Product diversification in the European banking industry: Risk and loan pricing

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Abstract

The purpose of this paper is to investigate the relationship between bank risk and product diversification in the changing structure of the European banking industry. Based on a broad set of European banks for the period 1996-2002, our study shows that banks expanding into non-interest income activities present higher risk than banks which mainly supply loans. Whereas previous studies (mainly on U.S. banks) focused on portfolio diversification effects we explore risk implications of cross-selling determinants of loan pricing as an alternative explanation. Our results show that higher income from other activities is associated with lower lending rates which suggests that banks may actually use loans as loss leader altering default screening and monitoring activities and consequently risk pricing.

JEL classification: G10, G21

Keywords: banking risk, interest income, non-interest income, product diversification

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1. Introduction

In the context of financial deregulation that took place in the seventies and in the eighties, western banking systems faced major changes in the form of increased competition, concentration and restructuring. Banks have reacted to the new environment by adopting a proactive strategy widening the range of products they offer to their clients. These changes mainly implied an increasing share of non-interest income in profits. Non-interest income stems from traditional service charges (checking, cash management, letters of credit…) but also from new sources. The decline in interest margins induced by higher competition lead banks to charge higher fees on existing or new services (cash withdrawal, bank account management, data processing…). As a result, the structure of banking experienced a dramatic change in both the U.S. and Europe. In the eighties, non-interest income represented 19 percent of U.S. commercial banks' total income. This share had grown to 43 percent of total income in 2001 (Stiroh, 2004). In Europe, non-interest income has increased from 26 percent to 41 percent between 1989 and 1998 (ECB, 2000).

Since the adoption of the new universal banking principle, commercial banks can compete on a wider range of market segments (investment banking, market trading …). A number of studies questioned the risk implications of this new environment. The issue is of importance for the safety and soundness of the banking system and a major challenge for supervisory authorities. U.S. regulators, such as Dingell (2002), have raised questions about the pricing of loans, claiming that "commercials banks may be winning high service fees by underpricing credit facilities as a loss leader to their clients". The existing literature, mostly based on U.S. banks, either focused on portfolio diversification effects (risk return profile) (Boyd *et al.*, 1980; Kwan, 1998; De Young and Roland, 2001) or on incentives approaches (Rajan, 1991; John *et al.*, 1994; Puri, 1996; Boyd *et al.*, 1998). Few studies were able to show that the combination of lending and non-interest income activities allows for diversification benefits and therefore risk reduction. Conversely, some papers find a significant positive impact on earnings volatility (De Young and Roland, 2001; Stiroh 2004). As noted by De Young and Roland (2001), three main reasons may explain this increase in risk. Firstly, income from lending activities is likely to be relatively stable over time, because switching and information costs make it costly for either borrowers or lenders to walk away from a lending relationship. In contrast, income from non-interest income activities may suffer from larger fluctuations as it might be easier to switch banks for this kind of activities than for

lending. Secondly, expanding non-interest income activities may imply a rise in fixed costs (for example, additional staff may be required), which increases the operational leverage banks. Conversely, once a lending relationship is established, the marginal cost induced by the supply of additional loans is limited to interest expenses. Thirdly, because bank regulators do not require banks to hold capital against non-interest income activities earnings volatility may increase because of a higher degree of financial leverage. As for Stiroh (2004), he mentions that cross-selling of different products to a core customer does not imply diversification benefits (more products are sold to the same customer) which may explain why interest income growth and non-interest income growth are highly correlated in his study.

The aim of this paper is to assess the risk implications of the changing structure of the European banking industry which has shifted away from traditional intermediation activities (deposit funded loans) towards activities generating non-interest income. Using individual bank data from 1996 to 2002, we start by analysing the link between banking risk and the degree of diversification by comparing the risk level of banks which have expanded into non traditional activities with banks which have not chosen such a strategy. Our sample is a panel of 951 listed and non listed. While previous work on bank diversification was essentially dedicated to the U.S. banking industry and limited to the overall link between risk and diversification (diversification benefits) we specifically focus on cross-selling determinants of loan pricing when different products are sold to a core customer. In this sense our aim is to explore whether banks engaged in diversification actually underprice loans using them as a loss leader in order to capture clients to whom they may sale non-interest income activities later on (Dingell, 2002; Nys, 2003).

The remainder of the paper is organized as follows. Section 2 reviews the literature on banking risk and product diversification. Section 3 analyses the relationship between the changing structure of bank income and risk in the European banking industry. Section 4 presents the methodology and the results of our investigation of cross-selling between lending and non traditional activities. Concluding remarks are presented in the final section.

2. Existing literature

Over the two past decades, the combination of traditional and non traditional activities in banking has given rise to a substantial number of studies. Most of the existing literature is dedicated to potential diversification benefits for banks to engage in a broader scope of

activities. In general, these studies, which essentially considered U.S. data, provide mixed results. Boyd *et al.* (1980), who simulated portfolios of banking and non-bank subsidiaries during the 1970s, find a potential for risk reduction at relatively low levels of non-bank activities. The results obtained by Kwast (1989) to determine an optimal risk-minimising combination of banking and non-banking activities for the period 1976-1985 show only a slight potential for risk reduction. Gallo *et al.* (1996) find, over the 1987-1994 period, that combination of bank and mutual fund activities allows for some diversification benefits increasing profitability for moderated risk levels. Moreover, a large number of studies show no diversification benefits or even an increase in risk when combining traditional and non interest income activities. According to Boyd and Graham (1986), expansion by BHCs into non-bank activities during the seventies tends to increase the risk of failure during less stringent policy period. Demsetz and Strahan (1995) who study the stock returns of BHCs between 1980 and 1993 find that although banks extended their product mixes, no reduction in risk could be observed as banks tended to move to riskier activities and to lower their capital ratio. Kwan (1998) who investigated bank section 20 subsidiaries during the 1990-1997 period underlines the increased volatility of accounting returns despite non increase in bank profitability. DeYoung and Roland (2001) look at the impact of fee-based activities on profitability and volatility of large U.S. commercial banks revenue from 1988 to 1995. They conclude that fee-based activities, which represent a growing share of banking activities, increase the volatility of bank revenue. Stiroh (2004) assesses the potential benefit of diversification for banks engaging in non interest activities for the period 1984-2001. He finds an increased correlation between net interest and non interest incomes[1].

Several causes were explored to explain why diversification benefits were not effective in some studies. DeYoung and Roland (2001) suggest three explanations: high competition on non-interest income activities, fixed costs associated to fee-based activities and lack of regulation on non-interest income activities. According to Stiroh (2004), as mentioned above, higher correlation between non-interest income and interest income can be due to possible cross-selling of different products to the same customer.

This paper extends the earlier work on bank diversification in several directions. First, to our knowledge, this is the first study to examine the case of the European banking industry

[1] Another group of studies simulate mergers between bank holding companies and nonbank financial firms (Boyd and Graham, 1988; Boyd *et al.*, 1993; Saunders and Walter, 1994; Laderman, 1999; Lown *et al.* 2000; Allen and Jagtiani, 2000; for a survey, see Kwan and Laderman, 1999). Simulations were ran to assess the impact on risk of combining traditional banking activities and securities and/or insurance activities (US commercial banks were not allowed to provide such activities before 1999).

which experienced tremendous changes over the last decade. Second, this study considers a large set of risk measures based on accounting data but also on market data and analyses the correlation between shifts in risk and changes in the degree of diversification at the bank individual level. Third, this is the first paper which empirically raises the issue of loan pricing implications of the trend towards diversification in Europe by assuming potentials for cross-selling among traditional and non-traditional activities which could induce banks to lower lending rates and underprice credit risk.

3. Banking risk and product diversification

3.1. Data set

The sample period extends from 1996 to 2002 for European commercial and cooperative banks. Our source for all bank-level variables is Bankscope Fitch IBCA which provides annual financial statement[2] for 2129 banks established in 14 European countries[3] (see Appendix 1, Table A.1). Two samples are used in our empirical work. The first sample includes banks for which sufficient information is reported in Bankscope for the purpose of our study throughout the 7 years we consider. This sample contains 951 banks. We also consider a second sample which is restricted to listed banks. Market data (bank stock prices) come from Datastream International. Banks with discontinuously traded stocks being omitted, 156 banks remain in this second sample.

Descriptive statistics of our two samples are presented in Table 1. Both samples show sufficient heterogeneity in different types of banking activities, enabling us to analyse the behaviour of banks depending on their degree of diversification.

[2] All the banks in our sample disclose their annual financial statements at the end of each calendar year.
[3] The European banking system can be considered as unified since the Second European Banking Directive of 1989. Thus, we consider a sample of European banks without taking into account countries of origination.

Table 1. Descriptive statistics for European commercial and cooperative banks, on average over the period 1996-2002 (%)

	LOANS	DEP	EQUITY	LLP	EXPENSES	ROA	ROE	NII	NNII	Interest rate	Lending rate
Sample 1 : Non listed and listed banks											
Mean	58.03	56.88	10.77	1.08	1.71	0.89	8.82	62.46	35.13	6.45	7.63
Std	19.36	19.56	11.41	9.92	1.94	2.20	17.71	24.37	25.21	3.46	3.75
Max	97.94	93.99	100.00	427.44	46.59	80.99	417.95	100.00	100.00	64.62	33.26
Min	4.52	0.30	0.26	-250.03	0.00	-45.69	-441.09	-137.07	-191.56	0.05	0.00
Sample 2 : Listed banks											
Mean	64.36	59.15	9.40	0.84	2.06	1.10	11.04	66.51	33.25	7.07	7.26
Std	13.83	16.88	7.74	0.78	3.58	1.66	7.19	15.66	16.33	2.87	2.73
Max	92.12	90.96	75.86	8.00	46.59	23.53	75.77	97.09	97.22	37.31	20.31
Min	26.58	12.92	2.23	-1.35	0.26	-1.74	-34.89	2.78	-89.55	1.97	0.00

Variable definitions (all variables are expressed in percentage): LOANS = loans/total assets; DEP = deposits/total assets; EQUITY = equity/total assets; LLP = loan loss provisions/net loans; ROA = return on asset; ROE = return on equity; NII = net interest income/net operating income; NNII = net non interest income/ net operating income; EXPENSES = personnel expenses/total assets; Interest rate = Interest revenue/total earning assets; Lending rate = Interest on loans/net loans.

3.2. Degree of diversification and risk

The literature cited above highlights, with regards to U.S. banks, that activity diversification does not necessarily imply lower risk, and may on the contrary increase banking risk. As a first step we check if similar results can also be obtained for European banks. One way to capture the degree of diversification of bank activities in the literature (see Stiroh (2004)) is to consider the structure of income statements that is relative portions of net interest income generated by traditional activities and non-interest income produced by non traditional activities. We therefore split our samples into different panels of banks on the basis of the value of the ratio of net non interest income to net operating income (NNII)[4]. We consider as diversified banks for which the value of the NNII ratio is higher than the third quartile (Q_{75}) and as non diversified banks with a NNII ratio lower than the first quartile (Q_{25}). Five standard measures of risk, based on accounting data and determined for each bank throughout the period, are used to compare the level of risk of these two groups of banks: (i) the standard deviation of the return on assets (SDROA); (ii) the standard deviation of the return on equity (SDROE); (iii) the coefficient of variation of the return on assets (CVROA)); (iv) the coefficient of variation of the return on equity (CVROE; (v) the ratio of loan loss provisions to net loans (LLP). We also use insolvency risk measures: (i) the "Z-score" (ADZ: (1 + average ROE) divided by SDROE) which indicates the probability of failure of a given bank[5]; (ii) the "ZP-score" (ADZP) as in Goyeau and Tarazi (1992) and its two additive components[6] which we call $ADZP_1$ and $ADZP_2$. $ADZP_1$ is a measure of bank portfolio risk whereas $ADZP_2$ is a measure of leverage risk.

Our diversification criteria is also disaggregated, as in De Young and Roland (2001) and in Stiroh (2004), to allow for deeper insights. Considering our data, we distinguish two components of non-interest income: commission and fee income and trading income. Firstly, we compare the level of risk of banks which are characterized by high levels of fee-based activities (banks with a ratio of net commission income to net operating income (COM) higher than the third quartile Q_{75}) with banks with the same ratio not exceeding the value of the first quartile (COM lower than Q_{25}). Secondly, we undertake the same comparison on the

[4] Net non-interest income is defined as the difference between the non-interest income and the non-interest expenses and net operating income is the sum of net interest and net non interest incomes.

[5] The Z-score is the number of standard deviations that profits must fall to drive a firm into bankruptcy. Higher values of Z-scores imply lower probabilities of failure (see Boyd and Graham (1986) for details).

[6] $ADZP = ADZP_1 + ADZP_2 = \frac{\text{average ROA}}{\text{SDROA}} + \frac{\text{average EQUITY}}{\text{SDROA}}$.

basis of the extent of trading activities (ratio of net trading income to net operating income (TRAD) higher than Q_{75} versus TRAD lower than Q_{25}).

The results in Table 2 show that banks which exhibit high degrees of diversification display higher risk and insolvency measures[7]. Therefore, on the whole, our results obtained for European banks are in line with those underlined for U.S. banks by DeYoung and Roland (2001) and Stiroh (2004). When we focus on the different sources of non traditional income our results also show that greater reliance on fee-based activities is associated with higher risk and insolvency indicators whereas higher dependence on trading activities does not imply such a result.

To check for robustness, we ran our risk estimations, using market data, on our sample of listed banks.

Three risk measures are used which are the standard deviation of daily returns (SDRET, calculated using stock price information), the market model beta coefficient estimated through a single factor model (BETA) and specific risk (RSPEC, standard deviation of the market model residual). Insolvency risk (bank default risk) is captured by a market data based Z-score (MDZ) and the distance to default[8] (DD). The results obtained in table 3 confirm those obtained with accounting data[9].

To explore the determinants of risk we extend our study by analysing throughout our sample period shifts in bank risk depending on diversification trends.

[7] Similar results, reinforced with higher significance levels, are obtained when the median or the mean is used to discriminate our two sets of banks.

[8] The distance to default is inferred from the market value of a risky debt (Merton, 1977) based on the Black and Scholes (1973) option pricing formula.

[9] Banks have been classified on the one hand depending on their level of diversification and on the other hand given the level of risk. A Spearman test was conducted to compare their respective ranks in each set. We reject the null hypothesis of independency of each group of banks. In other words, banks with a higher level of risk are also the ones exhibiting a higher level of diversification.

Table 2. Product diversification and level of risk and insolvency measures for European banks (1996-2002)

	Risk Measures					Insolvency measures			
	SDROA	SDROA	CVROA	CVROE	LLP	Z	Z'	Z_1'	Z_2'
NNII > Q_{75}									
Mean	1.20	9.33	0.59	0.12	2.44	2.45	27.83	2.15	25.67
(Obs.)	206	206	206	206	185	206	206	206	206
NNII < Q_{25}									
Mean	0.52	5.55	0.75	0.99	0.54	4.01	52.81	3.35	49.45
(Obs.)	290	290	290	290	280	290	290	290	290
T-statistic of the mean Test	5.305***	3.394***	-0.409	-1.712**	2.664***	-4.786***	-6.804***	-4.458***	-6.835***
COM > Q_{75}									
Mean	1.14	8.90	0.23	-0.15	1.56	2.54	30.68	2.25	28.42
(Obs.)	171	171	171	171	158	171	171	171	171
COM < Q_{25}									
Mean	0.55	5.59	0.76	0.88	0.80	3.84	48.38	3.23	45.14
(Obs.)	339	339	339	339	328	339	339	339	339
T-statistic of the mean Test	4.513***	3.022***	-1.462*	-1.856**	1.543*	-3.945***	-4.755***	-3.582***	-4.743***
TRAD > Q_{75}									
Mean	0.90	6.38	-1.33	0.71	2.02	2.94	34.99	2.52	32.47
(Obs.)	249	249	249	249	238	249	249	249	249
TRAD < Q_{25}									
Mean	1.22	9.13	0.77	0.65	0.04	3.31	32.21	2.51	29.70
(Obs.)	102	102	102	102	95	102	102	102	102
T-statistic of the mean Test	-0.920	-1.788**	-1.046	0.049	2.576***	-0.962	0.859	0.064	0.904

****, ** and * indicate significance respectively at the 1%, 5% and 10% levels for a unilateral test.*

Variable definitions: NNII = ratio of net non interest income to net operating income; COM = ratio of net commission income to net operating income; TRAD = ratio of net trading income to net operating income; SDROA = standard deviation of the return on assets; SDROE = standard deviation of the return on equity; CVROA = coefficient of variation of the return on assets; CVROE = coefficient of variation of the return on equity; LLP = ratio of loan loss provisions to net loans; ADZ = Z-score; ADZP = "ZP-score"; $ADZP_1$ = measure of bank portfolio risk; $ADZP_2$ = measure of leverage risk.

Table 3. Product diversification and level of risk and insolvency market measures for European listed banks (1996-2002)

	Risk Measures			Insolvency measures	
	SDRET	BETA	RSPEC	MDZ	DD
$NNII > Q_{75}$					
Mean	0.05	0.66	0.04	37.30	15.51
(Obs.)	39	39	39	39	38
$NNII < Q_{25}$					
Mean	0.02	0.18	0.02	51.31	26.13
(Obs.)	39	39	39	39	38
T-statistic of the mean Test	4.800***	4.970***	3.900***	-2.060**	-1.870**
$COM > Q_{75}$					
Mean	0.05	0.57	0.04	36.15	15.37
(Obs.)	39	39	39	39	38
$COM < Q_{25}$					
Mean	0.03	0.21	0.03	55.92	28.95
(Obs.)	39	39	39	39	38
T-statistic of the mean Test	3.270***	3.560***	2.540***	-2.820***	-2.350**
$TRAD > Q_{75}$					
Mean	0.04	0.68	0.03	38.80	16.09
(Obs.)	34	34	34	34	33
TRAD $< Q_{25}$					
Mean	0.03	0.32	0.03	43.55	21.29
(Obs.)	34	34	34	34	33
T-statistic of the mean Test	0.970	3.070***	0	-0.850	-0.890

****, ** and * indicate significance respectively at the 1%, 5% and 10% levels for a unilateral test. Variable definitions: NNII = ratio of net non interest income to net operating income; COM = ratio of net commission income to net operating income; TRAD = ratio of net trading income to net operating income; SDRET = standard deviation of daily returns; BETA = market model beta; RSPEC = standard deviation of the market model residual; MDZ = market data based Z-score; DD = distance to default.*

3.3. Trends in diversification and risk shifts

To study the link between the shift towards non interest income and bank risk we consider high frequency data (market data) therefore restricting our analyses to the sample of listed banks. In a first test we aim to investigate if banks characterized by a high annual growth rate in non traditional activities (ΔNNII > 3% per year) exhibit a higher increase in

risk than banks with a relatively low annual growth rate of NNII (ΔNNII < 1% per year)[10]. A similar procedure is adopted for the two components of net non interest income.

Table 4. Growth rates of degree of diversification and risk for European listed banks (1996-2002)

	Growth rate of risk Measures			Growth rate of insolvency measures	
	ΔSDRET	ΔBETA	ΔRSPEC	ΔMDZ	ΔDD
Δ NNII > 3%					
Mean	13.28	196.70	11.28	26.10	-6.57
(Obs.)	45	45	45	45	37
Δ NNII < 1%					
Mean	15.55	31.87	12.93	21.93	-4.51
(Obs.)	36	36	36	36	30
T-statistic of the mean Test	-3.560	4.880***	-2.680	6.230***	-0.840
Δ COM > 3%					
Mean	13.77	94.29	12.00	24.24	-5.61
(Obs.)	72	72	72	72	61
Δ COM < 1%					
Mean	11.68	-47.45	7.30	26.31	14.69
(Obs.)	11	11	11	11	11
T-statistic of the mean Test	2.690***	3.590***	6.330***	-2.950	-4.650
Δ TRAD > 3%					
Mean	15.05	-49.63	13.01	20.39	-15.54
(Obs.)	23	23	23	23	21
Δ TRAD < 1%					
Mean	14.02	-15.73	11.62	26.73	0.22
(Obs.)	53	53	53	53	44
T-statistic of the mean Test	1.460	-2.610	2.00**	-8.220	-6.210

****, ** and * indicate significance respectively at the 1%, 5% and 10% levels for a unilateral test.*
Variable definitions: ΔNNII = mean of the annual growth rate of the ratio of net non interest income to net operating income; ΔCOM = mean of the annual growth rate of the ratio of net commission income to net operating income; ΔTRAD = mean of the annual growth rate of the ratio of net trading income to net operating income; ΔSDRET = mean of the annual growth rate of the standard deviation of daily returns; ΔBETA = mean of the annual growth rate of the market model beta; ΔRSPEC = mean of the annual growth rate of the standard deviation of the market model residual; ΔMDZ = mean of the annual growth rate of the market data based Z-score; ΔDD = mean of the annual growth rate of the distance to default.

[10] The growth rate of each variable is computed as the mean of annual growth rates.

If we consider the set of banks which are more reliant on non interest income over the sample period, that is banks for which the net non interest income ratio has increased, results do not systematically display a rise in risk and insolvency measures. However, when considering the two components of net non interest income it appears that banks which have engaged into fee-based activities have significantly increased their risk, whereas risk is unchanged for banks which have mainly expanded their non traditional activities into trading.

To check the stability of our results, we also consider an increase in bank diversification taking into account the relative position of each bank with respect to the average level of diversification in our sample. More precisely, compared to the previous procedure, we excluded from our panel banks with a diversification level lower than the sample mean computed for the year 2002. Based on this criteria our tests show an increase in risk for banks which have developed non interest activities and which simultaneously exhibit the highest rates of diversification in 2002. The analysis of the subcomponents of net non interest income suggests that this result may be driven by banks which expanded their fee-based activities. Indeed, banks which highly shifted towards trading activities are not characterized by an increase in risk.

Consistent with some studies on U.S. banks, our results show that the shift from traditional intermediation activities toward non-interest income activities is associated with higher bank risk. However, in contrast with the U.S. case (see Stiroh (2004)), we find no evidence of a positive link between the extent of trading revenue and risk. In our study increase in risk is actually solely attributable to greater reliance on fee-based activities. This suggests that the European banking industry might have experienced different changes and that the supply of fee-based services might have altered bank loan pricing behaviour. This is a challenge for better understanding the link between risk and fee-based activities which therefore deserves a closer attention.

Table 5. Growth rate and level of diversification and growth rate of risk for European listed banks (1996-2002)

	Growth rate of risk Measures			Growth rate of insolvency measures	
	ΔSDRET	ΔBETA	ΔRSPEC	ΔMDZ	ΔDD
Δ NNII > 1% and NNII > NNII average of the banking industry in 2002					
Mean	19.75	258.16	15.502	27.44	-3.35
(Obs.)	24	24	24	24	19
Δ NNII < 1% and NNII < NNII average of the banking industry in 2002					
Mean	12.71	46.94	10.518	25.57	5.208
(Obs.)	29	29	29	29	23
T-statistic of the mean Test	7.700***	2.880***	5.430***	2.300**	-2.210
Δ COM > 1% and COM > COM average of the banking industry in 2002					
Mean	21.90	251.38	18.21	23.59	1.97
(Obs.)	29	29	29	29	23
Δ COM < 1% and COM > COM average of the banking industry in 2002					
Mean	9.89	-35.62	5.16	26.31	16.47
(Obs.)	10	10	10	10	10
T-statistic of the mean Test	9.320***	2.820***	10.66***	-1.460	-1.630
Δ TRAD > 3% and TRAD > TRAD average of the banking industry in 2002					
Mean	12.47	-113.97	9.04	21.25	-9.91
(Obs.)	14	14	14	14	14
Δ TRAD < 1% and TRAD > TRAD average of the banking industry in 2002					
Mean	14.64	-53.15	12.26	25.96	9.29
(Obs.)	35	35	35	35	29
T-statistic of the mean Test	-2.010	-2.580	-3.120	-4.300	-5.270

****, ** and * indicate significance respectively at the 1%, 5% and 10% levels for a unilateral test.*
Variable definitions: ΔNNII = mean of the annual growth rate of the ratio of net non interest income to net operating income; ΔCOM = mean of the annual growth rate of the ratio of net commission income to net operating income; ΔTRAD = mean of the annual growth rate of the ratio of net trading income to net operating income; ΔSDRET = mean of the annual growth rate of the standard deviation of daily returns; ΔBETA = mean of the annual growth rate of the market model beta; ΔRSPEC = mean of the annual growth rate of the standard deviation of the market model residual; ΔMDZ = mean of the annual growth rate of the market data based Z-score; ΔDD = mean of the annual growth rate of the distance to default.

4. Lending rate and non traditional activities

In this section we investigate cross-selling of loans and fee-based activities More precisely, we examine the hypothesis that banks have used lending as a loss leader in order to capture customers to sell additional non traditional products Our assumption is that banks may require lower rates on their lending activities underpricing credit risk which may in turn

increase their overall risk level. Consequently the price banks require for loans should be a decreasing function of non-interest income. We further investigate the determinants of the lending rate by distinguishing commission and fee income and trading income.

We focus on the determinants of the lending risk premium, i.e. the lending rate charged by the bank minus the risk free rate, using several definitions. Relying on the optimal bank interest margin literature (Klein, 1971; Monti, 1972; Ho and Saunders, 1981; Angbazo, 1997; Wong, 1997; Saunders and Schumacher, 2000; Drakos, 2003; Maudos and Guevara, 2004), we first selected a set of variables which are considered in most studies aiming to capture the determinants of bank loan pricing to which we added the diversification variables defined above

Our dependent variable is defined in several ways. The risk premium on loans (traditional activities) is first proxied by a spread W_SPREAD which is the difference between the ratio of net interest income to total earning assets and the 10 year government bond rate. We also consider a spread based on the difference between the lending rate determined as the ratio of interest from loans to net loans and the 10 year government bond rate (N_SPREAD)[11].

We estimate the three following equations for each spread:

$$SPREAD_{it} = \alpha_{1i} + \alpha_2 HERF_{jt} + \alpha_3 VR10Y_{jt} + \alpha_4 LLP_{it} + \alpha_5 EQUITY_{it} + \alpha_6 EXPENSES_{it} + AR(1) + \varepsilon_{it} \quad (1)$$

$$SPREAD_{it} = \alpha_{1i} + \alpha_2 HERF_{jt} + \alpha_3 VR10Y_{jt} + \alpha_4 LLP_{it} + \alpha_5 EQUITY_{it} + \alpha_6 EXPENSES_{it} + \alpha_7 NNII_{it} + AR(1) + \varepsilon_{it} \quad (2)$$

$$SPREAD_{it} = \alpha_{1i} + \alpha_2 HERF_{jt} + \alpha_3 VR10Y_{jt} + \alpha_4 LLP_{it} + \alpha_5 EQUITY_{it} + \alpha_6 EXPENSES_{it} + \alpha_8 COM_{it} + \alpha_9 TRAD_{it} + AR(1) + \varepsilon_{it} \quad (3)$$

where *i* and *t* are respectively indices for banks and time;

$SPREAD_{it}$ = W_SPREAD or N_SPREAD;

$HERF_{jt}$ = Herfindahl index computed from total assets for country *j*;

$VR10Y_{jt}$ = Volatility of the 10 year government bond rate (standard deviation computed with daily data) for country *j*;

[11] Results are not affected when a short risk free rate (3months) is used instead of the long rate.

LLP_{it} = loan loss provisions/net loans;

$EQUITY_{it}$ = equity/total assets;

$EXPENSES_{it}$ = personnel expenses/total assets;

$NNII_{it}$ = net non-interest income/total net operating income;

COM_{it} = net commission and fee income/ total net operating income;

$TRAD_{it}$ = net trading income/ total net operating income.

The Herfindahl index (HERF) is introduced to proxy the banking market structure. Because market power is often associated with higher lending rates the expected sign of the coefficient is positive ($\alpha_2 > 0$).The volatility (standard deviation) of the 10 year government bond rate (VR10Y) measures uncertainty in the money market. Therefore, a higher risk premium should be required following a rise in interest rate volatility ($\alpha_3 > 0$). Loan loss provisions (LLP) are considered as a measure of borrowers default risk. A higher premium should be charged by banks to offset higher credit risk ($\alpha_4 > 0$). The ratio of equity to total assets (EQUITY) is often used in the literature as a proxy of the degree of bank risk aversion. Firms which are more risk averse may require a higher spread to cover the higher cost of equity financing compared to other sources of funding ($\alpha_5 > 0$). Regarding personnel expenses (EXPENSES) the literature provides mixed results on the expected coefficient. Because screening and monitoring of borrowers require higher personnel costs the default risk premium charged on loans can be lower. Conversely, as the cost of granting loans increases with personnel expenses banks should charge higher premium.

As a first step (equation 1) we estimate a standard loan pricing model referring to a general specification often used in previous papers. By augmenting the standard model with diversification variables (equation 2 and equation 3) our aim is to capture loan pricing implications of the degree of bank diversification and to check for the robustness of results.

Fisher tests are used to determine if our data requires the utilization of panel estimation or pooled estimation techniques. Heterogeneity across units lead us to use panel data estimations. Most panel data models are estimated under either fixed-effects or random-effects assumption. We perform a Hausman test (see Hausman, 1978) to choose between these two basic models. The specification test shows that the fixed effect estimation procedure is relevant for all equations. All equations have been corrected from heteroscedasticity and from autocorrelation (autoregressive term AR(1)). The results are reported in Table 6.

Table 6. Risk premium and impact of product diversification for European banks (1996-2002)

	Dependent variables					
	W_SPREAD			N_SPREAD		
	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)
HERF	-1.842	-1.080	-1.533	-3.020	-2.588	-4.148***
	(-0.731)	(-0.480)	(-1.032)	(-1.521)	(-1.408)	(-2.665)
VR3M	0.362	0.360	1.046***	0.329	0.340	1.003***
	(0.680)	(0.705)	(2.644)	(1.189)	(1.286)	(2.788)
LLP	0.005	0.009	0.055**	0.077***	0.125***	0.089**
	(1.301)	(1.037)	(2.443)	(2.587)	(3.479)	(2.424)
EQUITY	0.051	0.017	0.038	0.022	0.019	0.026
	(1.539)	(0.663)	(1.269)	(1.423)	(1.056)	(1.615)
EXPENSES	0.0642***	0.908***	0.659***	0.111	0.168	0.067
	(3.430)	(4.408)	(2.971)	(0.600)	(0.866)	(0.460)
NNII	-	-0.022***	-	-	-0.009*	-
		(-3.798)			(-1.689)	
COM	-	-	-0.092***	-	-	-0.059***
			(-4.776)			(-3.221)
TRAD	-	-	-0.007	-	-	0.005
			(-0.870)			(0.522)
AR(1)	0.094	0.088	0.057	0.134	0.135	0.095
	(0.617)	(0.477)	(0.379)	(0.826)	(0.801)	(0.584)
R^2	0.634	0.671	0.618	0.817	0.823	0.824
N	4838	4779	3427	4082	4038	2786

****, ** and * indicate significance respectively at the 1%, 5% and 10% levels.*

Variable definitions: W_SPREAD = ratio of net interest income to total earning assets minus the 10 year government bond rate; N_SPREAD = lending rate determined as the ratio of interest from loans to net loans minus the 10 year government bond rate; $HERF_{jt}$ = Herfindahl index computed from total assets for country j at time t;$VR10Y_{jt}$ = Volatility of the 10 year government bond rate (standard deviation computed with daily data) for country j at time t ;LLP_{it} = loan loss provisions/net loans for bank i at time t; $EQUITY_{it}$ = equity/total assets for bank i at time t; $EXPENSES_{it}$ = personnel expenses/total assets for bank i at time t; $NNII_{it}$ = net non-interest income/ total net operating income for bank i at time t; COM_{it} = net commission and fee income/ total net operating income for bank i at time t; $TRAD_{it}$ = net trading income/ total net operating income for bank i at time t.

As Table 6 shows, regressions with the N_SPREAD variable as the dependent variable better fit the data than regressions with the W_SPREAD as the dependent variable. In Bankscope fewer banks report the interest they receive on customer loans which explains the fewer number of observations. On the whole, higher interest rate volatility (VR10Y), is associated to a higher risk premium. As expected, when the default risk proxy (LLP) increases, a higher spread is charged by banks. Credit risk is both significant and positive in each regression for which the lending rate is used to calculate the risk premium

(N_SPREAD). This result is consistent with the hypothesis that banks with more risky loans charge higher lending rates. The coefficient of the personnel expenses variable (EXPENSES) is positive and significant when the broader definition of the risk premium (W_SPREAD) is considered as the dependent variable. This result is consistent with the fact that banks which bear higher personnel expenses need to operate with higher spreads.

The net non-interest income variable (NNII) introduced in equation 2 has significant negative coefficient for both definitions of the dependent variable suggesting cross-selling of loans and non interest generating activities. To further investigate this hypothesis, we consider disaggregated non traditional income activities. More precisely, we decompose these activities into fee-based revenue and trading income. Equation 3 shows that the coefficient associated with the share of commission and fee-based income (COM) is negative and significant. Thus, this result may be consistent with the hypothesis that banks decrease their lending rate in order to attract borrowers which represent potential customers for fee generating products. Such a result suggests that banks may be cross-selling their products using loans as a loss leader. Conversely the coefficient of the variable indicating the extent to which bank revenue is trading based (TRAD) is not significantly different from 0. Our findings do not support evidence of any correlation between loan prices and the relative importance of income generated by trading activities.

5. Conclusion

The objective of this study was to analyze the risk implications of the trend towards stronger product diversification in the European banking industry. Our study shows that banks which have expanded into non-interest income activities present a higher level of risk than banks which principally supply traditional intermediation activities. A closer investigation shows that risk is positively correlated with the share of fee-based activities but not with trading activities. This result also holds when we consider the link between risk changes and higher diversification within our sample period. In addition to the plausible implication addressed in previous papers we test for a possible cross-selling behaviour of interest and non-interest products by analysing the determinants of the risk premium charged by banks on their loans. Our results show that higher reliance on fee-based activities is associated with lower lending rates suggesting that banks may use loans as a loss leader raising the issue of how cross-selling strategies should be addressed by regulators to control for bank risk.

Conversely, we do not find evidence of a positive link between bank risk and the growing share of trading activities in bank income statements.

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Appendix

Table A1. Distribution of banks by country

	Non listed and listed banks	Listed banks
Austria	32	4
Belgium	22	1
Denmark	43	33
France	161	23
Germany	198	16
Greece	7	9
Italy	152	26
Netherlands	31	1
Norway	15	15
Portugal	17	3
Spain	59	12
Sweden	6	3
Switzerland	111	6
United Kingdom	97	4
Total	**951**	**156**