

# The cross-selling of bank credit and other services : a theoretical and empirical analysis.

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## Abstract

Several recent studies have shown that banks have increased their service activities in recent years. This paper studies the cross-selling of services and credit, that is services sold by a bank because of an already existing credit banking relationship. In the theoretical model, we suppose that banks anticipate the potential sale of services to their clients when competing on the credit market. The question is whether this particular attitude affects the pricing strategy of banks as well as the risk borne on their balance sheet. Two of the main results derived from the analysis of the model is that services provision implies a lower loan interest rate and an increase of the average riskiness of all projects ...nanced by banks. The study, undertaken in this paper, tests services provision as one of the explanatory variables of the credit rate, in twelve selected European countries during the period 1989-1999 for a sample of 1436 banks. The empirical results tend to con...rm the inverse impact of commissions revenue on loan interest rate.

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## 1 Introduction

The usual operational definition of a bank is an “institution whose current operations consist in granting commercial loans and receiving deposits from the public”<sup>1</sup>. Another service commonly provided by banks to their clients has been the management of current accounts in associated payment services, but this activity had not been fully priced in past years<sup>2</sup>. Banking activity has dramatically changed over the last two decades, due in part to financial liberalisation, as it is the case in European countries. Commercial banks have developed services in addition to their credit activity, the structure of bank revenue has been modified. Over the last few years, the share of the non-interest income of banks’ revenue has grown faster. For example, in Europe, the share of non-interest income increased<sup>3</sup> from 26% to 32% between 1989 and 1995, and from 32% to 41% between 1995 and 1998. Services provided by banks cover a large range of activities including the management of means of payment, advisory/consulting activities, brokerage services, capital market asset trading, securitisation, etc<sup>3</sup>...

Considering this evolution, we may wonder how the role of banks has changed and how the bank-customer relationship has been affected. The existence of banks, in this theoretical model, is justified by their capacity to reduce asymmetric and/or imperfect information. More precisely, their role consists of screening the demand for loans and monitoring firms indebted to them. We consider services provision as a bank activity: more specifically we envisage that services are bought from banks because of an already existing bank-firm relationship. Making loans is one of the primary activities of banks (along with the management of current and saving/deposit accounts). The resulting relationships, and the information the banks get from them, make it easier for banks to cross-sell services and other products to their clients.

One of the difficulties concerning the multiproduct provision of banking services is that the pricing of services has been the subject of government interference/regulation. For example Klein (1971), and Barro and Santomero (1972) have studied the demand for deposits and have pointed out in their respective articles that when the government imposes an interest rate ceiling on current and saving accounts, banks pay an implicit interest rate by setting charges for services below the compet-

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<sup>1</sup> Definition given by Freixas and Rochet (1997), p1.

<sup>2</sup> In this paper we are focusing primarily on retail commercial banking rather than investment banking. Therefore we are not dealing with fee income from investment banking.

<sup>3</sup> Based on data published in ‘EU Banks’ Income Structure’ prepared by the Banking Supervision Committee for the European Central Bank.

itive price. As Saunders and Schumacher (2000) show in their empirical study over the 1988-1995 period, the implicit interest rate (undercharged services) has a significant and positive impact on net interest margins. In the eighties, regulation concerning interest rates on current and saving accounts has tended to disappear. As a consequence of deregulation, banks have increased the share of the costs of services provision they charge to clients (Jacolin and Paquier (1995))<sup>4</sup>.

Our view is that the recent years may have seen the development of a new strategy: after the deregulation of deposit rates, when competing for market share on the loan market, banks anticipate the potential sale of services in future periods. We then wonder if this new activity enables banks to decrease the price of loans, which would explain a lower interest margin (even possibly dumping or loss leading). We are interested here by a possible cross-subsidisation on the loan market, and its effect on the riskiness of project that the bank chooses to finance and thus on the banks' risk behaviour.

The paper is organised as follows: section 2 develops a model using a principal-agent theory structure based on the paper of Covitz and Heitfeld (1999). The particular feature of the model here is the introduction of services in the profit function of banks. The aim of this model is thus to investigate the impact of services revenue as an explanatory variable of the loan interest rate, as well as its impact on banks' behaviour with regard to loan monitoring and entrepreneurs' behaviour concerning the risk level of their project. Section 3 first explains the logic of our testing method. It gives as well the data sample on which regressions will be run. At last, this section presents the results of the tested relationship between loan interest rate and commissions revenue. Finally, section 4 concludes.

## 2 The model

In this model, a bank provides credit to one firm in the first period. The latter will pay back its loan at the end of this period. While lending to the firm, the bank develops a banking relationship with its client that may potentially enable the bank to sell services in the second period. Our aim is to understand how selling services can alter firms' behaviour towards project risk.

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<sup>4</sup>Another issue could be the effect in terms of efficiency. When banks charge the real price for services they provide to their clients, they eliminate cross-subsidisation between clients.

## 2.1 Model presentation

### 2.1.1 Sequence of events

Depending on the market structure of the economy, the interest rate is fixed either by the bank, in the case it is a monopolist in the lending market, or by the firm, in the case where the lending market is competitive. Both the entrepreneur and/or the bank can accept or refuse this credit rate. If they agree on the rate, the bank has two possibilities: (i) it monitors the loan, and if the risky project has been chosen, it recalls the loan; or (ii) it does not monitor the loan.

This sort of game is typically resolved by backward induction, that is, the second stage is determined and then the first one. For a given level of interest rate, the probability of monitoring and the probability of choosing the safe project are calculated. And given these values and the market structure, interest rates are determined as agents' behaviour is anticipated. See appendix A.

### 2.1.2 Borrowers/Firms

The firm is regarded to be an entrepreneur who may undertake two kinds of project: a safe project which yields a gross return  $s$  with quasi certainty, that is with probability  $\phi$  very close to one,  $\Pr(\text{return} = s) = \phi$ , and a risky project which yields either a gross return  $u$  with probability  $\mu$  or zero with probability  $(1 - \mu)$ ,  $\Pr(\text{return} = u) = \mu$ , with  $s < u$  and  $\mu < \phi$ .

To finance a project, a (non-bank) firm needs one monetary unit, which is borrowed entirely from its bank. The firm will repay its loan at the end of the first period and is assumed to be risk neutral. Ex-ante the bank cannot observe which project is chosen, but it can observe during the period at cost  $m$ .

Let  $p_s$  refer to the probability of the firm choosing the safe project whereas  $(1 - p_s)$  will refer to the probability of it choosing the risky one.

Firms are subject to limited liability. They do not repay banks when their project fails, banks keep the remaining assets, and the value of entrepreneurs' equity is normalized to zero.

### 2.1.3 Banks

Let  $r_f$  denote the gross interest rate of the risk-free asset in the economy, and the interest rate paid on current accounts. This cost of funds represents the opportunity cost for a bank in case the firm project fails.

In accordance with regulations, a bank needs to hold an amount  $k$  of shareholder capital in proportion of the bank balance sheet size. Thus, it has to collect an amount  $(1 - k)$  of deposits to lend one monetary unit

of investment funds<sup>5</sup>. The bank is assured to be neutral towards risk.

In this paper, we consider the bank as a specialist enterprise which sells credit and services (the latter is defined as generating commissions and fees). Given the relationship developed with its borrower, the bank will sell services to her in the second period with a positive probability. The expected present discounted level of both commissions and fees, earned from this activity, is denoted by  $c$ . The payment of commissions is conditional on the success of the entrepreneur's project because resources are necessary to pay expenses and on the probability that they will purchase services from you rather than a competitor. We suppose that the market for bank services is at least partially contestable<sup>6</sup>.

The bank has the opportunity to monitor a loan it has agreed upon at a present discounted cost  $m$ . If the firm chooses to undertake the risky project, monitoring will enable the bank to recall its loan. In this situation, because of credibility, banks will not propose the firm to finance the safe project: if after choosing the risky project, firms are monitored, they cannot undertake the safe project. Let us suppose that banks lend funds for the safe project after detecting a risky project, then the strategy of entrepreneurs would be to always undertake the risky project first, and then, if monitored, to move on to the safe one<sup>7</sup>. One solution to constrain firms to directly choose the safe project is to preclude those that choose the risky project (but this is a state that banks can only observe by monitoring)<sup>8</sup>.

Banks have limited liability: if they fail, they do not have to entirely refund depositors. However funds are guaranteed by a deposit insurance fund, hence depositors do not monitor banks. The price of the deposit insurance is fixed and normalized to zero. Because of the existence of a deposit insurance scheme with a fixed rate premium, banks may choose to take on too much risk, and in this case we would say that they adopt a strong moral hazard attitude towards the deposit insurance fund. We suppose that prudential regulation is in place to limit this risk.

Given this basic structure we next need to make some assumptions

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<sup>5</sup>No deposit reserve requirement.

<sup>6</sup>With regard to the services market, competition also occurs between banks and non-bank financial intermediaries in certain market segments. In this paper, we concentrate on the effect of services activity on agents' behaviour and interest rates (and not on the determination of service' prices).

<sup>7</sup>Monitoring and sanctions would then be necessary to assure that firms choose the safe project.

<sup>8</sup>The condition to assure that the bank will find it more profitable to implement the behaviour described here is  $r < r_f + c + \frac{(1-\mu)}{\mu}kr_f + \frac{m}{\mu}$ , that is the interest rate that banks charged for loans to firms is not too high. We will see later that this condition is satisfied when monitoring is a profitable option for the bank.

on the relation between the safe return  $s$ , the unsafe return  $u$  and the risk free rate  $r_f$ <sup>9</sup>. These conditions are necessary<sup>10</sup> to guarantee that both projects have a positive probability to be undertaken and that the bank will lend funds to an entrepreneur who wishes to undertake one of them.

#### Assumption 1

$$0 < (s - r_f) < \mu(u - r_f)$$

The lower bound imposes that banks must find it profitable to lend funds to firms which choose to invest in the safe technology rather than in the risk-free asset. The upper bound means that, without monitoring, firms always have incentives to undertake the risky project<sup>11</sup>.

#### Assumption 2

$$m < (\mu - \mu)kr_f < \mu u$$

This assumption guarantees that monitoring occurs with a positive probability, the middle term representing the opportunity cost of choosing the unsafe project relatively to the safe one. When firms have undertaken the unsafe project and it happens to be unsuccessful, the opportunity cost banks face (compared to the case where they would have financed the safe investment) is higher than the cost of monitoring. However this cost is not high enough for banks not to take advantage of their limited liabilities: the upper bound signifies that banks may find it profitable to let firms undertake the unsafe project.

## 2.2 Firm and bank choices on investment and monitoring<sup>12</sup>

In this section, we suppose interest rates have been set up and we resolve the second stage that is the probability that banks monitor loans and the probability that firms choose the safe project under the alternative market structures.

Let us envisage the bank and firm earnings, respectively, in the payoff matrix :

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<sup>9</sup>Interest rate earned when investing in the risk free asset.

<sup>10</sup>We will see later that this condition is necessary but not sufficient to assure a positive profit for firms in case of monopoly lending.

<sup>11</sup>We remind the reader that  $r_f$  is the cost of funds for banks, and that firms and banks have limited liability. Moreover, note this condition does not guarantee, ex-ante, a positive profit for the bank.

<sup>12</sup>Most of the mathematical resolutions can be found in a previous paper and are available on demand.

	Bank	
	monitoring ( $p_m$ )	no monitoring ( $1-p_m$ )
Firm : safe project ( $p_s$ )	$p_s \circ (r_i - r_f + c) + (1 - p_s) \circ (s_i - r)$	$\mu \circ (r_i - r_f + c) + (1 - \mu) \circ (s_i - r)$
Firm : unsafe project ( $1-p_s$ )	$(i - m; 0)$	$\mu (r_i - r_f + c) + (1 - \mu) k r_f$

2 Bank pro...t:

- when the bank monitors the loan, its expected pro...t ( $\pi_b^m$ ) is:

$$\pi_b^m = p_s \circ (r_i - r_f + c) + (1 - p_s) \circ (s_i - r) + p_m m + (1 - p_m) \mu$$

- when the bank does not monitor the loan, its expected pro...t ( $\pi_b^{nm}$ ) is:

$$\pi_b^{nm} = p_s \circ (r_i - r_f + c) + (1 - p_s) \circ (s_i - r) + (1 - p_s) \mu (r_i - r_f + c) + (1 - p_s) (1 - \mu) k r_f$$

2 Firm pro...t:

- when the safe investment is chosen, the expected ...rm's pro...t  $\pi_f^s$  is:

$$\pi_f^s = p_s \circ (s_i - r) + (1 - p_s) \circ (s_i - r) = \circ (s_i - r)$$

- when the risky project is chosen, the expected ...rm's pro...t  $\pi_f^u$  is:

$$\pi_f^u = p_m \cdot 0 + (1 - p_m) \mu (u_i - r) = (1 - p_m) \mu (u_i - r)$$

The cost of services, denoted  $c$ , does not appear in the pro...t function of the ...rm since it belongs to the total cost that the ...rm bears. When buying services to banks, we suppose that the entrepreneur either uses services for a better management of its ...rm and/or has changed the provider of services (that is the ...rm is purchasing to the bank services it was used to buying to another seller).

When the ...rm chooses the safe project, the bank's pro...t is always higher when it has decided not to monitor. However we have to concentrate on the case where the ...rm chooses the unsafe project. Indeed the bank has two possibilities: monitoring or not monitoring. It will then choose the strategy that will enable it to earn the highest pro...t. Given the assumptions put forward above, there is an indetermination that we

have to resolve. To be able to do so, we have to determine condition on variables to know which one of these two projects is the highest.

The strategy of not monitoring will be more profitable for the bank if :

$$\begin{aligned} \mu(r - r_f + c) + (1 - \mu)kr_f &> i m \\ \mu r &> \mu r_f + \mu c + (1 - \mu)kr_f + i m \\ r &> r_f + c + \frac{1 - \mu}{\mu}kr_f + \frac{m}{\mu} \end{aligned}$$

The interest rate limit is:

$$e^s = r_f + c + \frac{1 - \mu}{\mu}kr_f + \frac{m}{\mu}$$

For a value of the loan rate higher than  $e^s$ , the bank will prefer to not monitor the loan if the firm chooses the unsafe project, and for a value less than  $e^s$  the bank will prefer to monitor it.

This critical interest rate is less than if banks are not selling services, which were  $r_f + \frac{1 - \mu}{\mu}kr_f + \frac{m}{\mu}$ .

- <sup>2</sup> For a value of the credit rate higher than  $e^s$ , there is a pure strategy: banks do not monitor loans and firms choose the risky project.
- <sup>2</sup> We now analyse the behaviour of banks and firms for value of the credit rate between  $(r_f + c)^{13}$  and  $e^s$ .

In this interval, the probability that banks monitor loans is no longer equal to zero. We now have to determine the strategy of the firm given that  $p_m$  is positive.

This equilibrium is defined under mixed strategy.

- The firm will prefer to undertake the safe project when:

$$\frac{1}{4}_f^s > \frac{1}{4}_f^u$$

$$(s - r) > (1 - p_m)\mu(u - r) \quad (1)$$

The choice of the firm will depend on the bank's behaviour.

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<sup>13</sup>The credit rate  $r$  has to be higher than  $r_f + c$ , and not  $r_f$ . The reason is the anticipation of the sale of services by the bank, sale of services conditional on an already existing bank-firm relationship. We remind the reader that  $r$  has to be higher than  $r_f$  (in a model without services) otherwise it would be more profitable for banks to hold the safe asset rather than granting a loan.

- A bank will prefer to monitor loans when:

$$\frac{1}{4}_b^m > \frac{1}{4}_b^{nm}$$

$$p_s(r_i r_f + c) + p_s(1 - \theta)kr_f + m > p_s(r_i r_f + c) + (1 - p_s)\mu(r_i r_f + c) + (1 - p_s)(1 - \mu)kr_f + p_s(1 - \theta)kr_f \quad (2)$$

The choice of the bank will depend on the firm behaviour.

From (1) we get the probability of monitoring loans and from (2) we get the probability of choosing the safe investment.

**Assumption 3**

$$e^s < \theta s$$

The gross return of the safe investment is high enough for the firm to repay the loan. This condition is sufficient but not necessary.

**Proposition 1** The equilibrium we obtain is as follows:

- for an interest rate  $r$ , such as  $(r_f + c) < r < e^s$ , the probability of monitoring and the probability of choosing the safe investment are:

$$p_m = 1 - \frac{\theta(s - r)}{\mu(u - r)}$$

$$p_s = 1 - \frac{m}{(1 - \mu)kr_f + \mu(r_i r_f + c)}$$

- for an interest rate  $r$ , such as  $e^s < r < u$ , the probability of monitoring loans and the probability of choosing the safe investment are equal to zero.

To facilitate comparison, if banks do not sell services, the probability that the bank monitors the firm and the probability that the firm chooses the safe project, for  $r_f < r < e^s$ <sup>14</sup>, are:

$$p_m = 1 - \frac{\theta(s - r)}{\mu(u - r)}$$

$$p_s = 1 - \frac{m}{(1 - \mu)kr_f + \mu(r_i r_f)}$$

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<sup>14</sup>  $e = r_f + \frac{1 - \mu}{\mu}kr_f + \frac{m}{\mu}$

We observe that when considering services activity, the behaviour of firms changes with regard to project choice whereas the behaviour of banks does not<sup>15</sup>. It is not affected by the introduction of this new activity that services represent. The probability of choosing the safe project  $p_s$  decreases for a given level of the credit rate. Hence firms have more incentives to choose the risky project. Therefore the sale of services by banks to firms influences the attitude of borrowers towards risk: for the same level of interest rate, banks now finance more risky projects than when they were just selling credit. The desire to supply services increases the risk of the bank's balance sheet.

## 2.3 Interest rate

Depending on the market structure of the economy, the credit rate  $r$  will be set either by banks or by borrowing firms.

### 2.3.1 Monopoly lending

The entrepreneur has no choice other than borrowing from one specific bank which has monopoly power in the market. Therefore the bank chooses the loan interest rate which maximises its profit subject to participation of the firm.

Given assumptions 1 and 3 of the model, the firm will always receive a non-negative profit.

<sup>2</sup> If  $r > e^a$ ;

then the probability of monitoring  $p_m$  equals zero and the probability of choosing the safe project  $p_s$  equals zero.

The bank profit is as follows:

$$\pi_b = \pi_b^{nm} = \mu (r - r_f + c) - (1 - \mu) k r_f$$

Profit is an increasing linear function of interest rate  $r$ .

**Proposition 2** A first equilibrium is not monitoring from banks and only unsafe investment undertaken by firms. Banks profit is then maximum for  $\bar{r}_m = u$ .

This interest rate is the same as when no services are sold, but the profit of the bank is higher. This increase in profit depends on the level of commissions and fees earned from services, and on the probability that the risky project succeeds.

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<sup>15</sup>We do not take into account yet here the effect of service provision on the interest rate level. We only compare agents' behaviour for a given level of interest rate.

<sup>2</sup> If  $(r_f + c) < r < e^a$ ;

the probability of monitoring and the probability of choosing the safe project are:

$$p_m = 1 - \frac{\mu(s - r)}{\mu(u - r)}$$

$$p_s = 1 - \frac{m}{(1 - \mu)kr_f + \mu(r_f + c)}$$

Given the definition of a mixed strategy, for these values of  $p_m$  and  $p_s$ , the bank is indifferent between monitoring and not monitoring i.e. the level of profit is the same in both situations. Therefore the simplest way of writing profit is:

$$\pi_b = p_s \mu (r - r_f + c) + p_s (1 - \mu) kr_f - m$$

**Proposition 3** The value of the loan interest rate which maximises bank profit is :

$$r_m = r_f + c + \frac{1 - \mu}{\mu} kr_f + \frac{1}{\mu} \frac{m}{\mu} \frac{r_f + c}{r_f + c}$$

For this value of the interest rate, the probability of choosing the safe project remains identical to the situation where banks sell only credit, but the probability of monitoring decreases<sup>16</sup>.

This rate is less than when banks do not sell services. The difference comes from the existence of services. Because of the revenue they get from their service activities, banks can set up a lower interest rate on loans. Services subsidise the credit activity of banks.

The profit function is locally concave. At its local maximum, the following assumption will assure a positive bank profit:

**Assumption 4**

$$p_m \frac{m}{(1 - \mu)kr_f + \mu(r_f + c)} > \frac{m}{\mu}$$

<sup>16</sup> Let us derive  $p_m$  with respect to  $r$ :  $\frac{\partial p_m}{\partial r} = \frac{\mu(s - r)}{[\mu(u - r)]^2}$ .  $p_m$  is an increasing function of  $r$ .

### 2.3.2 Competitive lending

In the case when lending market is competitive and firms are able to choose from whom they borrow. Therefore the economy-wide credit rate can be found by maximising firms' profits subject to bank participation. The latter should receive a non-negative profit.

<sup>2</sup> If  $r > e^a$ ;

then the probability of monitoring  $p_m$  equals zero and the probability of choosing the safe project  $p_s$  equals zero.

The firm profit is as follows:  $\pi_f = \pi_f^u = \mu(u - r)$

Profit is a decreasing linear function of interest rate. Firms will choose the lowest credit rate that guarantees bank participation.

**Proposition 4** The interest rate accepted by firms when they adopt a strong moral hazard attitude is such that bank profit is equal to zero, that is:  $\bar{r}_c = r_f + c + \frac{1-\mu}{\mu}k r_f$

This level of the loan interest rate is lower than when banks sell only credit. Firms, when setting the credit rate, take into account that banks have different sources of revenue<sup>17</sup>.

<sup>2</sup> For  $(r_f + c) < r < e^a$ ;

firm profit is equal to:  $\pi_f = \pi(s - r)$

As before, the interest rate will be set in order to ensure bank participation.

**Proposition 5** The loan interest rate when firms have a weak moral hazard behaviour is :

$$\bar{r}_c = r_f + c + \frac{c \left[ \frac{c}{2\mu} \left( \frac{1-\mu}{\mu} k r_f + r_f \right) \right]}{\left[ \frac{c}{2\mu} \left( \frac{1-\mu}{\mu} k r_f + r_f \right) \right]^2 + 4\mu k r_f \left[ \frac{c}{2\mu} \left( \frac{1-\mu}{\mu} k r_f + r_f \right) \right]}$$

Once more, we observe a lower interest rate than when the credit activity was the only source of revenue. Profit is still equal to zero, however the structure of banks revenue has changed. The share of interest-earning revenue has decreased at the advantage of the commissions and fees one.

<sup>17</sup>We remind the reader that services are not a new expense for firms; they were before either borne by the firms themselves, either supplied by other providers.

### 3 Empirical results

One of the main interests of our theoretical framework is to stress the link between the loan interest rate and the expected income from the sale of services. The sign of this link remains negative in both structures: monopolistic or competitive market. Thus, the first objective of the empirical work undertaken is to observe if data sustain the results found previously : does the sale of services have an inverse impact on the level of the loan interest rate<sup>18</sup>?

#### 3.1 Data sample

The major source of data for this study is balance sheet and income-statement information derived from IBCA's Bankscope Database. The data base is annualised and covers the period 1989-1999. One of the main advantage of the Bankscope Database is its attempt to standardise financial statements across countries, so as to enable reasonable cross-country comparison. The twelve countries chosen, initially, belongs to the European Union. One of the hypothesis of our theoretical model specify that banks which develop a credit relationship in the first period, will have the opportunity to sell more easily services to their credit clients in the second period. Therefore to satisfy our previous requirement of a bank-customer long term relationship (on both asset and deposit sides), only commercial banks are selected<sup>19</sup>. The number of banks in the sample for each country is as follows : Belgium(58), Denmark(51), France(315), Germany(247), Greece(22), Ireland(27), Italy(154) Luxembourg(127), Netherlands(63), Portugal(45), Spain(116) and UK(211).

Through the process, we also need the so-called "risk-free rate". Indeed banks' shareholders can invest their capital either in the risk-free asset of the economy or in the firm project through a bank loan. The return of the 10 years Government Bond has been chosen as the risk-free rate, rather than the return of the 3 months Treasury Bill. The former asset has a maturity closer to credit loans than the latter<sup>20</sup>. Series were

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<sup>18</sup>The second relationship described in the theoretical paper, which underlines the effect of commissions revenue on credit risk, will be studied in a forthcoming paper.

<sup>19</sup>IBCA-Fitch definition of commercial banks : The country specific specialisations are available for the 15 EU countries as well as for Switzerland and Japan. For banks of the EU and the EFTA countries, the Official Journal of the EU provides a classification of the listed banks according to their specialisation. These categories vary from one country to another since they are based on the declarations made to the European Commission by the relevant professional organisation of the member states. For Swiss banks, the classification is provided by the Commission Fédérale des Banques. For Japanese banks, it is supplied by the Federation of Bankers' Associations of Japan (Zenginkyo).

<sup>20</sup>One can argue that usually in the literature, the long term risk-free rate chosen

collected from Datastream, but Portugal which was collected from the OECD data.

### 3.2 Tested equations

The work presented in this paper is based on the theoretical work done previously. Therefore we use the loan interest rate found before, to model the equations. As it will be reminded all along this section, our purpose is not to test the specific equation of the model rather than the behaviour of banks with regard to the possible "cross-subsidisation" of services revenue and loan interest rate.

The aim of the test is to analyse the effect of the sale of services on the determination of the loan interest rate. However given the period studied, and because of the banking market deregulation, the spread loan interest rate minus risk-free rate is decreasing, and services revenue is increasing. Therefore one of the concern of our work is the effect of deregulation that we are careful to take into account when undertaking our empirical work.

The process of the empirical study will be driven in three steps : first, the monopoly market structure hypothesis is tested for each country overall the banks (no matter the competitive structure of the selected country). Secondly, the same procedure is repeated for the competitive market case. Finally, we take into account the results of the Herfindahl and C(5)<sup>21</sup> indexes to present our test according to the real nature of countries' market structures (as shown by the upnamed indexes).

#### 3.2.1 First step : monopoly market structure

If we consider the loan market as a monopoly, the loan interest rate is defined as follows in our theoretical model :

$$r = r_f + c + \frac{1}{\mu} k r_f + \frac{1}{\mu} m k r_f - 1 + \frac{\mu}{\mu}$$

The equation estimated is<sup>22</sup>:  $(r - r_f) = a_1 + a_2 c + a_3 (k : r_f) + a_4 (k : r_f : m)^{0.5}$

As said before, this equation will be estimated for a country whatever its market structure may be. It might be explained by the fact that

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is the 1 year Treasury Bill. Because of the countries considered initially and the sources of data available, the 10 years Government Bond offers larger availability of data.

<sup>21</sup>definition : for each country, total asset of the five first banks over the total asset of all banks.

<sup>22</sup>As stated at the beginning of the section we do not intend to test the specific equation, as we do not have included all the determinants of the spread. However such an equation enables us to grasp the different effects of the explicative variables, given the theoretical framework, and make the sign in front of c better determined.

the banking market structure can never be described either as a pure monopoly or as a pure competitive market. Therefore, running the test for the two extreme cases enable us to delimit the intermediate case.

Moreover we want to stress the fact that we study a behaviour rather than the definition of the loan interest rate<sup>23</sup>.

### 3.2.2 Second step : competitive market structure

If we consider the loan market as competitive, the loan interest rate is defined as :

$$r_c = r_f + c + \frac{c \cdot [[(1 - \mu) + \mu(1 - \theta)]k r_f + (\theta - \mu)m]_i}{2 \mu \cdot [[(1 - \mu) + \mu(1 - \theta)]k r_f + (\theta - \mu)m]_i^2 + 4 \mu k r_f [(\theta - \mu)m + (1 - \mu)(1 - \theta)k r_f]}$$

Considering the theoretical writing of the interest rate, and given the information collected, it is, with no more hypotheses, impossible to get further with regard to the test. Therefore, we consider several scenarios to generate the term in brackets (which we will refer to the name VARIOUS later on) depending on the hypotheses made on the values of  $\theta$ <sup>24</sup> and  $\mu$ <sup>25</sup>.

The equation estimated is:  $(r_i - r_f) = a_1 + a_2 c + a_3 \text{VARIOUS}$

### 3.2.3 Third step : test according to concentration indexes

In this third step, we do not properly undertake tests, but the results (previous ones) will be presented depending on the proper structure of each country's loan market.

## 3.3 Variables definition

Variables presented here are the ones used to test the relationship between the loan interest rate and services.

We undertake two sets of regressions, depending on how we define the variables (cf. below, either dividing by loans or by total asset).

The following variables is common to all the different sets of regression:

$r_f$  = risk free rate (of the 10 years Government Bond as said before)

<sup>23</sup>Our purpose is to point out the impact of  $c$  on  $r$ , not to be exhaustive on the explanation of  $r$ .

<sup>24</sup> $\theta$  is the probability that the safe project, undertaken by the entrepreneur, succeed. It is, by definition, very close to one.

<sup>25</sup> $\mu$  is the probability that the risky project succeed. It is by definition smaller than  $\theta$ .

### 3.3.1 Set 1<sup>26</sup>

$r$  = interest income / loans

spread =  $r_i - r_f$

$m$  = personal expenses / loans

For the variable  $c$ , two definitions are considered (for each of them, a specific regression is done within the set) :

1.  $c = \text{netcom} = \text{net commission revenue} / \text{loans}$

2.  $c = \text{com} = \text{commission income} / \text{loans}$

$k$  = equity / loans

For the monopoly structure :

$k:r_f = k \alpha r_f$

$m:k:r_f = (m \alpha k \alpha r_f)^{0.5}$

For the competitive structure : cf. the tested equation section for a definition of the VARIOUS variable, which is computed for three different values of both  $\alpha$  and  $\mu$  and given the definitions above.

Special case set 1 : for Denmark, France, Germany, Italy and Spain, the variable "Interest from Lending" is available. This definition of the data is closer to the one of our framework. So we did special regressions within this set 1 using this data in place of  $r = \text{interest income on loans}$ . For these regressions we have,  $r = \text{interest receivable from customers on loans}$  and spread =  $r_i - r_f$ .

### 3.3.2 Set 2

This second set of variables definition takes into account that the asset side of banks' balance sheet does not only include credit activity. Our aim is to approach a measure of variables considering this effect, and then to observe if it affects the results found previously.

$r$  = interest income / total asset

spread =  $r_i - r_f$

$m$  = personal expenses / total asset

For the variable  $c$ , two definitions are considered (for each of them, a specific regression is done within the set) :

1.  $c = \text{netcom} = \text{net commission revenue} / \text{total asset}$

2.  $c = \text{com} = \text{commission income} / \text{total asset}$

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<sup>26</sup>It would appear to be logical within our framework to use gross loans rather than loans (as soon as monitoring expenses are based upon gross loans). However this data is not available in the IBCA's Bankscope Database, and must be rebuilt. It has led us to an important lack of data and therefore results (However the results obtained from the rebuilt variables are available on demand).

$k = \text{equity} / \text{total asset}$

For the monopoly structure :

$$k:r_f = k \times r_f$$

$$m:k:r_f = (m \times k \times r_f)^{0.5}$$

For the competitive structure : as before, cf. the tested equation section for a definition of the VARIOUS variable, which is computed for three different values of both  $\rho$  and  $\mu$ .

Special case set 2 : refer to special case set 1. The reader should observe that because we do have the right definition of credit interest revenue, the loan interest rate is found dividing interest from lending by loans.

### 3.4 Data restrictions

The objective of data restrictions is twofold : firstly, it enables us to get rid of abnormal observations, and secondly, we can select a sample according to the hypotheses made in the model.

#### 3.4.1 abnormal observations

The restrictions imposed are the following : the variable  $m$ , that is monitoring cost, should be positive, as well as the variable  $k$ , i.e. shareholder capital, and commissions income (and not net commissions revenue).

#### 3.4.2 theoretical restriction

In the theoretical model, the bank has the possibility to lend money to a firm, in the first period. When offering a loan interest rate<sup>27</sup>, the bank takes into account that it may sale services to its clients in the second period. Because the 'interest from lending' variable is usually not available, one way to approximate the loan interest rate is to impose a ratio loans over total asset quite important. Therefore interests approximated in set 1 and 2 are closer to those offered by banks. Such a ratio is also a way to assure that banks personal expenses are related to monitoring cost rather than broker expenses.

Therefore regressions will be undertaken under two sets of restrictions, the first one will include restrictions to get rid of abnormal observations and a ratio loans over total asset higher than 60%, and a second one identical to the first one but with a ratio loans over total asset higher than 80%.

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<sup>27</sup>For the monopoly case, the bank chooses the loan interest rate which maximises its profit subject to participation of the firm. In the competitive case, the bank has no other choice to set a loan interest rate that equals its profit to zero.

## 3.5 Results

OLS regressions have been applied on panel data.

### 3.5.1 monopoly market

As said before, we have undertaken different regressions, depending on variable definitions and restricted samples. Within the tables, the reader will find the different restricted samples. In the first table, data are presented given the definition of set 1, and in the second table given the definition of set 2.

Table 1

	restriction : loans/ta = 0.6		restriction : loans/ta = 0.8	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Belgium (35)	0.439 (0.937)	0.340 (0.506)	NS	NS
Denmark (164)	-0.980 (-3.332)	-0.794 (-2.892)	ND	ND
France (710/298)	-0.635 (-5.019)	-0.304 (-3.865)	-0.785 (-3.331)	-0.521 (-2.631)
Germany (442/152)	-0.474 (-8.138)	-0.276 (-5.370)	-0.937 (-8.141)	-0.335 (-1.330)
Greece	ND	ND	ND	ND
Ireland (44)	-0.481 (-0.878)	-0.446 (-0.827)	ND	ND
Italy (97)	0.467 (1.432)	-0.258 (-3.229)	NS	NS
Luxembourg (28)	-0.219 (-0.628)	-0.061 (-0.537)	ND	ND
Nether. (108/35)	0.154 (0.315)	0.272 (0.620)	2.670 (4.576)	2.718 (4.615)
Portugal (44)	-1.410 (-1.312)	-1.452 (-1.462)	ND	ND
Spain (184/52)	0.069 (0.384)	0.594 (3.461)	-1.292 (-3.149)	-1.278 (-2.230)
U.K. (241/130)	-0.518 (-3.809)	-0.411 (-2.507)	-0.539 (-2.866)	-0.209 (-0.969)
All (2097/687)	-0.378 (-7.441)	-0.210 (-6.246)	-0.712 (-6.450)	-0.507 (-4.610)

The number(s) in brackets, after the country name, is(are) the number(s) of observations for each sample.

The letters ND stand for no data, and NS for number of observations not sufficient (i.e. the coefficients are not relevant as the number of data is too small).

The coefficients in bold are significant at the fifth percent level.

The coefficients in italics are significant at the tenth percent level.

Table 1 a. Special case set 1 ( $r = \text{interest from lending/loans}$ )

	restriction : loans/ta = 0.6		restriction : loans/ta = 0.8	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Denmark (164)	-0.630 (-2.102)	-0.454 (-1.626)	ND	ND
France (710/298)	-0.140 (-1.869)	-0.125 (-2.719)	0.034 (0.249)	0.084 (0.738)
Germany (441/151)	-0.497 (-8.192)	-0.255 (-4.719)	-0.956 (-8.440)	-0.366 (-1.458)
Italy (79)	0.122 (0.522)	0.002 (0.037)	NS	NS
Spain (58)	0.042 (0.342)	0.040 (0.335)	NS	NS
All (1467/467)	-0.396 (-9.393)	-0.176 (-5.985)	-0.631 (-6.892)	-0.054 (-0.489)

Table 2

	restriction : loans/ta = 0.6		restriction : loans/ta = 0.8	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Belgium (35)	0.519 (1.234)	1.632 (3.077)	NS	NS
Denmark (164)	-0.591 (-1.979)	-0.361 (-1.288)	ND	ND
France (710/298)	-0.770 (-5.300)	-0.495 (-5.063)	-0.791 (-3.258)	-0.501 (-2.478)
Germany (442/150)	-0.594 (-9.537)	-0.323 (-5.285)	-0.958 (-8.139)	-0.364 (-1.403)
Greece	ND	ND	ND	ND
Ireland (44)	-0.659 (-1.006)	-0.592 (-0.915)	ND	ND
Italy (97)	1.214 (3.069)	-0.369 (-4.567)	NS	NS
Luxembourg (28)	-0.178 (-0.417)	-0.036 (-0.259)	ND	ND
Nether. (108/35)	0.108 (0.248)	0.025 (0.064)	3.019 (5.693)	3.031 (5.629)
Portugal (44)	-0.848 (-0.863)	-0.801 (-0.862)	ND	ND
Spain (184/52)	-0.376 (-1.771)	0.444 (2.049)	-1.630 (-3.430)	-1.519 (-2.164)
U.K. (241/130)	-0.813 (-5.431)	-0.625 (-3.309)	-0.572 (-2.850)	-0.256 (-1.103)
All (2097/687)	-0.491 (-8.321)	-0.268 (-6.245)	-0.730 (-6.350)	-0.536 (-4.815)

Table 2 a. Special case set 3 ( $r$  = interest from lending/loans)

	restriction : loans/ta = 0.6		restriction : loans/ta = 0.8	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Denmark (164)	-0.960 (-2.103)	-0.677 (-1.597)	ND	ND
France (710/298)	-0.168 (-1.715)	-0.154 (-2.372)	0.028 (0.180)	0.091 (0.726)
Germany (441/151)	-0.631 (-8.207)	-0.332 (-4.458)	-1.072 (-7.900)	-0.270 (-0.904)
Italy (79)	0.163 (0.441)	-0.002 (-0.016)	NS	NS
Spain (58)	0.055 (0.294)	0.054 (0.301)	NS	NS
All (547/470)	-0.524 (-9.494)	-0.243 (-5.713)	-0.704 (-6.762)	-0.053 (-0.427)

General comments for the monopoly case: The strong restriction put on the ratio loans over total asset has decreased the number of data available, which explains most of the missing coefficients. None of the Greek data support the restrictions, therefore we do not have results for Greece when testing the monopoly market structure (and it will be the same for the competitive market structure). Otherwise apart from Netherlands, our theoretical expectations are fulfilled by the test. For Belgium, Italy and Spain, the coefficients found in front of services revenue are either positive or negative, but most of the significant ones are negative. For the other countries, we found the expected sign, with a fair number of them being significant.

When considering this encouraging result, we keep in mind that, during this period, the banking market has been deregulated. Consequences of the latter are a positive trend for commissions revenue and a negative one for the interest rate spread. To confirm that deregulation is not responsible of our negative relationship between interest rate and services, we thought first of introducing dummies. However, given the number of explicative variables and the number of dummies we should have introduced (10), this method could not give any results (because of the matrix obtained, which is a near singular one). Thus, we have undertaken, considering all the data together a year by year analysis. We have used the same sets of variables as before, as well as restrictions, to run the regressions. The results (cf. appendix B) show a negative relationship between the two variables of interest, which confirm that the relation tested is not a consequence of the deregulation of the market.

### 3.5.2 competitive market

To test the competitive market structure, the variable `VARIOUS` need to be generated. However, when computing the latter, we lose a consequent number of data. Therefore the number of observations is sufficient

for a limited number of countries. We have relaxed the theoretical restriction, when considering set 2, and we have kept either a loan over total asset ratio equals to 0.4 or to 0.5.

Moreover, to compute VARIOUS we need to make hypotheses on the value  $\rho$  of  $\mu$ . It leads us to run the regression nine times. Results will be presented for each country. Because of a lack of data or an insufficient number of observations, we do not have results for the following countries: Belgium, Denmark, Greece (no data at all), Ireland, Luxembourg and Portugal.

As explained in the section Variables definition, for some countries the interest revenues from lending data are available. Given the number of tables in the body text, are only presented here the results different from the set 1, and set 2 ones<sup>28</sup>.

## France

	restriction : loans/ta = 0.6		restriction : loans/ta = 0.8	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Set 1				
$\rho = 1, \mu = 0.8$	-0.717 (-1.077)	-0.928 (-1.640)	NS	NS
$\rho = 1, \mu = 0.6$	-1.663 (-6.071)	-1.293 (-5.172)	-2.364 (-3.867)	-2.038 (-3.146)
$\rho = 1, \mu = 0.4$	-0.843 (-5.540)	-0.297 (-3.138)	-1.047 (-3.244)	-0.891 (-2.850)
$\rho = 0.99, \mu = 0.8$	-0.993 (-1.316)	-1.161 (-1.867)	NS	NS
$\rho = 0.99, \mu = 0.6$	-1.620 (-5.953)	-1.288 (-5.084)	-2.348 (-3.719)	-2.037 (-3.038)
$\rho = 0.99, \mu = 0.4$	-0.823 (-5.410)	-0.287 (-3.036)	-1.023 (-3.184)	-0.862 (-2.765)
$\rho = 0.95, \mu = 0.8$	-1.148 (-0.865)	-1.589 (-1.506)	NS	NS
$\rho = 0.95, \mu = 0.6$	-1.574 (-5.199)	-1.240 (-4.542)	-2.348 (-3.337)	-2.127 (-2.925)
$\rho = 0.95, \mu = 0.4$	-0.842 (-5.573)	-0.274 (-2.974)	-1.008 (-3.191)	-0.783 (-2.618)

<sup>28</sup> However tables are available on demand.

	restriction : loans/ta = 0.4		restriction : loans/ta = 0.5	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Set 2				
$\sigma = 1, \mu = 0.8$	-0.193 (-0.287)	-0.397 (-0.964)	NS	NS
$\sigma = 1, \mu = 0.6$	-0.481 (-2.278)	-0.371 (-2.321)	-0.642 (-2.830)	-0.546 (-3.176)
$\sigma = 1, \mu = 0.4$	-0.541 (-4.637)	-0.386 (-5.182)	-0.611 (-4.607)	-0.448 (-5.021)
$\sigma = 0.99, \mu = 0.8$	-0.278 (-0.371)	-0.734 (-1.169)	NS	NS
$\sigma = 0.99, \mu = 0.6$	-0.486 (-2.267)	-0.377 (-2.330)	-0.653 (-2.837)	-0.556 (-3.195)
$\sigma = 0.99, \mu = 0.4$	-0.415 (-4.115)	-0.335 (-5.392)	-0.495 (-4.144)	-0.379 (-4.968)
$\sigma = 0.95, \mu = 0.8$	-0.463 (-0.396)	-1.532 (-1.693)	NS	NS
$\sigma = 0.95, \mu = 0.6$	-0.427 (-1.882)	-0.375 (-2.266)	-0.546 (-2.234)	-0.513 (-2.882)
$\sigma = 0.95, \mu = 0.4$	-0.525 (-4.481)	-0.372 (-4.771)	-0.592 (-4.458)	-0.419 (-4.753)

The sign in front of the commission revenue variable is the expected one, and most of coefficients are significant.

### Germany

	restriction : loans/ta = 0.6		restriction : loans/ta = 0.8	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Set 1				
$\sigma = 1, \mu = 0.6$	-0.260 (-3.206)	-0.229 (-3.477)	NS	NS
$\sigma = 1, \mu = 0.4$	-0.601 (-8.829)	-0.286 (-4.568)	-1.077 (-6.285)	-0.219 (-0.488)
$\sigma = 0.99, \mu = 0.6$	-0.272 (-3.372)	-0.235 (-3.594)	NS	NS
$\sigma = 0.99, \mu = 0.4$	-0.598 (-8.841)	-0.282 (-4.535)	-1.080 (-6.365)	-0.181 (-0.403)
$\sigma = 0.95, \mu = 0.6$	-0.293 (-3.355)	-0.284 (-3.359)	NS	NS
$\sigma = 0.95, \mu = 0.4$	-0.591 (-8.316)	-0.265 (-3.781)	-1.171 (-6.465)	-0.206 (-0.387)

	restriction : loans/ta = 0.4		restriction : loans/ta = 0.5	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Set 2				
$\sigma = 1, \mu = 0.6$	-0.325 (-4.489)	-0.277 (-4.356)	-0.285 (-3.434)	-0.237 (-3.347)
$\sigma = 1, \mu = 0.4$	-0.652 (-11.403)	-0.324 (-5.491)	-0.674 (-10.290)	-0.295 (-4.430)
$\sigma = 0.99, \mu = 0.6$	-0.331 (-4.556)	-0.281 (-4.413)	-0.295 (-3.533)	-0.244 (-3.429)
$\sigma = 0.99, \mu = 0.4$	-0.657 (-11.912)	-0.293 (-5.353)	-0.666 (-10.713)	-0.272 (-4.399)
$\sigma = 0.95, \mu = 0.6$	-0.339 (-4.268)	-0.326 (-4.250)	-0.318 (-3.495)	-0.305 (-3.445)
$\sigma = 0.95, \mu = 0.4$	-0.656 (-11.112)	-0.314 (-4.866)	-0.682 (-10.158)	-0.279 (-3.796)

As for France, results for Germany show a negative impact of commissions revenue on the interest rate spread.

## Italy

	restriction : loans/ta = 0.6/0.4		restriction : loans/ta = 0.8/0.5	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Set 1				
$\rho = 1, \mu = 0.4$	-0.199 (-0.467)	-0.247 (-0.598)	ND	ND
$\rho = 0.99, \mu = 0.4$	-0.413 (-0.915)	-0.456 (-1.047)	ND	ND
$\rho = 0.95, \mu = 0.4$	-0.973 (-2.527)	-0.821 (-2.224)	ND	ND
Set 2				
$\rho = 1, \mu = 0.4$	0.669 (4.087)	0.612 (4.390)	0.271 (1.398)	0.227 (1.263)
$\rho = 0.99, \mu = 0.4$	0.689 (4.649)	0.394 (3.119)	0.276 (1.523)	0.116 (0.698)
$\rho = 0.95, \mu = 0.4$	0.568 (3.257)	0.537 (3.663)	0.173 (0.853)	0.154 (0.826)

Results for set 1 are the expected ones, while set 2 results show the opposite relationship. However if we consider the data "interest rate from lending", results are slightly different:

### Special case set 1, and set 2

	restriction : loans/ta = 0.6/0.4		restriction : loans/ta = 0.8/0.5	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Set 1				
$\rho = 1, \mu = 0.4$	-0.359 (-1.384)	-0.351 (-1.392)	ND	ND
$\rho = 0.99, \mu = 0.4$	-0.519 (-1.921)	-0.501 (-1.915)	ND	ND
$\rho = 0.95, \mu = 0.4$	-0.561 (-1.903)	-0.520 (-1.879)	ND	ND
Set 2				
$\rho = 1, \mu = 0.4$	-0.560 (-2.567)	-0.350 (-1.850)	-0.831 (-3.251)	-0.782 (-3.312)
$\rho = 0.99, \mu = 0.4$	-0.768 (-4.548)	-0.639 (-4.479)	-1.020 (-5.082)	-0.999 (-5.463)
$\rho = 0.95, \mu = 0.4$	-0.534 (-2.277)	-0.314 (-1.565)	-0.865 (-3.082)	-0.809 (-3.154)

The coefficients found here are all negative, and mainly significant at the tenth percent level. This table seems more appropriate to use as the definition of interest revenue is more precise in this one compared to the former one.

## Netherlands

	restriction : loans/ta = 0.4		restriction : loans/ta = 0.5	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Set 2				
$\sigma = 1, \mu = 0.4$	-0.449 (-1.173)	-0.348 (-1.113)	-0.498 (-1.458)	-0.432 (-1.455)
$\sigma = 0.99, \mu = 0.4$	-0.264 (-1.841)	-0.247 (-1.987)	-0.203 (-0.780)	-0.174 (-0.742)
$\sigma = 0.95, \mu = 0.4$	-0.477 (-1.244)	-0.402 (-1.205)	-0.511 (-1.573)	-0.429 (-1.515)

## Spain

	restriction : loans/ta = 0.6/0.4		restriction : loans/ta = 0.8/0.5	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Set 1				
$\sigma = 1, \mu = 0.4$	-0.271 (-0.746)	-0.077 (-0.204)	NS	NS
$\sigma = 0.99, \mu = 0.4$	-0.259 (-0.711)	-0.078 (-0.207)	NS	NS
$\sigma = 0.95, \mu = 0.4$	-0.187 (-0.365)	0.147 (0.260)	NS	NS
Set 2				
$\sigma = 1, \mu = 0.4$	-0.638 (-1.862)	0.100 (0.280)	-0.683 (-1.533)	0.277 (0.576)
$\sigma = 0.99, \mu = 0.4$	0.154 (0.570)	0.888 (3.690)	-0.312 (-0.879)	0.682 (1.973)
$\sigma = 0.95, \mu = 0.4$	-0.892 (-2.113)	0.063 (0.134)	-0.944 (-1.682)	0.402 (0.597)

## U.K.

Results are done only when the number of observations is enough to undertake the regressions.

	restriction : loans/ta = 0.4		restriction : loans/ta = 0.5	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
Set 2				
$\sigma = 1, \mu = 0.4$	1.180 (3.475)	1.969 (5.170)	1.372 (3.671)	2.239 (5.439)
$\sigma = 0.99, \mu = 0.4$	1.246 (4.157)	1.714 (5.597)	1.285 (3.963)	1.894 (5.241)
$\sigma = 0.95, \mu = 0.4$	1.836 (5.580)	2.164 (6.303)	1.908 (5.769)	2.436 (6.672)

The results found for UK, when testing the competitive market, are not the expected ones.

As for the monopoly market, the possible effects of deregulation have been once more taken into account. Difficulties to use dummies were the same as before. Therefore a year by year analysis has been undertaken (cf. appendix C) and shows a negative relationship between commissions revenue and loan interest rate.

### 3.5.3 discriminated market<sup>29</sup>

Finally, in this section, for each country we present the most relevant results depending on the Herfindahl and C(5) indexes, calculated on the different country sample (see Appendix D).

The two indexes give us three sets of countries : (i) highly concentrated market: Belgium, Denmark, Greece, Ireland and Netherlands, (ii) moderately concentrated market: France, Germany, Portugal and Spain, and (iii) not concentrated market: Italy, Luxembourg and U.K. However, if we compare these results to the literature, the figures we found are generally under-estimated (at least for the last set of countries). Therefore it might be more relevant to consider, as for the moderately concentrated market, the two extreme cases results.

**Highly concentrated market.** (Because of a lack of data, no results could be obtained for Greece.) When considering the four remaining countries, outcomes show an inverse impact of commissions revenue on loan interest rate for Denmark and Ireland. However a same one is found for the other countries. We should stress that results for Denmark are reinforced by the ones found when using "interest from lending" data (most of the coefficients are significant).

**Moderately concentrated market.** For the four countries, both monopoly and competitive market structure results suggest an inverse impact of the sale of services on the loan interest rate. Most of the coefficients are significant at the fifth percent level. The empirical findings strengthen the theoretical ones.

**Not concentrated market.** Monopoly market results mainly show an opposite relationship between loan interest rates and commissions revenue, however the nature of the relationship is a lot less obvious when considering competitive market regressions. However the only results obtained for U.K. are based on the set 2 definition, which is not the most accurate one, especially given the theoretical restriction. When considering Italy results, both market structure tend to show a same inverse relationship between services and credit rate.

**Overall** results suggest that commissions revenue is an inversely linked determinant of the loan interest rate.

## 4 Conclusion

The objective of the theoretical investigation is to capture the effect of services provision as a banking activity on the behaviour of banks and firms when considering credit relationship. While the goal of the empiri-

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<sup>29</sup>The reader should refer to the tables previously shown in this paper, using each time the relevant one.

cal study is to concentrate on the services revenue as a determinant of the loan interest rate. Future research will complete such an investigation by studying the effect of the sale of services on credit risk.

More generally, in the theoretical model, we discuss what is happening on interest rate, project risk and monitoring when banks provide payable services. It is important to note that, whatever the market structure, the production of services by banks has an impact on the level of interest rates and on the structure of bank products.

At equilibrium, in both market structures, the credit rate, when banks are selling services, is lower to the one which occurs when banks are not selling services. The question is whether the services activity enables banks to subsidise their credit activity. Cross-subsidisation concerning interest rates paid on current and saving accounts, and services has long been practised, but this paper shows that the billing practices for services may imply cross-subsidisation on the loan market.

Another result is that whatever banks' attitude towards the deposit insurance scheme, the credit risk borne on their balance sheet is greater when they sell services. The reason is a lower probability of monitoring loans<sup>30</sup>. One of the concern for the authorities of regulation should be the monitoring incentives of banks which decrease with the sale of services.

This relation between services' provision and credit rate has been emphasized by the empirical work undertaken. For each country, the two extreme cases, i.e. monopoly and competitive market, have been studied such as to be able to draw a conclusion given the concentration indexes found. For most of the European countries considered in the test, the results suggest an inverse impact of commissions revenue on the level of loan interest rate.

We have underlined here how services provision affects the behaviour of banks, and their willingness to take on further risk. It is the next part of our forthcoming empirical research.

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<sup>30</sup>The implicit idea behind this result is that banks compete firstly on the loan market because it will be easier for them afterwards to sell services to the firms they have lent funds to. Therefore they may be willing to accept now risky projects they would have refused if they were only selling credit.

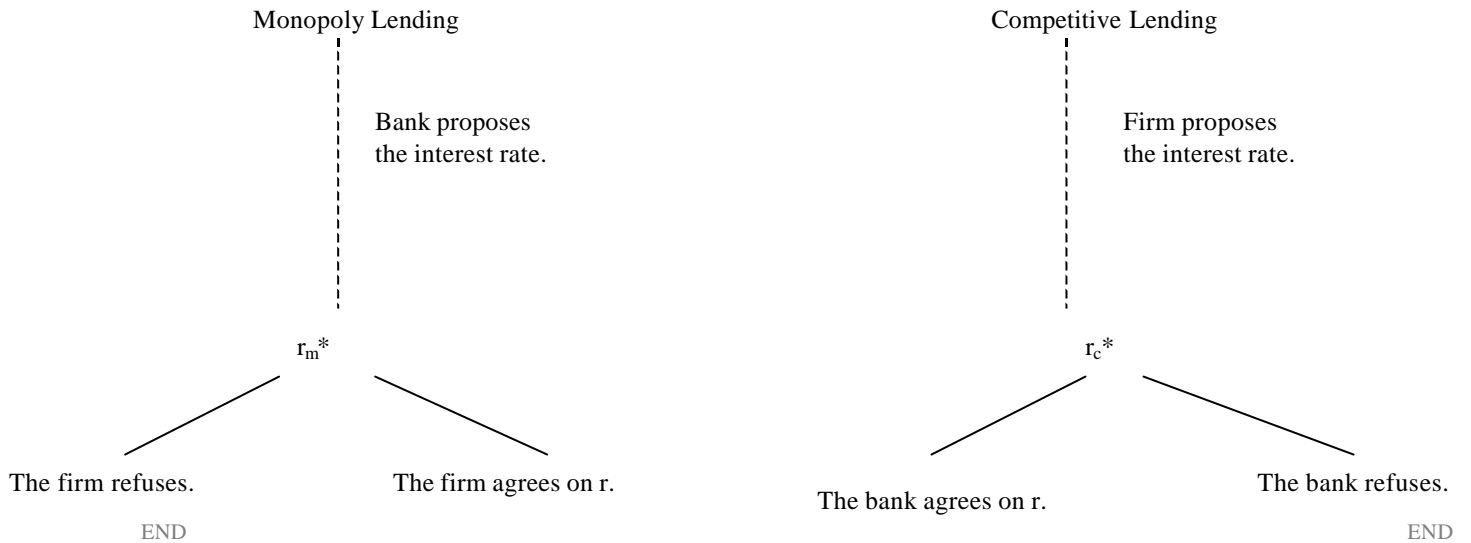
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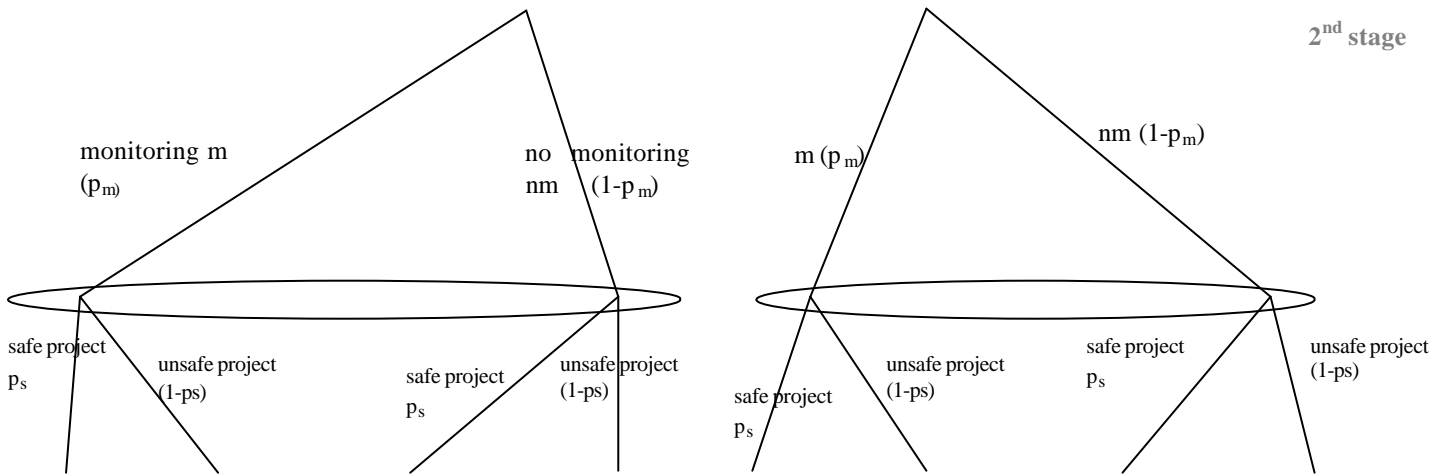
# APPENDIX

## A Game tree

1<sup>st</sup> stage



2<sup>nd</sup> stage



Firm earning

s prob $\gamma$ 0 prob $(1-\gamma)$ $-r$ prob $\gamma$	The bank recalls its loans.	s prob $\gamma$ 0 prob $(1-\gamma)$ $-r$ prob $\gamma$	u prob $\theta$ 0 prob $(1-\theta)$ $-r$ prob $\theta$	s prob $\gamma$ 0 prob $(1-\gamma)$ $-r$ prob $\gamma$	The bank recalls its loans.	s prob $\gamma$ 0 prob $(1-\gamma)$ $-r$ prob $\gamma$	u prob $\theta$ 0 prob $(1-\theta)$ $-r$ prob $\theta$
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Total bank earning (1<sup>st</sup> and 2<sup>nd</sup> period)

$r-r_f, c$ prob $\gamma$ $-kr_f$ prob $(1-\gamma)$ $-m$	$-m$	$r-r_f, c$ prob $\gamma$ $-kr_f$ prob $(1-\gamma)$	$r-r_f, c$ prob $\theta$ $-kr_f$ prob $(1-\theta)$	$r-r_f, c$ prob $\gamma$ $-kr_f$ prob $(1-\gamma)$ $-m$	$-m$	$r-r_f, c$ prob $\gamma$ $-kr_f$ prob $(1-\gamma)$	$r-r_f, c$ prob $\theta$ $-kr_f$ prob $(1-\theta)$
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## B Monopoly market: a year by year analysis

The regressions have been undertaken over the complete sample of banks with a year by year restriction. It was done, as for each country, given the three different sets of variables. Only results for set 1 are presented, the other ones are available on request.

	restriction : loans/ta = 0.6		restriction : loans/ta = 0.8	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
1989(34)	-0.649 (-1.008)	-0.036 (-0.114)	NS	NS
1990 (63)	0.023 (0.043)	-0.160 (-1.873)	NS	NS
1991(98)	0.615 (3.161)	0.050 (0.622)	NS	NS
1992 (178/59)	-0.261 (-1.137)	-0.511 (-3.251)	-0.176 (-0.411)	-0.534 (-2.142)
1993 (210/65)	-0.034 (-0.160)	-0.070 (-0.350)	-0.776 (-1.967)	-0.631 (-1.674)
1994 (225/72)	-0.560 (-4.376)	-0.257 (-4.076)	-1.011 (-3.263)	-0.877 (-2.390)
1995 (235/85)	-0.525 (-2.661)	-0.427 (-3.938)	-0.606 (-1.882)	-0.370 (-1.030)
1996 (258/91)	-0.561 (-3.508)	-0.214 (-0.955)	-0.829 (-2.452)	0.023 (0.060)
1997 (257/96)	-0.804 (-5.049)	-0.600 (-3.312)	-0.960 (-3.828)	-0.385 (-0.913)
1998 (270/92)	-0.271 (-3.170)	-0.137 (-1.560)	-0.875 (-3.801)	-0.115 (-0.306)
1999 (269/87)	-0.462 (-3.108)	-0.177 (-1.635)	-0.421 (-1.183)	-0.153 (-0.413)

The number(s) in brackets, after the country name, is(are) the number(s) of observations for each sample.

## C Competitive market: a year by year analysis

As previously, the regressions have been undertaken over the complete sample of banks with a year by year restriction. It was done, as for each country, given the three different sets of variables. Only results for set 2 and a specific set of values for  $\rho$  and  $\mu$  are presented ( $\rho=1$ ,  $\mu=0.4$ ), the other ones are available on request. (Results for set 1 have not been chosen given the number of missing coefficients, because of a lack of data or an insufficient number of observations)

	restriction : loans/ta = 0.4		restriction : loans/ta = 0.5	
	netcom coef. (t-stud)	com coef. (t-stud)	netcom coef. (t-stud)	com coef. (t-stud)
1989(44/30)	0.517 (1.103)	-0.016 (-0.074)	0.077 (0.141)	-0.103 (-0.308)
1990 (41/31)	-0.885 (-2.574)	-0.099 (-0.727)	-0.701 (-1.670)	-0.151 (-1.175)
1991(47/39)	-0.108 (-0.313)	-0.013 (-0.134)	-0.450 (-1.232)	0.010 (0.079)
1992 (79/68)	-0.425 (-1.228)	-0.254 (-0.787)	-0.433 (-1.170)	-0.223 (-0.644)
1993 (133/105)	-0.128 (-0.605)	-0.080 (-0.389)	-0.138 (-0.593)	-0.100 (-0.440)
1994 (131/111)	-0.442 (-2.812)	-0.208 (-1.835)	-0.500 (-3.015)	-0.243 (-2.030)
1995 (120/97)	-0.379 (-1.756)	-0.167 (-1.101)	-0.352 (-1.446)	-0.145 (-0.860)
1996 (142/108)	-0.604 (-3.098)	-0.239 (-1.139)	-0.734 (-3.364)	-0.367 (-1.505)
1997 (192/133)	-0.520 (-4.649)	-0.136 (-1.055)	-0.704 (-3.855)	0.419 (1.464)
1998 (269/208)	-0.399 (-4.392)	-0.181 (-1.897)	-0.420 (-4.142)	-0.191 (-1.725)
1999 (241/195)	-0.383 (-2.992)	-0.245 (-2.560)	-0.341 (-2.315)	-0.217 (-2.018)

## D: Concentration Indexes

Country	C(5) HHI		1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989									
	Belgium	0.96	0.95	0.90	0.88	0.87	0.87	0.92	0.92	0.92	0.93	0.93	0.37	0.25	0.19	0.23	0.22	0.22	0.24	0.24	0.31	0.25
Denmark	0.93	0.94	0.94	0.94	0.94	0.97	0.99	0.99	1	1	1	0.35	0.34	0.35	0.34	0.33	0.33	0.40	0.40	0.40	0.65	0.77
France	0.70	0.63	0.60	0.61	0.61	0.62	0.64	0.62	0.63	0.64	0.65	0.15	0.10	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.11
Germany	0.84	0.82	0.70	0.78	0.78	0.75	0.72	0.75	0.77	0.78	0.80	0.17	0.15	0.12	0.17	0.16	0.15	0.15	0.17	0.13	0.14	0.14
Greece	0.83	0.81	0.86	0.95	0.97	0.97	1	1	1	1	1	0.19	0.19	0.22	0.27	0.30	0.31	0.68	0.52	0.50	0.46	0.48
Ireland	0.84	0.81	0.82	0.76	0.78	0.82	0.85	0.93	1	1	1	0.19	0.18	0.22	0.19	0.21	0.24	0.26	0.30	0.52	0.54	0.67
Italy	0.57	0.55	0.47	0.49	0.50	0.51	0.50	0.63	0.57	0.57	0.66	0.08	0.08	0.06	0.06	0.06	0.07	0.07	0.09	0.09	0.08	0.05
Luxembourg	0.40	0.37	0.32	0.34	0.38	0.35	0.35	0.40	0.40	0.37	0.60	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.09
Netherlands	0.90	0.89	0.86	0.82	0.82	0.85	0.86	0.87	0.90	0.91	0.91	0.30	0.31	0.31	0.26	0.27	0.29	0.30	0.30	0.31	0.33	0.39
Portugal	0.61	0.59	0.52	0.56	0.60	0.60	0.59	0.57	0.95	0.98	1	0.10	0.09	0.08	0.08	0.09	0.10	0.10	0.10	0.26	0.28	0.30
Spain	0.74	0.76	0.73	0.72	0.74	0.73	0.73	0.73	0.69	0.68	0.70	0.23	0.15	0.28	0.14	0.14	0.14	0.13	0.13	0.11	0.11	0.06
UK	0.52	0.50	0.48	0.46	0.53	0.58	0.59	0.63	0.62	0.62	0.63	0.07	0.06	0.06	0.05	0.07	0.08	0.09	0.10	0.10	0.10	0.10

>0.18 highly concentrated mkt

0.10-0.18 moderately concentrated mkt

no colour < 0.10 not concentrated mkt (as considered by the US department of Justice)