. The SPNE for the two-stage game are presented in Subsection 3.2.

3.1. Second stage competition: The choice of interest rates

There are three subgames [12] to be considered: two non-phonebanks (N_A, N_B) (Subsection 3.1.1), one phonebank only (P_A, N_B) (Subsection 3.1.2) and two phonebanks (P_A, P_B) (Subsection 3.1.3). In order to derive a Nash equilibrium in deposit rates for each subgame, we compute the best response functions for both banks, taking into account that the behavior of the indifferent depositor determines their market share. Section 3.1.4 interprets the results within and across subgames.

3.1.1. Subgame (N_A, N_B)

This subgame is comparable to a well-known model of product differentiation on the circle with linear transportation costs, since every depositor has to execute all transactions at the branch of his bank. From (1), bank A's market share is

$$x = \frac{1}{t(H+h)}\left(r_A - r_B + \frac{t(H+h)}{2}\right). \tag{4}$$

Substituting (4) into bank A's profit function, we obtain its best response function:

$$r_A = \frac{1}{2}\left(r_B - \frac{t(H+h)}{2} + R\right). \tag{5}$$

In a similar way, one finds the best response function for bank B. In equilibrium, each bank captures half of the market, charges the same deposit rate $r_A^*(N_A, N_B) = r_B^*(N_A, N_B) = R - t\ (H+h)/2$ and obtains as profit

$$\pi_A^*(N_A, N_B) = \pi_B^*(N_A, N_B) = \frac{t(H+h)}{4}. \tag{6}$$

[12] The same results apply for the cases where bank B is the first element in the tuple.

Table 2
Comparative statics for the (N_A, N_B) case

	t	H	h	M	m	$k-\tau$
r_i^*	–	–	–	0	0	0
x_i^*	0	0	0	0	0	0
π_i^*	+	+	+	0	0	0

Eq. (6) contains only *location-specific* transactions. The m- and M-transactions disappear because of a Bertrand result: banks are not differentiated with respect to these *non-location-specific* transactions.

Comparative statics for the (N_A, N_B) case are shown in Table 2. An increase in t enhances both banks' monopoly power, generating lower deposit rates and higher profits. Both types of *location-specific* transactions reduce the equilibrium deposit rate and increase profits. Changes in exogenous variables do not affect the equilibrium market share. The M-transactions and the difference $k-\tau$ do not influence the equilibrium deposit rate, market share and profits.

3.1.2. Subgame (P_A, N_B)

In the second subgame, only one bank offers the phone option. From Eq. (2), bank A's market share is

$$x = \frac{2}{t(2H+h)}\left(r_A - r_B + h(k-\tau) + m\left(k-\tau+\frac{t}{4}\right) + \frac{t(H+h)}{2}\right). \quad (7)$$

Substituting Eq. (7) into bank A's profit function, its best-response function equals

$$r_A = \frac{1}{2}\left(r_B - \frac{t(H+h)}{2} - h(k-\tau) - m\left(k-\tau+\frac{t}{4}\right) + R\right). \quad (8)$$

Substituting Eq. (7) into bank B's profit function, its best-response function becomes

$$r_B = \frac{1}{2}\left(r_A - \frac{tH}{2} + h(k-\tau) + m\left(k-\tau+\frac{t}{4}\right) + R\right). \quad (9)$$

From Eqs. (8) and (9) the equilibrium deposit rates for this subgame are:

$$r_A^*(P_A, N_B) = R - \frac{t(H+h)}{2} - \frac{h}{3}(k-\tau) + \frac{th}{6} - \frac{m}{3}\left(k-\tau+\frac{t}{4}\right) \quad (10)$$

and

$$r_B^*(P_A, N_B) = R - \frac{t(H+h)}{2} + \frac{h}{3}(k-\tau) + \frac{th}{3} + \frac{m}{3}\left(k-\tau+\frac{t}{4}\right). \quad (11)$$

The corresponding equilibrium market shares are:

$$x_A^*(P_A, N_B) = \frac{2}{t(2H+h)}\left(\frac{t(3H+2h)}{6} + \frac{h}{3}(k-\tau) + \frac{m}{3}\left(k-\tau+\frac{t}{4}\right)\right) \tag{12}$$

and

$$x_B^*(P_A, N_B) = \frac{2}{t(2H+h)}\left(\frac{t(3H+h)}{6} - \frac{h}{3}(k-\tau) - \frac{m}{3}\left(k-\tau+\frac{t}{4}\right)\right). \tag{13}$$

It follows that the equilibrium profits are:

$$\pi_A^*(P_A, N_B) = \frac{2}{t(2H+h)}\left(\frac{t(3H+2h)}{6} + \frac{h}{3}(k-\tau) + \frac{m}{3}\left(k-\tau+\frac{t}{4}\right)\right)^2 \tag{14}$$

and

$$\pi_B^*(P_A, N_B) = \frac{2}{t(2H+h)}\left(\frac{t(3H+h)}{6} - \frac{h}{3}(k-\tau) - \frac{m}{3}\left(k-\tau+\frac{t}{4}\right)\right)^2. \tag{15}$$

In this subgame, banks are clearly differentiated with respect to the m-, h- and H-transactions. As a consequence, these transactions enter into the profit functions.

Comparative statics for the (P_A, N_B) case are summarized in Table 3. Higher transportation costs reduce both banks' deposit rates. However, they affect the (non-) phonebank's market share in a (positive) negative way. The overall effect on profits is positive for both banks. *Location-specific* transactions increase the intermediation rate for both banks. The H-transactions reduce the phonebank's

Table 3
Comparative statics for the (P_A, N_B) case

	t	H	h	M	m	$k-\tau$
r_A^*	–	–	–	0	–	–
r_B^*	–	–	–	0	+	+
x_A^*	–	–	?	0	+	+
x_B^*	+	+	?	0	–	–
π_A^*	+	+	?	0	+	+
π_B^*	+	+	?	0	–	–

market share to the advantage of the non-phonebank and decrease the gains from differentiation. The effect of h-transactions on the deposit rate is negative, while the effect on market share and profits is ambiguous. The m-transactions and the difference in fixed costs $k-\tau$ reduce (increase) the (non-)phonebank's deposit rate and increase (reduce) market share. They both unambiguously enhance (reduce) the profits of the (non-) phonebank.

3.1.3. Subgame (P_A, P_B)

From Eq. (3), bank A's market share is

$$x = \frac{1}{tH}\left(r_A - r_B + \frac{tH}{2}\right). \tag{16}$$

Substituting Eq. (16) into bank A's profit function, we can derive its best response function:

$$r_A = \frac{1}{2}\left(r_B - \frac{tH}{2} + R\right). \tag{17}$$

Bank B's best-response function is similarly derived. In equilibrium, each bank captures half of the market and offers as deposit rate

$$r_A^*(P_A, P_B) = r_B^*(P_A, P_B) = R - \frac{tH}{2}. \tag{18}$$

The equilibrium profits are

$$\pi_A^*(P_A, P_B) = \pi_B^*(P_A, P_B) = \frac{tH}{4}. \tag{19}$$

Eq. (19) shows that the h-transactions do not enter the profit function for the same reason as the m- and M-transactions in Eq. (6). Banks are not differentiated with respect to the h-transactions, and price competition cannot be relaxed. Consequently, a Bertrand result appears.

Comparative statics are summarized in Table 4 and are similar to the (N_A, N_B) case except for the h-transactions.

3.1.4. Interpretation

Before moving to the first stage, some comparisons can be made about the deposit rates and market shares within and across the different subgames. First,

Table 4
Comparative statics for the (P_A, P_B) case

	t	H	h	M	m	$k-\tau$
r_i^*	–	–	0	0	0	0
x_i^*	0	0	0	0	0	0
π_i^*	+	+	0	0	0	0

$r_A^*(P_A, N_B)$ can either be larger or smaller than $r_A^*(N_A, N_B)$. This ambiguity stems from two reasons. The first is that in the (P_A, N_B) case more differentiation is introduced *vis-à-vis* the (N_A, N_B) case: all depositors strictly prefer the phone option for their m- and h-transactions being offered at bank A only. This results in a reduction of A's deposit rate as shown by the third and fifth term in Eq. (10). The same reasoning explains the opposite observation in Eq. (11) for bank B's deposit rate. The other reason is that less differentiation results in banks competing more strenuously for the same depositors: neighboring depositors become less captive, resulting in a reduction of their monopoly power. The fourth component in Eqs. (10) and (11) illustrates this effect. Adding up both effects generates the above ambiguity for bank A. For bank B, however, no ambiguity results, since $r_B^*(P_A, N_B) > r_B^*(N_A, N_B)$. The non-phonebank increases its deposit rate on deposits in order not to be driven out of the market.

Second, $r_B^*(P_A, N_B) > r_A^*(P_A, N_B)$. Bank A is differentiated from B and can use its monopoly power to charge a lower deposit rate.

Third, $r_A^*(P_A, N_B) < r_A^*(P_A, P_B)$. When both banks introduce the phone option, they are not differentiated with respect to their m- and h-transactions: a Bertrand result holds for these transactions. If bank B does not offer the phone option, more differentiation results. Depositors prefer bank A in order to execute their m- and h-transactions. Therefore, they become more captive *vis-à-vis* the situation where both banks offer the phone option. This results in a lower deposit rate. The same reasoning explains why $r_B^*(P_A, N_B)$ can either be larger or smaller than $r_B^*(P_A, P_B)$.

Fourth, $r_i^*(N_A, N_B) < r_i^*(P_A, P_B)$, with $i = A, B$. Both banks are differentiated with respect to their h-transactions when both banks do not offer the phone option. This is not the case if both banks offer the phone option. The introduction of the phone option unambiguously steps up competition between banks, yielding a higher deposit rate.

Fifth, $x_A^*(P_A, N_B) > x_B^*(P_A, N_B)$. The phonebank clearly attracts a higher market share *vis-à-vis* the subgames (N_A, N_B) and (P_A, P_B). Two effects can be distinguished in case bank A deviates from the (N_A, N_B) towards the (P_A, N_B) case. [13] One is the *demand effect* (the direct effect) through a change in market share given B's equilibrium deposit rate of the (N_A, N_B) case. This change equals

$$x_A(P_A, N_B)\,|_{(N_A,N_B)} - x_A^*(N_A, N_B)$$
$$= \frac{2}{t(2H+h)}\left(\frac{th}{4} + h(k-\tau) + \frac{m}{2}\left(k - \tau + \frac{t}{4}\right)\right) > 0 \tag{20}$$

and is positive since depositors strictly prefer to execute their m-and h- transactions by phone. The direct effect on profits is positive, since bank A's deposit rate

[13] See Tirole (1988, p. 281) for more details on these two effects.

decreases. The other is the *strategic effect* (the indirect effect) and captures the impact on A's (the phonebank's) profits through the change in B's (the non-phonebank's) deposit rate. The effect on market share is negative and equals

$$x_A^*(P_A, N_B) - x_A(P_A, N_B)\,|_{(N_A, N_B)}$$
$$= \frac{2}{t(2H+h)}\left(-\frac{th}{6} - \frac{h}{6}(k-\tau) - \frac{m}{6}\left(k - \tau + \frac{t}{4}\right)\right) < 0. \quad (21)$$

The change in deposit rate is positive, resulting in a negative strategic effect on profits. Adding up Eqs. (20) and (21), the total change in terms of market share becomes positive: a phonebank competing with a non-phonebank attracts a higher market share. The *total* effect on profits, however, is ambiguous.

Sixth, a simple welfare analysis shows that depositors are best off if both banks offer the phone option. The introduction of the phone option by only one bank also increases the welfare of the depositors. Both increases in welfare result from a combination of the competitive effects between banks and the decrease in transportation costs. The depositors strictly prefer (P_A, P_B) to (P_A, N_B) and (P_A, N_B) to (N_A, N_B).

Finally, using the terminology of Fudenberg and Tirole (1984), banks act as *puppy dogs* in their decision to offer the phone option. According to the above analysis, that decision negatively (positively) influences the opponent's market share (deposit rate), irrespective of his first stage decision. Due to the negative effect on the opponent's profit, offering the phone is a tough strategy. Since price competition yields strategic complements, the *puppy dog* strategy follows. As a result, banks show a tendency towards *underinvestment* in the phone technology.

3.2. First stage competition: Phone option decision

In the first stage of the game, the two banks simultaneously choose whether to introduce the phone option or not. They do so knowing that in the second stage they will compete in deposit rates as described in Subsection 3.1.

From Eqs. (1), (2) and (3), M-transactions do not affect the marginal depositor. Therefore, M equals zero without loss of generality. In what follows, we normalize $h + H + m = 1$. Then, m measures the percentage of *non-location-specific* transactions. For the sake of simplicity, assume $H = \alpha h$, so that $h = (1-m)/(1+\alpha)$ and $m \in [0, 1]$.

The following proposition characterizes all possible SPNE in pure strategies for the overall game.

Proposition. *Let* $H = \alpha h > 0$, $h + H + m = 1$,

$$\underline{m}(t) \equiv 1 - \frac{(4(k-\tau)+t)(\alpha+1)}{3t\sqrt{2(\alpha+1)(2\alpha+1)} + \alpha(4(k-\tau)-5t) - 3t}$$

and

$$\overline{m}(t) \equiv 1 - \frac{(4(k-\tau)+t)(\alpha+1)}{-3t\sqrt{2\alpha(2\alpha+1)} + \alpha(4(k-\tau)+7t)+3t}.$$

(*a*) *If* $m \in [0, \underline{m}(t)]$, *then no bank introduces the phone option* (*region I*).

(*b*) *If* $m \in [\underline{m}(t), \overline{m}(t)]$, *then only one bank introduces the phone option* (*region II*).

(*c*) *If* $m \in [\overline{m}(t), 1)$, *then both banks introduce the phone option* (*region III*).

Proof. Straightforward calculations show that $\pi_i^*(P_i, N_j) \leqslant \pi_i^*(N_i, N_j)$ if and only if $m \leqslant \overline{m}(t)$ and $\pi_j^*(P_i, P_j) \leqslant \pi_j^*(P_i, N_j)$ if and only if $m \leqslant \overline{m}(t)$, $i \neq j$ and for all $i, j \in \{A, B\}$. Notice that $\underline{m}(t) \leqslant \overline{m}(t)$.

(a) For $m \leqslant \underline{m}(t)$, we have that $\pi_i^*(P_i, N_j) \leqslant \pi_i^*(N_i, N_j)$ and $\pi_j^*(P_i, P_j) \leqslant \pi_j^*(P_i, N_j)$ hold, resulting in (N_A, N_B) as the unique SPNE.

(b) For $\underline{m}(t) \leqslant m \leqslant \overline{m}(t)$, we have that $\pi_i^*(P_i, N_j) \geqslant \pi_i^*(N_i, N_j)$ and $\pi_j^*(P_i, P_j) \leqslant \pi_j^*(P_i, N_j)$ hold. This results in (P_A, N_B) and (N_A, P_B) as the two SPNE.

(c) For $\overline{m}(t) \leqslant m$, we have that $\pi_j^*(P_i, P_j) \geqslant \pi_j^*(P_i, N_j)$ and $\pi_i^*(P_i, N_j) \geqslant \pi_i^*(N_i, N_j)$ hold, resulting in (P_A, P_B) as the unique SPNE. □

Fig. 2 illustrates the Proposition for given values of α, τ and k. We depict t on the horizontal and m on the vertical axis. The functions $\underline{m}(t)$ and $\overline{m}(t)$ represent

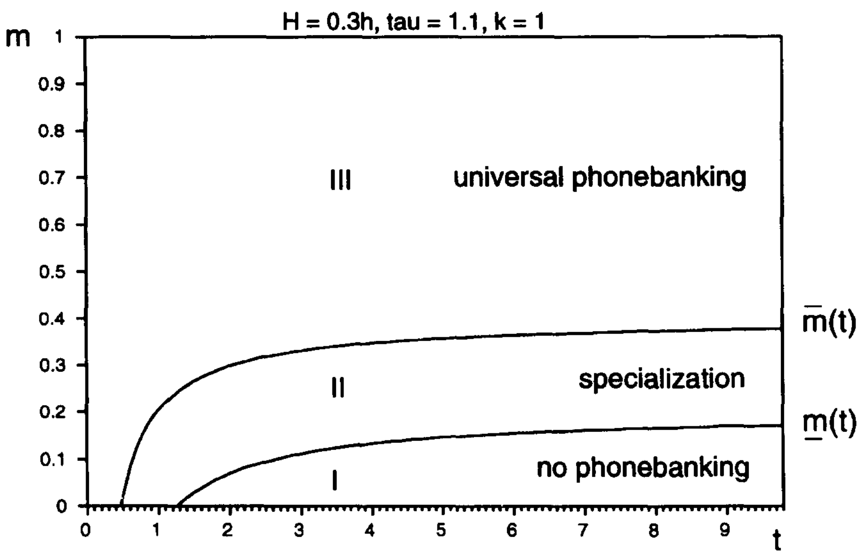

Fig. 2. The phone option decision.

the borderlines between regions *I* and *II*, *II* and *III*, respectively. From the normalization, the size of the regions is a measure for their relative importance.

The equilibrium outcome depends on the relative strength of the demand and strategic effect. Region *I* describes the parameter constellations for an equilibrium with *no phonebanking*. Introducing the phone option in that region implies a strategic effect outweighing the demand effect. Thus, although offering the phone option yields a higher market share, the percentage of m-transactions is too low to compensate for the encouraged competition. The higher their percentage, however, the more a depositor values a phonebank.

Region *II* satisfies the parameter constellations for *specialization*: only one bank offers the phone option. Specialization occurs whenever transportation costs are sufficiently high and m has intermediate values. Here, offering the phone option implies a demand effect dominating the strategic effect. Only in this region, the depositors' value for the phone option affects the marginal depositor. The phonebank appropriates part of its depositors' value for the phone option. Therefore, it enjoys a lower deposit rate and a larger market share compared to the non-phonebank. The latter does not offer the phone option, as it induces two effects. First, the percentage of m-transactions would not affect the marginal depositor's choice of bank anymore. Second, it would result in a lower degree of horizontal differentiation, enhancing competition. Adding up, the strategic effect overwhelms the demand effect. It is clear that a coordination problem arises with respect to who will become the phonebank. A sequential game where nature decides who moves first, could solve this problem.

Region *III* contains the parameter constellations where *universal phonebanking* takes place. Each bank individually decides to offer the phone option: the demand effect always dominates the strategic effect. Remark that (N_A, N_B) as well as (P_A, P_B) are standard models of product differentiation, the latter having lower costs of transportation. Therefore, in region *III* a Prisoner's dilemma situation occurs. Although not introducing the phone option would be more profitable for both banks, each bank individually decides to offer the phone option.

The borderline $\underline{m}(t)$ is upward-sloping and concave. The slope can be explained from Eqs. (6) and (14), where $\partial\pi_A^*(N_A, N_B)/\partial t > \partial\pi_A^*(P_A, N_B)/\partial t$ for any (m, t) satisfying $\underline{m}(t)$. For a given m, the strategic effect increases with t, whereas the demand effect is decreasing. An increase in the m-transactions countervails these two effects. That is, along this borderline, a bank needs more m-transactions when offering the phone as t increases. Concavity results from $\partial^2\pi_A^*(P_A, N_B)/\partial m^2 > 0$. In a similar way, one can explain the upward-sloping concave borderline $\overline{m}(t)$ separating regions *II* and *III*.

The demand effect becomes more important when the cost difference $k - \tau$ increases. In other words, the size of region *III* (universal phonebanking) increases. The opposite holds for region *I* (no phonebanking). The size of regions *I*, *II* and *III* depends upon the *underinvestment* effect. The *puppy dog* strategy enlarges the set of parameters satisfying regions *I* and *II*.

Two special cases remain. First, if $m = 1$, (P_A, N_B), (N_A, P_B) and (P_A, P_B) are SPNE. The second-stage equilibrium in both the (P_A, P_B) and (N_A, N_B) case is setting $r_i = R$. In cases (P_A, N_B) or (N_A, P_B), the phonebank's optimal deposit rate drives its non-phone competitor out of the market. (N_A, N_B) cannot be a SPNE, since one bank always makes strictly positive profits by offering the phone option. Then, the non-phonebank cannot strictly increase its profits with also offering the phone option. The same reasoning applies to the (P_A, P_B) equilibrium. Each SPNE enables all depositors to make use of the phone option. However, all gains from the phone technology are captured by depositors when both banks offer the phone option. Second, if $\alpha = 0$, the results for regions I and II of Fig. 2 remain intact. Region III, however, shows three SPNE: (P_A, P_B), (P_A, N_B) and (N_A, P_B). If both banks offer the phone option, they set deposit rates equal to R and realize zero profits. If only one bank offers the phone option, its optimal deposit rate is such that the non-phonebank is driven out of the market. It follows then that (P_A, P_B), (P_A, N_B) and (N_A, P_B) are SPNE for region III.

3.3. Collusion, fees, and multiproduct banks

Assume banks can collude in the second stage by signing some binding agreement. [14] Then, universal phonebanking will result. Offering the phone option induces only a demand effect. Banks fully appropriate the marginal depositor's decrease in travelling costs per depositor. Alternatively, any deposit rate fixed by government, encourages universal phonebanking.

Introducing more complicated contracts in this model will not necessarily alter our results. Take the case of a fee per (type of) transaction and a deposit rate. In practice, some banks charge a fee for phonebanking. In our model, however, a higher deposit rate will fully compensate this fee. The fee per (type of) transaction acts as a perfect substitute for the deposit rate, since the number of transactions is fixed. Deposit rate and fees, however, are no longer perfect substitutes if the number of transactions is endogenous. Also, spatial discrimination is not an alternative. Depositors can circumvent this by making an agreement with someone living closer to the bank.

Suppose a phonebank offers its depositors the choice between two products. In contrast to the first product, the second allows the depositor to use the phone option. With each product, the bank associates a deposit rate. Nearby depositors are most willing to buy product one if its associated deposit rate is sufficiently higher. Note that these two products do not affect the location of the marginal depositor between banks. Therefore, the multiproduct phonebank can not improve on profits. In other words, it is optimal for banks to practice 'pure bundling'. [15] Heterogeneity in the number of depositors' transactions would allow banks better

[14] See Fershtman and Gandal (1994).

[15] This stems with the statement that 'a bank offers an indivisible array of services' (see Tirole (1988, p. 160).

to discriminate among depositors. Differentiation between firms, however, seems to be more important for profitability than the possibility of discrimination (see Champsaur and Rochet, 1990).

4. Concluding remarks

We investigated the effects of phonebanking upon competition in the market for deposits. Our model shows that diverse equilibria occur. Two opposite effects are responsible for this diversity. First, the phone option reduces depositors' transaction costs. This creates a demand effect. Second, it encourages competition among banks through these lower transaction costs. This is the strategic effect. There is no phonebanking if the strategic effect dominates. Specialization appears for a relatively large demand effect and a moderate strategic effect. Universal phonebanking emerges if the demand effect overwhelms the strategic effect. The latter leads to tougher competition compared to no phonebanking. The competitive effects result in a tendency to underinvest in the phone technology. Depositors are best off with universal phonebanking.

We conclude with three possible extensions. First, if the phone option implies a reduction in processing costs, its attractiveness for banks increases. The competitive effects, however, remain. Second, one could make the number of financial transactions endogenous, following the Baumol–Tobin tradition (see Barro and Santomero, 1972; Santomero, 1979). One expects the average outstanding amount of deposits to be higher in case a of a phonebank. Therefore, the attractiveness of offering the phone option increases. Third, our results also remain valid in a slightly different model with some depositor heterogeneity in terms of the number of transactions. Price competition is relaxed in the (P_A, N_B) case. However, price competition is enhanced in the (P_A, P_B) case.

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