A European study of bank interest margins: Is net fee revenue a determinant ?✧

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Abstract

The aim of this paper is to analyse the determinants of bank interest margins for twelve selected European countries during the period 1989-1999. We use the theoretical literature on net interest margins to specify which variables affect the margin, considering the evolution of bank income structure over the last two decades. The empirical results corroborate the conventional theoretical findings, but we also observe an inverse effect of net fee income on bank interest margins. The latter result could be interpreted as a possible cross-subsidisation of the lending rate by the sale of services.

JEL Classification : G21, G10
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1. Introduction

Bank interest margins, or commonly called net interest margins, are defined as the difference between interest revenue and interest expense as percentage of total assets[1] and vary widely across time and across countries. In table 1, for the years 1989-1999, are shown the net interest margins (NIMs) for a sample of commercial banks from 12 European countries all belonging to the European Union. We can notice that the NIM has decreased for France, Germany, Greece, Ireland, Italy, Portugal and Spain over the period. For the other countries, the NIM remains almost the same across time (however it looks like the NIM has increased for Luxembourg).

Table 1. Net Interest Margins : basic statistics [a,b]

		89	90	91	92	93	94	95	96	97	98	99
Belgium	mean	1.909	1.710	1.647	1.781	1.924	1.820	1.981	1.969	1.726	2.136	2.409
	std dev	1.781	1.172	1.166	1.166	1.823	1.575	1.820	1.775	1.533	2.200	2.724
Denmark	mean	4.446	4.608	4.270	4.963	5.189	5.143	4.905	4.594	4.356	4.237	4.209
	std dev	1.279	1.524	1.541	1.640	1.574	4.466	2.027	1.915	1.821	1.804	1.818
France	mean	3.061	2.950	3.155	3.608	3.341	3.059	2.992	3.041	2.953	2.935	2.637
	std dev	1.796	2.474	1.865	2.379	3.014	2.080	1.977	2.300	2.585	2.604	2.194
Germany	mean	3.914	3.646	3.948	2.636	2.510	2.731	2.599	2.681	2.316	2.365	2.162
	std dev	8.086	6.461	6.952	1.993	1.885	2.187	2.156	2.650	2.271	2.334	1.775
Greece	mean	4.998	5.903	4.049	NA	3.410	2.504	2.676	2.831	2.976	2.664	2.423
	std dev	1.119	1.804	2.169		1.937	1.557	1.720	1.284	1.059	0.886	0.880
Ireland	mean	NA	NA	NA	3.653	3.077	2.261	2.596	2.132	1.767	1.860	1.676
	std dev				1.511	1.523	1.444	2.086	1.491	1.240	1.281	1.399
Italy	mean	3.474	3.513	3.517	3.789	3.864	3.761	4.146	3.688	3.160	3.029	2.698
	std dev	0.993	1.071	1.101	1.150	1.217	1.187	1.224	1.073	1.201	0.889	0.939
Luxembourg	mean	0.335	0.306	0.561	0.729	0.952	0.894	0.851	0.822	0.817	1.016	0.940
	std dev	1.536	1.126	1.185	1.185	0.619	0.458	0.423	0.435	0.264	2.030	1.109
Netherlands	mean	1.463	1.383	1.588	1.396	1.683	1.546	1.526	1.394	1.344	1.588	1.639
	std dev	1.215	1.273	1.299	0.751	1.889	0.883	0.781	0.687	0.605	0.795	0.869
Portugal	mean	3.064	4.274	4.467	3.533	3.145	2.832	2.235	2.057	1.986	1.928	2.006
	std dev	1.176	1.962	1.698	1.119	1.053	1.745	1.141	1.108	1.268	1.117	1.396
Spain	mean	4.084	4.177	4.171	4.841	3.970	3.460	3.976	3.471	3.092	2.887	2.629
	std dev	1.902	2.389	2.585	4.836	2.355	1.780	2.720	2.431	1.998	2.064	1.744
UK	mean	2.453	2.741	4.160	2.868	3.015	2.803	2.864	2.864	2.897	3.262	2.815
	std dev	1.641	1.881	3.058	2.867	3.614	3.285	3.297	3.456	3.450	4.763	2.920

Source : Fitch IBCA (1997, 2001)

[a] The sample is issued from the Bankscope database. More precisely data from 1989 to 1991 comes from a different Cd than the data from 1992 to 1999. Therefore, the value obtained for the first three years might be quite different from the ones that are following. The case is the same for the next table.
[b] The number of observations for each country and each year is displayed in appendix A, table 5.

[1] Spread is the difference between the yield rate on average interest earning assets and the cost rate on interest bearing funds, with both elements expressed in percentage terms.

When studying the literature, it is not clear if high margins are beneficial from a social welfare perspective. As it is stated by Saunders and Schumacher (2000), on the one hand, narrow margins may be indicative of a relatively competitive banking system with a low level of intermediation costs and regulatory (e.g. reserve requirements and capital requirements). On the other hand, relatively large margins may bring a degree of stability for a banking system, in that they can add to the profitability and capital of banks so as to insulate them from exogenous shocks, macroeconomic and other ones. As is well known, bank failures can carry significant externalities and social costs.

This paper attempts to investigate empirically, on a set of twelve European countries over the period 1989-1999, the determinants of net interest margin in the light of the substantial changes that have been undertaken in commercial banking in the last twenty years. Deregulation and competition have prompted such changes, one of these effects being a stronger competition in the credit market. Moreover, over the last few years, the share of the non-interest income of banks' revenue has grown faster. For example, in

Table 2. Commissions and fees revenue as a percentage of total asset

		89	90	91	92	93	94	95	96	97	98	99
Belgium	mean	0.923	0.813	0.837	0.340	0.251	0.382	0.387	0.294	0.380	0.748	0.959
	std dev	0.460	0.540	0.764	0.473	0.487	0.599	0.737	0.598	0.593	1.313	1.972
Denmark	mean	NA	0.369	0.403	0.567	0.698	0.889	0.752	1.055	1.241	1.566	1.504
	std dev	NA	0.242	0.235	0.272	0.314	0.544	0.370	1.525	2.396	3.827	2.861
France	mean	1.066	0.938	0.828	1.392	1.608	1.792	1.482	1.610	1.850	1.955	2.424
	std dev	3.124	2.594	2.489	5.315	4.225	4.583	3.191	3.573	4.256	4.707	7.441
Germany	mean	3.540	3.816	4.708	1.068	2.812	1.201	1.198	1.193	1.243	1.685	1.685
	std dev	8.434	8.299	10.178	1.896	1.986	2.314	2.580	2.583	2.910	4.404	3.332
Greece	mean	NA	NA	1.458	NA	1.523	1.554	1.523	1.446	1.423	1.362	2.388
	std dev			1.252		0.954	0.747	0.800	0.816	0.809	0.543	1.698
Ireland	mean	NA	NA	NA	NA	0.577	0.529	0.586	0.820	0.685	0.461	0.426
	std dev					0.735	0.617	0.577	0.881	0.803	0.624	0.487
Italy	mean	0.606	0.684	0.704	0.822	0.691	0.760	0.733	1.514	1.141	1.277	1.483
	std dev	0.314	0.336	0.360	0.375	0.388	0.507	0.498	9.102	2.995	1.154	1.081
Luxembourg	mean	NA	NA	NA	0.331	0.540	0.663	0.672	0.649	0.801	1.194	1.072
	std dev				0.649	0.995	1.408	1.460	1.039	1.243	3.915	2.080
Netherlands	mean	0.709	0.615	0.615	0.694	0.717	0.782	0.770	0.769	0.788	1.113	1.685
	std dev	0.873	0.712	0.609	0.862	0.929	1.259	1.417	1.450	1.469	2.286	3.769
Portugal	mean	2.566	0.493	0.682	0.447	0.449	0.505	0.409	0.425	0.597	0.686	0.960
	std dev	1.330	0.515	0.501	0.307	0.242	0.322	0.423	0.314	0.525	0.476	1.093
Spain	mean	0.568	0.784	0.981	0.812	0.767	0.810	0.776	0.635	0.761	0.956	1.091
	std dev	0.398	0.668	1.123	0.714	0.675	0.692	1.232	0.545	0.743	1.021	1.229
UK	mean	0.938	1.334	3.202	1.126	1.204	1.373	1.685	1.443	1.373	1.187	1.237
	std dev	0.614	2.005	6.814	1.507	1.779	2.304	3.539	2.951	2.705	2.702	1.459

Source : Fitch IBCA (1997, 2001)

Europe, the share of non-interest income increased[2] from 26% to 32% between 1989 and 1995, and from 32% to 41% between 1995 and 1998. In the same report, we find that fees and commissions represent by far the most important component, accounting for 58 % of all non-interest income[3]. However, the relative importance of this source of income has recorded a slight downward trend over the period 1994-1998[4]. Table 2 displays the net commissions and fees revenue as a percentage of total asset. The ratio has increased for the sample countries we study, apart from Germany, Ireland and the UK. However the standard deviation has also clearly increased, which would mean that fee-based activities have not grown equally across banks. Given the changes in the industry, one question of interest is whether the sale of services may affect the strategy of banks when setting price for their traditional activity.

Two modelling frameworks have been used to study the determinants of bank interest margins. The dealership approach views banks as risk-adverse dealers in the loan and deposit markets, where loan requests and deposit funds occur non-synchronously at random time arrivals[5]. Bank interest margins are shown to be fees charged by banks for the provision of liquidity. This model has been developed by Ho and Saunders (1981) and further extended by number of other researchers such as Allen (1988), McShane and Sharpe (1985), Angbazo (1997). The alternative approach is the micro-model of the banking firm – based originally on the approach of Klein (1971) and Monti (1972) – which views the banking firm in a static setting where demands for and supplies of deposits and loans simultaneously clear both markets, see for example Zarruck (1989), Wong (1997), Goyeau *et al.* (1999).

This paper is organised as follows : in section 2 we will present a short review of the literature on determinants of banks interest margins. Then section 3 will discuss the data and data set, as well as the results found in the case of twelve European countries. Finally, section 4 concludes.

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[2] Based on data published in *"EU Banks' Income Structure"* prepared by the Banking Supervision Committee for the European Central Bank.

[3] This figure is an EU-weighted average for the period 1993-1998. Three countries, Austria, Finland and Sweden, are included in this average but are not present in our study.

[4] Such a phenomenon has been as well taken place in the US, see Boyd and Gertler (1994), Edwards and Mishkin (1995), De Young and Roland (2001).

2. Determinants of net interest margins

2.1. A review of the literature

In the first framework considered here, that is the dealership approach, the bank is viewed as a dynamic dealer, setting interest rates on loans and deposits to balance the asymmetric arrival of loan demands and deposit supplies. A bank is viewed paying for funds (deposits) at one price (the "bid" price) and lending funds at another (the "ask" price).

Economists, such as Ho and Stoll (1980), have studied the determination of the bid-ask prices as a function of the characteristics of the security, as well as the inventory policy of the trader. Ho and Saunders (1981) analyse the bank's brokerage function, adapting the finance literature on broker bid-ask spreads, to explain bank margins, that is the difference between the bid and ask price[6]. The purpose of the model is to provide a simple framework for characterizing the risk factors that influence bank net interest margins determination.

In the Ho and Saunders model, the bank is viewed as a dealer in the credit market, acting as an intermediary between the demanders for and suppliers of funds. The planning horizon is a single period during which bank rates, which are posted prior to observing the demand for immediacy, are held constant, and a single transaction in loans and deposits occurs. Risk-averse banks facing asymmetric arrival time for the demand for loans and the supply of deposits select optimal loan and deposit rates which minimize the risk of excessive demand for loans or insufficient supply of deposits. The rates are :

$$r_L = r + b$$

$$r_D = r - a$$

and the margin is $r_L - r_D = a + b$, where r_L is the lending rate, r_D is the deposit rate, r is the expected risk-free rate, and a and b are fees charged by the bank in order to provide immediacy and to bear interest rate risk.

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[5] It is a model of bid-ask prices for security dealers (see Stoll 1978) applied to the analysis of bank interest margins.

The authors also assume that the bank maximises its expected utility of terminal wealth. Eventually, they find the following value for the net interest margin :

$$s = a + b = \frac{a}{b} + \frac{1}{2} R s_I^2 Q \ .$$

The ratio a / b provides some measure of the producer's surplus or monopoly rent element in bank spreads or margins. The second term is a first-order risk adjustment term and depends on three factors : (*i*) *R*, the bank management's coefficient of absolute risk aversion; (*ii*) *Q*, the size of bank transactions; and (*iii*) s_I^2, the instantaneous variance of the interest rate on deposits and loans, i.e. the variability of interest rates. The second term implies that, ceteris paribus, the greater the degree of risk aversion, the larger the size of transactions and the greater the variance of interest rates, the larger bank margins are.

The structure employed by Ho and Saunders was originally intended for the analysis of the trading activities of security dealers. As stated by Zarruk (1989), they thus fail to consider some appropriate aspects of a bank's operation. Therefore, in his model of the bank interest margin, the bank is viewed as a firm in a static setting where demands for and supplies of loans and deposits simultaneously clear both market. He used a framework similar to the one employed by Sealey (1980), who introduced risk and cost considerations to the firm theoretic approached developed by Klein (1971) and Monti (1972).

The second type of framework used assumes a firm-theoretical approach, and was developed among others by Zarruk (1989), Wong (1997), and Goyeau, Sauviat and Tarazi (1999). The main results obtained by these three articles conclude that the optimal bank interest margin is larger when the bank is risk averse than when the bank is risk neutral and that a size-preserving increase in the bank's market power increases the optimal interest margin. They also find that under a decreasing absolute risk aversion utility function, an increase in the marginal administrative cost of loans will increase the optimal bank interest margin; an increase in the money market interest rate on the optimal bank interest margin is either positive or ambiguous depending on whether the bank is a net borrower or a net lender in the central monetary market, respectively; a mean-preserving increase in credit

[6] This model has been further extended by Allen (1988), who considers loan heterogeneity, and Angbazo

risk will increase the optimal bank interest margin; and finally if the interest rate risk is not severe, an increase in the bank's equity capital will decrease the optimal bank interest margin (otherwise the effect is ambiguous).

In other words, the authors find that the optimal interest margin is positively related to the bank's market power, to operating costs, to the degree of interest rate risk, and to the degree of credit risk. However, the effect of changes in the money market interest rate on the optimal margin is ambiguous and depends on the bank's net position in the Central monetary market. Furthermore, the bank's equity capital is negatively related to the margin when interest risk is trivial.

The optimal bank behaviour can be captured through the bank interest margin which can be estimated with the implicit solutions obtained for the loan rate and for the quantity of issued deposits[7]. The net interest margin is computed as the difference between the implicit rate on assets, r_A, and the implicit rate on liabilities, r_P. Margins are defined ex-post in the sense that they incorporate the actual realisations of non-performing loans, γ is the proportion of non-performing loans in the loan portfolio at the end of the period :

$$\text{NIM} = r_A - r_P = \frac{\left(rB + r_L\left(1-g\right)L\right)}{B+L} - \frac{r_D D}{K+D}$$

where L represents risky non-tradable loans, D deposits, K equity variable, B the bank's net position in the central monetary market, r_L the lending rate, r_D the deposit rate and r the risk free rate.

2.2. Empirical specification

Before specifying our test, we are going through some empirical studies in order to determine which variables have been found to be relevant as determinants of the net interest margins.

(1997), who introduces default risk.

[7] Wong (1997) supposes that the bank is price marker in the loan market, which is imperfect, and quantity setter on the deposit market where the supply of deposits is perfectly elastic.

Based on the dealership approach, Angbazo (1997) undertakes an empirical study on American commercial banks for 1989-1993[8]. The empirical specification focuses on the reported net interest margins, which is assumed to be a function of the desired spread, but also on bank specific factors. The author explores the relationship between net interest margins and the risk factors which banks face when providing immediacy. The empirical specification retains default risk and interest rate risk as risk factors, and liquidity risk, capital base, implicit interest payments, non-interest bearing reserves, management quality, and branching restrictions as bank-specific control variables. Default risk is measured as the ratio of net charge-offs on average loans, and interest rate risk exposure is the net position in short term assets deflated by the book value of total equity capital.

Following Angbazo, Drakos (2003) similarly studies the banking system efficiency of Central and Eastern European countries and Former Soviet countries using a dealership approach and a data set of 283 banks. The explanatory variables retained by the author are interest rate risk, liquidity risk, and default risk. He also takes into account a measure of financial leverage that will account for differences in the financial profile of the institutions, as well as a first dummy variables which is equal to 1 if the bank is state owned and a second one which equals 1 if foreign bank.

Goyeau *et al.* (1999) apply the firm theoretic approach in the context of Central and Eastern European countries. They are able to specify two groups of factors that influence the net interest margin. The first one contains the variables which explain the desired spread under uncertainty; this set of variables reflects the mark-up required by banks to compensate their exposure to interest rate risk and credit risk. The second group is assumed to capture the effects of operating costs, prudential regulation, and the effects of active portfolio reshuffling.

The aim of our study is to determine which variables explained the net interest margins. We therefore combined both approaches in order to underline which one are empirically significant. A first set of risk factors includes default risk, interest rate risk and liquidity

[8] Angbazo (1997) includes default risk in the Ho and Saunders model, he obtains the following pure lending spread : $s = \frac{a}{b} + \frac{1}{4} R\left[\left(Q + 2L_0 \right) s^2 \left(L \right) + 2Q s^2 \left(C \right) + 2 \left(C_0 - Q \right) s \left(CL \right) \right]$ where σ^2(L) is a measure of pure ^{2}(C) a measure of money market interest risk.

risk. A second set of bank specific variables consists of a measure of financial leverage, administrative costs, opportunity cost. We consider as well fee-based activities that are likely to impact on banks margin. We thus take into account net fees revenue as an explanatory variable, as others have retained implicit interest (see for instance the empirical studies of Angbazo (1997), Saunders and Schumacher (2000)).

In general form :

NIM_{it} = *f* (interest rate risk, liquidity risk, credit risk, administrative costs, opportunity cost, equity capital, net fees)

3. Empirical analysis

3.1. Data set

The empirical study is carried out for 12 European countries (number of banks) : Belgium (27), Denmark (42) , France (170), Germany (139), Greece (9), Ireland (11), Italy (116), Luxembourg (42), Netherlands (34), Portugal (34), Spain (39) and UK (55)[9]. The data for this study have been obtained from IBCA and their Bankscope database which provides series from individual bank balance sheets and income statements. The database is yearly data and covers the period 1989-1999. More precisely, the sample includes commercial banks only, i.e. institutions relying more heavily on loan and deposit activities in order to focus on intermediation, banking generating interest margins. Appendix B provides summary statistics (average) on key characteristics. 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[10]. Interest rate series are those supplied by Datastream and by the OECD.

[9] A panel of banks is considered for each country. The number of banks is the one after cleaning data, cf. below.

[10] If Ehrmann *et al*. (2002) argue that the Bankscope database suffers from a composition bias compared to the databases collected by the respective national central banks, Fitch-IBCA has proceed to the construction of a consistent database for reasonable cross-country comparison.

The banking markets considered in this study are rather concentrated apart from Luxembourg (see table 3). In all these countries, the five largest commercial banks comprised, in 1998, between 37 % to 95 % in aggregate assets.

Table 3. Concentration ratios

	Number of commercial banks	C(5) index[a]		Number of commercial banks	C(5) index
Belgium	55	0.95	Italy	154	0.55
Denmark	51	0.94	Luxembourg	129	0.37
France	314	0.63	Netherlands	63	0.89
Germany	246	0.82	Portugal	45	0.59
Greece	22	0.81	Spain	115	0.76
Ireland	27	0.81	UK	211	0.50

[a] C(5) definition: for each country, market share of the five largest banks in terms of total assets.

3.2. Empirical variables

As explained before, we are adopting an eclectic approach with the explanatory variables that have been underlined in the two approaches discussed above. The aim is to determine which variables affect, in a general empirical framework, the net interest margins. We define them below.

The net interest margin is measured by the ratio net interest revenues (interest income – interest expense) to total assets.

Interest rate risk arises because given their maturity and their rate definition, assets and liabilities will be affected differently by market interest rate variation. Therefore a measure of the interest rate risk should capture the maturity gap. Consistent with Flannery and James (1984) and Angbazo (1997), the standard measured exposure is the net position in short term assets (12 months or less) deflated by the value of equity capital. Unfortunately, such a variable cannot be calculated from the data available for our countries. In fact the variables that can be calculated can only implicitly capture effects related to bank balance sheet structures, and thus transformation risk, without explicitly distinguishing interest rate risk from liquidity risk. The latter is the risk of not having sufficient cash or borrowing capacity to meet deposit withdrawals or new loan demand, thereby forcing banks to borrow

emergency funds at excessive cost. The ratio of loans to the bank's customer over short term funding is used as a proxy of the transformation risk. Thus, the higher the level of loans, the greater the premium in the net interest margins.

The credit risk exposure is proxied by the ratio of loan loss provisions to gross loans. Estimations were also estimated using the ratio of loan loss reserves to gross loans, available for a limited number of countries. Whenever the comparison was possible, either income statement (loan loss provisions) or balance sheet (loan loss reserves) information led to the same results. The idea is that banks, whose loans are more risky, will require a higher net interest margins to compensate for higher risk of default.

The interest rate of the central monetary market is approximated by the three month money market rate. This variable, named opportunity cost, is supposed to capture substitution effects, that is substituting marketable assets for loans.

The capital ratio is measured by the ratio of equity capital to total loans. Since equity is more expensive funding source than debt[11], an increase in equity capital may increase the average cost of capital. Therefore, higher net interest margins could be required ex-ante.

The variable reflecting changes in administrative costs is defined as the sum of personnel expenses and non-interest expenses deflated by total assets. The theoretical model suggests that the administrative costs of loans should be separate from the administrative costs of issuing deposits. Unfortunately the data set does not allowed for such a distinction.

The revenue from the sale of services is measured as the net commissions and fees revenue (i.e. commissions and fees income less commissions and fees expense) deflated by the total of assets. We do not include income from securities, net profit (loss) on financial operations and other operating income, as it would not fit in our definition of services sold by banks.

[11] Deposits can be described as debt for banks.

3.3. The results

We have eliminated the banks that over the sample period had less than four years of balance sheet observations, in order to control for the consistency of bank reporting. Then, in order to minimize the effects of measurement errors, we have excluded all the outliers by eliminating the bank observations that did not meet a ratio of total loans over total assets bigger than 10% and smaller than 95%, and the bank/year observations when the equity variable was negative[12].

The parameters of the resulting unbalanced panel are estimated by generalised least squares (GLS). We report the result for all studied countries[13]. To account for time effects either a trend or dummies have been inserted whenever relevant. We expect this(ese) variable(s) to account for the competitive pressure that was increasing over the period[14], and therefore we expect a negative coefficient (as competition increases, the net interest margin decreases).

3.3.1. Effect of standard determinants

The goodness of fit coefficients (R^2) are reasonably high, between 0.74 and 0.98. However to analyse the results we should put more emphasis on the significance of *t*-statistics.

A time effect has not been significant for Belgium, and the U.K.. On the contrary, we have a negative and significant trend for France, Germany, Greece, Luxembourg, Portugal and Spain. Dummy variables show a negative and significant effect at the end of the period considered for Denmark, Ireland and the Netherlands. However if we do observe negative

[12] Such a procedure has been used by Cavallo and Majnoni (2001).
[13] A Hausman test has been used to decide if either the fixed or random effect estimation was to be kept. When the constant coefficient is missing, it means that the fixed effect estimation has been chosen. A diagnostic test for correlation has also been undertaken, but given the structure of the data set, and the number of missing observations, results are of poor quality. However no correlation has been detected.
[14] As competition increased in the lending and deposit markets, we expect the NIM to decrease as a consequence.

Table 4. Estimation results (GLS). Dependant variable: Net Interest Margin[a,b]

	Belgium	Denmark	France	Germany	Greece	Ireland
Constant	0.006 (2.587)**		0.010 (3.065)**	0.020 (5.685)**	0.020 (1.402)	
Opportunity cost	-0.0002 (-0.804)	0.0002 (2.354)**	0.0004 (1.590)	-0.0007 (-2.476)**	-0.0005 (-1.008)	0.001 (3.005)**
Capitalisation	0.0004 (0.200)	-0.013 (-2.582)**	-0.0002 (-0.821)	-0.0004 (-2.384)**	0.037 (2.642)**	0.004 (0.655)
Administrative costs	0.411 (6.367)**	0.887 (18.40)**	0.569 (19.32)**	0.551 (27.48)**	0.562 (4.277)**	1.110 (7.265)**
Default risk	0.0005 (2.304)**	0.0001 (0.986)	0.00007 (0.775)	0.025 (8.167)**	0.0002 (0.512)	-0.002 (-1.448)
Transformation risk	0.018 (4.586)**	0.000002 (0.775)	0.007 (4.632)**	0.009 (5.058)**	0.017 (1.720)*	0.002 (0.525)
Fees	-0.144 (-3.040)**	-0.417 (-7.431)**	-0.334 (-10.75)**	-0.270 (-8.127)**	-0.010 (-0.539)	-1.076 (-4.904)**
Adjusted – R^2	0.92	0.95	0.77	0.92	0.83	0.96
Observations	183	315	1330	890	55	59

(continued on next page)

[a] Figures in parentheses are the t-statistics, asterisks (**) and (*) indicate respectively significance at 5% and 10%.
[b] All regression estimates are heteroskedastic consistent and are based on the revised covariance estimate of White (when relevant).

Table 4. (*continued*)

	Italy	Luxembourg	Netherlands	Portugal	Spain	UK
Constant	-0.007 (-2.460)**	0.010 (2.925)**	0.012 (5.890)**	0.021 (2.075)**	0.013 (2.627)**	
Opportunity cost	0.002 (6.791)**	-0.0001 (-0.418)	-0.0007 (-3.638)**	0.0002 (0.343)	0.0005 (2.087)**	0.0001 (2.229)**
Capitalisation	0.010 (3.225)**	0.002 (1.116)	-0.006 (-2.144)**	0.018 (2.637)**	0.031 (5.515)**	0.008 (4.701)**
Administrative costs	0.754 (21.80)**	-0.007 (-0.465)	0.796 (7.362)**	0.143 (2.192)**	0.555 (9.825)**	0.884 (19.25)**
Default risk	0.0001 (0.897)	0.0001 (0.789)	0.201 (6.770)**	0.069 (2.031)**	0.0003 (0.834)	-0.00003 (-0.211)
Transformation risk	0.006 (0.469)	0.007 (5.187)**	0.001 (0.921)	0.018 (5.080)**	0.006 (3.207)**	0.010 (10.12)**
Fees	-0.0001 (-0.002)	0.098 (2.341)**	-0.988 (-6.770)**	-0.045 (-0.319)	0.239 (2.965)**	-0.780 (-22.07)**
Adjusted – R^2	0.86	0.74	0.78	0.75	0.94	0.98
Observations	868	266	265	245	380	383

dummy coefficients for the beginning of the period for Italy, dummy coefficients are positive for the end of the period[15].

For all countries, the bank interest margin reacts positively to the administrative costs variable, coefficients are significant at the 5% level, but Luxembourg (however the coefficient is not significant). The theoretical effect is thus not rejected, and therefore an increase in the administrative costs implies a higher bank interest margin.

The transformation risk variable which has been retained as a proxy of interest rate risk has the expected positive sign in all the countries but the coefficient is not significant at the 5% level for four of them, Denmark, Ireland, Italy and the Netherlands. We also observe that when the effect of transformation risk is not severe on the net interest margin we indeed find as shown in Wong (1997) that the capitalisation variable has a negative impact on the bank interest margins (see Denmark and the Netherlands). For both of these countries, their capital ratio is negative and significant.

For Greece, Italy, Portugal, Spain and the U.K., the variable which is a proxy for the capital requirement has a positive sign, with a significant effect. The coefficient is not significant for Belgium, Ireland and Luxembourg. Thus, a higher capital ratio is compensated for these countries by a higher net interest margin.

The default risk proxy is positive and significant for Belgium Germany, Ireland, the Netherlands and Portugal. For Denmark, France, Greece, Italy, and Spain the coefficient is positive but not significant. However for Greece and Luxembourg, the coefficient is negative and significant. A negative effect of credit risk on the bank interest margin is inconsistent with the theoretical model. A possible explanation relates to asymmetric information which is not explicitly taken into account here. If riskier projects mean higher bank margins, then the probability of non-performing loans may increase. Thus banks may choose to increase their monitoring on loans rather than increasing their margins.

[15] We then wonder if it has been caused by an increased of banks monopoly power following consolidation in the Italian banking market.

The opportunity cost variable is significant for seven of the twelve countries. However the sign of the coefficient is either positive or negative, and therefore the effect on bank interest margins is ambiguous. It may depend on the net position of banks on interbank market as seen above.

3.3.2. Effect of the commissions and fees variable

Finally, we look at the net fees variable, which has a negative impact on net interest margins in all countries but Luxembourg and Spain. In other words, results show for most the countries a negative impact of the sale of services on the pricing of net interest margins. Then, what could induce such an impact ?

From the presence of a time effect in each of the regression which should capture competition effect, we know that the inverse relationship observed between net fees and commissions revenue on total assets and net interest margins is not due to a positive trend in the former variable, and a negative one in the latter.

The question raised now is how to explain such a relationship. De Young and Roland (2001), Drucker and Puri (2002), as well as American regulators raised the question of credit providing to borrowers at reduced rates to get compensated by high fee business. The cross-subsidisation literature in the banking market may give some indications. Several authors, as Barro and Santomero (1972), Mitchell (1979), Whitesell (1992), and Tarkka (1995), have shown that deposit interest rate regulations have implied "implicit interest" in the form of services rendered at prices below cost. Chiapporri *et al.* (1995) have modelled the effect of deposit rate regulation on the lending rate using a Salop setting framework, underlying the existence of subsiding sale. An alternative consideration of the fees and lending rate relationship could be Cukierman (1978) who showed that borrowers who are buying more services than others to a same bank are less prone to credit rationing. With regards to our study, that implies to consider the effect of the sale of services on the determination of the lending rate (most of deposit rates being still under regulation).

4. Conclusion

The aim of this paper is to analyse the behaviour of banks in terms of pricing strategy. Indeed, as mentioned previously, banking activities have dramatically changed over the last two decades : the share of non-interest income of bank revenue has become a substantial part of banks profit. We therefore wondered how determinants of net interest margins have been affected in European countries.

The dealership and firm theoretic models, as well as data availability, have led us to choose default risk and transformation risk as risk factors determinants. We have also included an opportunity cost, a capital ratio and an administrative costs variables. Our results show a positive and significant impact of default risk, administrative costs and transformation risk in most European countries. In overall, the results found here are at least as good as those obtained in previous studies.

Finally, to take into account changes in banks profit, we have added a fee variable. The results show that services provision reduces the net interest margins. This finding invites us to determine the relationship between this two variables in the field of the cross-subsidisation literature we exposed earlier. If we observe an empirical effect on the net interest margin, a theoretical investigation may precise what can be the effect of services provision on the lending rate and possibly credit risk. Does the sale of services alter banks behaviour? Such a result would suggest to the authorities regulation to take the "non-traditional" activities of banks into consideration. If the revised regulation of the Cooke ratio, Basle accord, takes into account market risk exposure, it may not give enough emphasis to the services activity of banks – even if banks diversify their activities, they may not consider the possible effects on pricing strategy and risk.

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Appendix A.

Table 5. Number of observations

	89	90	91	92	93	94	95	96	97	98	99
Belgium	23	22	26	26	35	43	45	44	43	34	31
Denmark	14	16	18	33	36	43	48	49	49	49	47
France	121	133	141	237	265	276	274	264	242	225	178
Germany	57	67	90	111	160	186	195	202	199	181	142
Greece	6	6	8	5	7	11	11	13	19	17	14
Ireland	2	2	2	6	9	12	14	15	17	16	13
Italy	70	77	78	69	104	113	119	129	126	120	110
Luxembourg	35	63	71	75	97	104	104	107	107	102	98
Netherlands	27	28	29	35	41	49	54	55	48	44	37
Portugal	6	13	16	32	33	34	39	41	41	38	32
Spain	62	73	83	57	61	63	74	93	97	92	83
UK	13	17	25	104	130	135	148	161	149	141	119

Source : Fitch IBCA (1997, 2001)

Appendix B. Summary statistics.

Table 6. Descriptive Statistics

	Mean	Std. dev	Min	Max
Belgium				
Total Assets	$ 15.83 B	$ 43.71 B	$ 52 M	$ 342 B
Deposit / TA	89.27	4.87	0.53	95
Equity / TA	5.69	4.04	1.38	34.14
Loans / TA	35.84	18.38	10.03	85.67
Denmark				
Total Assets	$ 3.88 B	$ 13.56 B	$ 34.3 M	$ 94.5 B
Deposit / TA	83.05	3.72	59.70	91.06
Equity / TA	10.98	3.49	4.16	20.23
Loans / TA	56.43	12.96	10.39	82.04
France				
Total Assets	$ 9.98 B	$ 43.64 B	$ 5.52 M	$ 702 B
Deposit / TA	78.01	15.77	10.04	95
Equity / TA	8.61	9.60	0.02	80.19
Loans / TA	54.87	23.88	10.01	95
Germany				
Total Assets	$ 6.45 B	$ 27.99 B	$ 10.8 M	$ 289 B
Deposit / TA	77.60	18.12	10.25	95
Equity / TA	8.94	8.90	0.50	73.46
Loans / TA	50.39	22.71	10.09	95
Greece				
Total Assets	$ 6.42 B	$ 10.97 B	$ 88 M	$ 46.55 B
Deposit / TA	85.40	6.50	58.23	95.58
Equity / TA	8.53	4.78	0.14	28.41
Loans / TA	40.67	11.97	11.54	71.91

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Table 6. (*continued*)

	Mean	Std. dev	Min	Max
Ireland				
Total Assets	$ 7.84 B	$ 13.49 B	$ 117 M	$ 65.55 B
Deposit / TA	82.87	17.53	12.59	95
Equity / TA	9.18	13.15	0.63	86.55
Loans / TA	55.10	19.83	12.71	85.51
Italy				
Total Assets	$ 11.48 B	$ 30.21 B	$ 35.9 M	$ 330 B
Deposit / TA	76.64	8.91	16.23	95
Equity / TA	8.63	4.04	0.62	35.91
Loans / TA	47.12	10.67	10.60	95
Luxembourg				
Total Assets	$ 4.51 B	$ 6.68 B	$ 47.9 M	$ 37.2 B
Deposit / TA	87.25	9.82	11.81	95
Equity / TA	5.03	4.79	0.90	48.01
Loans / TA	30.05	17.46	10.00	94.79
Netherlands				
Total Assets	$ 18.22 B	$ 61.33 B	$ 25.9 M	$ 504 B
Deposit / TA	80.44	16.15	13.59	95
Equity / TA	6.95	5.33	0.85	62.46
Loans / TA	52.15	22.77	10.90	95
Portugal				
Total Assets	$ 6.48 B	$ 10.02 B	$ 53.4 M	$ 57.6 B
Deposit / TA	79.96	13.81	15.72	95
Equity / TA	9.28	7.80	0.20	64.62
Loans / TA	45.90	15.05	11.22	83.78
Spain				
Total Assets	$ 10.44 B	$ 29.77 B	$ 16.4 M	$ 237 B
Deposit / TA	81.91	13.43	11.85	95
Equity / TA	10.95	11.00	0.35	79.31
Loans / TA	51.25	20.11	10.09	95
UK				
Total Assets	$ 5.53 B	$ 12.96 B	$ 8.3 M	$ 164 B
Deposit / TA	77.29	14.71	10.24	95
Equity / TA	12.69	10.32	0.42	71.04
Loans / TA	50.53	27.62	10.04	95

Source : Fitch IBCA (1997, 2001)

All figures are in percentages unless stated otherwise.