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The Expansion of Diversification activities: the Change of Cross-Selling Behavior after the Financial Crisis

A quantitative study of European commercial banks

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Abstract

This study investigates the change in the application of cross-selling strategies within European commercial banks by analyzing the relationship between banks net interest margins and non-interest income. Cross-selling consists of promoting additional products and services to an already existing customer with the intention of increasing the volume of earnings. The essence of cross-selling involves reducing lending rates to attract customers who buy non-traditional services. Thereby, cross-selling explains the negative relationship between non-traditional activities and interest margin. In other words, income from diversification increases at the expense of interest margins. Due to several reasons banks started to pay higher attention to income generated from other activities than lending and deposits before the crisis in 2007/2009. This increased the level of competition among banks. The intensified competition and the shift towards diversification activities have raised incentives for banks to adopt cross-selling strategies. The extent of cross-selling after the recent financial crash is important to analyze. Regulators have raised concerns that commercial banks might earn greater service fees by underpricing loan rates and therefore credit risk.

Data from commercial banks within 12 European countries have been gathered between the years 2004-2006 and 2011-2013 representing pre- and post-crisis. A regression analysis was performed to assess the relationship of diversification activities with interest margins. Our results support that non-interest income has a weaker negative correlation with net interest margin after the financial crisis, compared to before. We conclude that cross-selling behaviors have decreased in European commercial banks. Our findings can contribute to the knowledge of how the relationship between net interest margin and diversification has developed after the financial crash. The current application of cross-selling strategies is of importance for regulatory policy. The regulatory institutions have shown interest in developing a framework to supervise these strategies. Therefore, our findings might contribute to the evaluation of current guidelines for cross-selling.

Keywords
Cross-selling, net interest margin, diversification, interest income, non-interest income, traditional banking activities, non-traditional activities, dealership model.

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Table of contents

1. Introduction

Before the financial crisis in 2007/2009, a new trend in banks' behavior has been observed. Higher attention has been paid to income generated from other activities than lending and deposits. Banks have, during the past decades been growing more diversified, which is explained by several disruptive changes in the banking industry. Deregulation in the banking sector has been the most noteworthy change. Deregulation and the removal of cross-border entry restrictions allowed banks to combine traditional banking services with insurance and other financial services (De Jonghe, 2010). Along with the globalization of financial services, it was expected that the competition in the banking industry would intensify (IMF, 2000; EC, 1997; Ciarrapico & Cosci, 2011). Banks responded to the new environment by diversifying into new products and services (diversification activities), de-emphasizing their traditional lines of business.

The shift towards non-traditional activities transformed bank income structures (Lepetit et al., 2008). Income generated from lending and deposits has traditionally been an important source of revenue for banks (Stiroh, 2004; Ciarrapico & Cosci, 2011). In 1987, diversification activities in European banks represented approximately 20 percent of banks total income. However, in 2006, this amount had increased to 44 percent. Similarly, the share of interest-based income in the U.S fell from 80 percent to 50 percent in the 90's (Ciarrapico & Cosci, 2011). Diversification activities generally include income from commissions, fees, trading activities and are commonly referred to as non-interest income (Lepetit et al., 2008; Maudos & Solís, 2009; Sabato et al., 2009; Nguyen, 2012). In other words, the shift has lead to a decrease in interest margins, while income generated from diversification activities has continued to grow (Lepetit et al., 2008; Sabato et al., 2009; Campbell, 2011; Ciarrapico & Cosci, 2011; Nguyen, 2012).

It is common that the increase in non-interest income is at the expense of bank interest margins. One plausible explanation for this trend is the use of cross-selling strategies (e.g. Lepetit et al., 2008). When banks cross-sell, they are not only diversifying into new activities, rather they are willing to reduce interest income from lending and deposits. Cross-selling as such, is a practice of promoting additional products and services to potential customers with the intention to increase volume of earnings (Vyas et al., 2006). The intensified competition and the shift towards diversification activities have raised incentives for banks to adopt cross-selling strategies by decreasing lending rates to attract customers to buy diversification services or products (Lepetit et al., 2008).

Previous research in the field has analyzed the impact of the trend towards diversification (e.g. DeYoung & Rice, 2004a; Chen 2007; Carbó & Rodríguez, 2007; Lepetit et al., 2008; Ciarrapico & Cosci 2011; Nguyen, 2012; Zhao et al., 2013). Already before the financial crisis, studies highlighted the negative effect of cross-selling. One of

the effects identified in these studies is that by offering lower lending rates to attract customers to buy banks' non-traditional products, banks will underestimate credit risk (Lepetit et al., 2008). As this will be expressed through lower interest margins, some studies have explored cross-selling strategies by investigating the relationship between non-interest income and net interest margins (Lepetit et al., 2008; Nguyen, 2012). Regulators have raised concerns before the crisis, stating that commercial banks may be earning higher service fees by underpricing loans (Dingell, 2002; Lepetit et al., 2008). Further, several researchers have suggested that diversification activities contributed to the financial crisis in 2007/2009. After the crisis, The European Central Bank in 2012 pointed out the relevance of applying a regulatory framework in order to protect banking investors in respect to banks cross-selling strategies.

To our knowledge, there have not been any studies that investigate whether a bank's cross-selling behaviors have continued or changed after the recent financial crisis in the European countries (Entrop, et al., 2015). The primary aim of our study is to investigate changes in diversification strategies within European commercial banks after the financial crisis. This change in behavior will be analyzed by examining cross-selling. To fulfill the purpose of this study, the following research question will be answered:

Have cross-selling behavior within European commercial banks changed after the financial crisis in 2007/2009?

Cross-selling strategies will be analyzed by investigating the relationship between non-interest income and interest margins by using the dealership model of Ho and Saunders (Lepetit et al., 2008; Maudos & Solís, 2009; Ciarrapico & Cosci, 2011; Nguyen, 2012). The model includes the factors that influence bank margins (Ho & Saunders, 1981). The study is conducted in commercial banks within 12 European countries by testing the relationship between non-interest income and interest income during two historical periods, pre- and post-crisis. To achieve this, we use a version of a model originally developed by Ho and Saunders in 1981, which has been extended and used in several studies. The regression models include the determinants of net interest income and variables representing diversification activities. We find that income generated from non-traditional activities is statistically negative related to bank's net interest margin. This confirms the existence of cross-selling strategies in banks, as revealed in previous studies (e.g. Lepetit et al., 2008). Our results support that non-interest income has a weaker negative correlation with interest margin after the financial crisis compared to before. Thereby we find that cross-selling behaviors have decreased after the financial crisis in European commercial banks.

The study presented in this thesis contributes to the debate of banks shifting towards diversification activities by investigating European cross-selling strategies in the time period after the financial crisis. Our findings contribute to the knowledge of how the relationship between net interest margin and non-interest income has developed, which is

of importance for regulatory policy. The European Security and Market Authority (ESMA) periodically delivers guidelines for evaluation and supervision of these strategies, issuing warnings when current developed guidelines are not followed. The regulatory institution ECB (2012) has shown interest in developing a framework to supervise cross-selling. Hence, our findings might contribute to the evaluation of current guidelines.

This paper is structured in the following manner: Chapter two incorporates the literature review. It provides the reader with a general idea of the background of our research, such as banking income sources, non-traditional activities, cross-selling practices, etc. Later on, the development of hypothesis is covered in chapter three. In the fourth chapter, the models used to test the developed hypothesis are presented. Thereafter, empirical findings and analysis of the results are exhibited in chapter five. Finally, conclusions and ideas for further research are illustrated in chapter six.

2. Literature Review

This chapter presents extant literature relevant to our research question. The first section in the chapter examines the bank business model and the historical trend towards bank diversification. The second section examines the practice of cross-selling and theories about why banks might forego profitability in one area to furthering another. The chapter concludes with a review of the recent financial crisis, and theories about the role of cross-selling and diversification in that crisis.

2.1 Sources of income in the banking industry

The traditional view of banks is that they exist to mitigate the problem of excess and lack of liquidity among financial actors. Those actors with surplus of liquidity are commonly known as depositors and those with a shortage of liquidity are the liquidity demanders (DeYoung & Rice, 2004a). The traditional source of bank income comes from charging interest on the lending process. The difference between rates charged and rates paid from lending and deposit activities constitutes bank's net interest margins. This intermediation activity remains the primary source of earnings for most of the commercial banks (DeYoung & Rice, 2004a) and is widely referred to as the traditional or core activity of banks (e.g. Angbazo, 1997; DeYoung & Rice, 2004a; Stiroh, 2004; Lepetit et al., 2008; Nguyen, 2012; Lin et al., 2012).

Banks also earn considerable amounts of income from diversification activities, which constitutes non-interest income. This sort of income can be generated from traditional activities or from new business lines (DeYoung & Rice, 2004a). Our paper will focus on the later one, still both sources are described below. The income sources are illustrated in Table 1.

Non-interest income from traditional activities includes those using traditional production methods, such as deposit account services, checking, save-keeping deposits, cash management and emission of letters of credit to corporate clients etc. (DeYoung & Rice, 2004a). While these services are beyond the core activities of lending and funding, they are considered traditional since banks have performed them for decades. In recent years, advances in communication, information and financial technologies have introduced new production methods that have enabled banks to offer traditional activities in more efficient manners while also presenting an opportunity for increasing fee income for banks. Some of these activities are ATMs, Internet services, etc. (DeYoung & Rice, 2004a). Non-interest income and interest income from traditional activities coexist, rather than replacing each other (DeYoung & Rice 2004a; DeYoung & Rice 2004b).

Non-interest income generated from new business lines has emerged in response to the changes in the banking industry. Commercial banks within the European Union

experienced deregulation in the banking market in the mid 90's as part of reforms designed to promote competition between banks. These reforms removed cross-border entry restrictions as well as restrictions preventing banks from combining banking, insurance and other financial services (De Jonghe, 2010; EC, 1989). The increased competition lead to lower lending rates and consequently earnings generated from lending and deposits were not as profitable as before (Bolt & Tieman, 2004). At the same time, this opened up the door for commercial banks to earn commissions and fee-based incomes from other business lines rather from the traditional ones. These new lines include securities brokerage, insurance agency, investment banking, and merchant banking (Allen & Santomero, 2001; DeYoung & Rice, 2004a; DeYoung & Rice, 2004b). These new business lines mostly or wholly generate non-interest income and they are the focus of our study when we refer to income from diversification or non-interest income.

Table 1: Source of non-interest income within the banking sector

SOURCES OF NON-INTEREST INCOME AT THE BANKING INDUSTRY	
Fee-generating activities: Non-traditional	
Investment banking Securities brokerage Insurance activities Merchant banks	
Fee-generating activities: Traditional	
Traditional production methods	***New production methods***
- Deposit account services *(e.g. safe-keeping)* - Lending *(e.g. letters of credit)* - Cash management *(e.g. payroll procesing)* - Trust account services *(e.g. wealth management)*	- Deposit account services *(e.g. online bill-pay)* - Lending *(e.g. securitization)* - Cash management *(e.g. lock box check conversion to electronic ACH payments)*

Source: DeYoung and Rice, (2004a).

Diversifying into new business lines allowed banks to offer additional services to loans and deposits customers (Vyas et al., 2006). These additional services might be promoted via more favorable lending and deposit rates, sacrificing some traditional income in order to grow total income per customer (McGoldtrick & Greenland, 1992; Lepetit et al., 2008). This practice is called cross-selling, and the overall effect on the bank is higher non-interest income at the relative expense of interest income from lending and deposits (e.g. Carbó & Rodríguez, 2007; Lepetit et al., 2008; Lin et al., 2012; Nguyen, 2012). However, the phenomena of cross-selling and diversification activities should not be confused. Non-interest income itself might grow even in the absence of cross-selling.

2.2 Cross-selling strategies in the banking sector

Before the financial crisis in 2007/2009, both European and U.S. banks had a negative relationship between net interest income and income from non-traditional activities (e.g. Lepetit et al., 2008; Nguyen, 2012). One plausible explanation for the negative relationship was the raised focus on cross-selling (Stiroh, 2004). Banks are tempted to adopt cross-selling when striving to be larger actors and increase overall incomes (ECB, 2011; 2013 & 2014). A common example is when banks issue lending products to a specific customer, and once the loan is approved, it is easier to sell other services to that specific client (Sabato, et al., 2009). Banks decrease lending rates to entice customer to acquire their new products and thereby, underprice credit risk (Lepetit et al., 2008). Regulators have raised concern regarding the negative consequences associated with cross-selling and have also pointed out the importance of future regulatory framework to protect banking customers (ECB, 2015).

Analyzing company accounting data from 12 commercial and cooperative banks within Europe, Lepetit et al., (2008) find that cross-selling has important implications for regulators in order to control for risk. The study analyzed the relationship between net interest income and non-interest income between 1996 and 2002, using the dealership model from Ho and Saunders (1981). This dealership model incorporates the determinants of net interest margins**.** Income from diversification activities in European banks was negatively related to bank net interest margins, which proves the existence of cross-selling. A deeper approach is applied by analyzing the determinants of the risk premium charged by banks on their loans. It is found that higher non-interest income is related to a weaker link among bank loan spread and loan risk (Lepetit et al., 2008).

Similar conclusions were drawn by Carbó and Rodríguez (2007). Through the application of the same dealership model, the relationship among bank margins and market power in various levels of diversified banks was assessed during 1994 and 2001. The study was performed for banks in seven European countries and the sample represented different types of banks, not only cooperative and commercial, as in the study made by Lepetit et al. (2008). The results suggested that higher market power or competition, partially caused the decline in net interest margins in the European banking market (Carbó & Rodríguez, 2007; Maudos & Solís, 2009). On the other hand, through high competition, banks decrease their rates in order to catch more clients, bringing therefore an increment on interest margins (Ho and Saunders, 1981). The authors proposed that the drop in net interest margin could partly be explained by the new patterns of diversification. Diversified banks have a stronger position to compete against specialized banks by earning income from non-traditional activities and exercising cross-selling practices (DeYoung & Rice, 2004a; Carbó & Rodríguez, 2007). Before and during the financial crisis, German banks up until 2009 were adopting cross-selling strategies (Entrop et al., 2015). A significant negative association

between net interest margin and non-interest income has been observed across financial markets worldwide.

Non-traditional activities and cross-selling have been analyzed outside Europe as well. Stiroh (2004) analyzes the potential benefits with diversification in U.S commercial banks by exploring the link between non-interest income and the volatility of bank earnings. The growth in non-interest income has been explained by the increased focus on cross-selling strategies. The findings support that by cross-selling more products to the same customers, banks will not achieve diversification benefits in the forms of more stable profits or revenues. In the Mexican banking system, Maudos and Solís (2009) analyze company data from Mexican commercial banks between 1993 and 2005, finding the same conclusion as previous papers (e.g. Carbó & Rodríguez; 2007: Lepetit et al., 2008). The existence of cross-selling is evidenced in an increase in income from diversification activities, while banks with higher level of diversification have lower interest margins (Maudos & Solís, 2009). The impact on net interest margin has also been analyzed in Asian countries. Lin et al. (2012) divide Asian commercial banks between 1997 and 2005 into banks with high and low levels of diversification. The paper finds that interest margins in diversified banks have smaller fluctuations compared to interest margins within banks with a low share of diversification. Both Lin et al. (2012) and Maudos and Solís (2009) apply the Ho and Saunders dealership model in their research. The determinant of interest margins and non-interest income has been analyzed in commercial banks in 28 financially liberalized countries between 1997-2004. The relationship is claimed to be important to investigate due to potential regulatory policy. It is found that the relationship between net interest margin and non-interest income turns out to be statistically significantly negative. The negative relationship between non-interest income and interest income confirms the existence of cross-selling strategies.

To summarize, all these papers bring about evidence that banks forego profitability in one area to further another by using cross-selling strategies. However, to our knowledge, no studies have investigated the situation after 2009 and up until the current situation in respect to the level of cross-selling.

2.3 Consequences with non-interest income and cross-selling

Before the recent crisis, banks had gradually increased their earnings generated from trading, securitization, brokerage commissions and insurance activities etc. The financial crisis in 2007/2009 was triggered by the downfall of the U.S. housing market, and later on it broadly spread to the global economies (Chen et al., 2007). The previous years of stable growth were some of the many causes of the financial collapse. This promoted complacency and risk-taking by creating new bank products in order to expand a bank's income and range of products and services (The Economist, 2013).

Deregulation and higher competition increased bank diversification into non-interest income. This modified a bank's income structure (Lepetit et al., 2008), which has been identified by some as one of the roots of the financial collapse (Campbell, 2011). Loan rates declined as a response to the increased diversification, which is the essence of cross-selling. The cross-selling strategy has been criticized by several papers in respect to a higher likelihood of underestimating credit risk (e.g. Lepetit et al., 2008; Nguyen, 2012). There is a long-running debate on the consequences of a bank's involvement in cross-selling and diversification activities.

DeYoung and Rice (2004a) set out to highlight what they perceive to be a common misunderstanding related to income generated from diversification. One common belief is that non-interest income reduces credit risk and interest rate risk, and that this sort of income is therefore more stable compared to other income streams. However, the authors demonstrate that a higher share of fee income actually increases the volatility of bank earnings (DeYoung & Rice, 2004a). Bank financial performance has been investigated in respect to the linkage between non-interest income and U.S banks earnings. The applied model used accounting data and analyzed whether non-interest income for U.S commercial banks have been associated with an increase or decrease in bank financial performances. Non-interest income is related to higher earnings, more fluctuating profits and a decrease in the risk return (DeYoung & Rice, 2004b). A higher return is marked by larger earnings volatility and associated with greater risk (Van Ewijk & Arnold, 2014). DeYoung and Roland (2001) tested how the shift towards non-traditional activities affected earnings volatility in U.S commercial banks between 1988 and 1995. It was found that fee-based activities were associated with higher earnings volatility. The findings are similar to Stiroh (2004), who found that higher shares of non-interest income were associated with higher volatility for U.S commercial banks between 1979 and 2000.

The general conclusion that can be drawn from these papers is that a higher share or reliance on non-interest income is not related with reduced earnings volatility as it is commonly believed (DeYoung & Roland, 2001; DeYoung & Rice 2004a; DeYoung & Rice 2004b; Stiroh, 2004). A higher share of non-interest income actually increases banks earnings volatility (DeYoung & Rice, 2004a). Three explanations are presented in the literature by DeYoung and Roland (2001). First, the lending activities are commonly relationship-based, meaning that there is a high switching cost for both borrowers and lenders. This results in a more stable lending relationship between the bank and the customer. Second, higher reliance on non-interest income is associated with greater operating leverage. Thereby, revenue volatility transforms into more earnings volatility. Third, the diversification activity that generates non-interest income does not generally have a significant regulatory capital charge. Volatility is expected due to the allowance of greater financial leverage (DeYoung & Roland, 2001).

The strength of the financial system is the duty of financial supervisors, and includes regulation and supervision to reduce financial instability. Several papers address the unknown impact of diversification on the banks' ability to withstand a future financial crisis (e.g. De Jonghe, 2010). The probability of a decline in bank stock prices across the board is commonly used as a proxy for systemic risk. It has been used as the dependent variable explained by different income streams. De Jonghe (2010) analyzed the correlation between different income streams and bank stock prices. They found that non-interest income correlated with the dependent variable, hence, this income was associated with a higher probability of a sharp decline in bank stock prices. One of the characteristics of financial systemic risk is contagion, i.e., one failure in a specific financial institution leads to the failure of another one. This domino effect is very common due to the linkage between markets and industries (Chen et al., 2013). It was concluded that diversified banks contributed to systemic risk, which reduces bank stability. Regulators have aimed to minimize systemic risk and prevent future crashes (Bank of England, 2008), and cross-selling could be a potential target for future regulation. By separating different sources of income, it is found that income generated from traditional lending and deposit activities was less risky compared to all other income streams. As long as banks operate without regulating cross-selling practices in respect to handling systemic risk, banks will continue to be engaged in non-traditional activities and cross-selling practices (De Jonghe, 2010).

De Jonghe's (2010) conclusions are supported by findings from DeYoung and Torna (2013). Diversified U.S banks had a significant effect on the probability of failure during the financial crisis in 2007/2009. The probability of a failure increased if the bank was already suffering from distress. Unlike De Jonghe (2010), non-interest income from fee activities reduced the probability of a failure if the bank did not suffer from distress (DeYoung & Torna, 2013). In another study, non-interest income was analyzed in relation to systemic risk. The study focused on commercial banks in the U.S covering the timeframe between 1986 and 2008. Their findings support that activities that are not linked to deposits and lending, are associated with greater contribution to systemic risk (Brunnermeier et al., 2012).

It has been suggested that diversification and involvement in fee-based activities raise systemic risk compared to banks only involved in lending and deposit activities (Brunnermeier et al., 2012; Chen et al., 2013; Slijkerman et al., 2013). Non-interest income might provide stability in overall income, but it is not clear if the stronger dependence on non-interest income diminishes overall risk in banks. The income generated from diversification activities tends to be more volatile than the one generated from traditional ones. Therefore, it is likely that the benefits of financial stability, which come from non-interest income, take place only in cases of slight systemic risk (ECB, 2011).

3. Hypothesis development

The previous chapter addressed relevant literature serving as a base for the development of the hypothesis. The current chapter illustrates the development of the hypothesis. The formulated hypothesis will be used for answering the research question whether cross-selling behavior has changed after the financial crisis. The prediction of the Ho and Saunders model is described, and the model itself is described in detail in chapter four.

3.1 The decrease in cross-selling behavior after the crisis

Cross-selling behavior has been observed before the most recent financial crisis in 2007/2009. The majority of the studies conducted before the financial collapse found a negative association between net interest margin and banks' non-interest income. The negative relationship is considered as evidence of cross-selling behavior (e.g. Stiroh, 2004; Carbó & Rodríguez, 2007 Lepetit et al., 2008; Maudos & Solís, 2009; Nguyen, 2012). However, there is considerable support in the literature, which supports that even if cross-selling strategies have been applied before the crisis, the strategies should not be displayed to the same extent after the financial crash. Based on previous research, we predict a decrease in banks cross-selling behaviors.

Banks highly involved in non-traditional activities are associated with greater contribution to systemic risk and consequently to a higher risk for a bank collapse (Brunnermeier et al., 2012). Income generated from commission, fee or trading activities is considered to be more volatile compared with income generated from lending and deposits (DeYoung & Ronald, 2001; DeYoung & Rice 2004a; DeYoung & Rice, 2004b).

Another research, which supports the decrease in the application of cross-selling strategies, is the one performed by De Jonghe (2010). The study covered the period from 1993 to 2007, and analyzed the relationship between a bank's increased diversification of financial activities and their ability to resist a future banking crash. The shift towards non-traditional banking activities is associated with a higher probability of a sharp decline in bank stock prices. Further, a higher share of non-interest income actually increases banks earnings volatility instead of decreasing it (DeYoung & Roland, 2001; DeYoung & Rice 2004a; DeYoung & Rice 2004b; Stiroh, 2004).

DeYoung and Torna (2013) found that an increase in non-interest income had economically significant effects on the probability of bank failures during the financial crash. By cross-selling more products to the same customers, banks will not achieve diversification benefits in the forms of more stable profits or revenue (Stiroh, 2004), suggesting that cross-selling should have decreased due to non-benefits. The fact that regulators have raised concern about the negative consequences with cross-selling strategies, confirms the strategy is in the

scope for regulatory policy, supporting a decrease in its use. Further, it has also highlighted the importance of a future regulatory framework to protect banking customers (ECB, 2015).

Nonetheless, there are arguments in literature, which do not support a decrease in banks' cross-selling behavior. During the financial crisis, German banks in 2009 displayed evidence of cross-selling strategies (Entrop et al., 2015). In 2014 the involvement of banks in diversification activities still continued to increase (ECB, 2014). There is also research that suggests that cross-selling behavior should be expected to continue. Furthermore, without a regulatory policy addressing how to handle systemic risk in respect to cross-selling, banks may want to continue to cross-sell even if negative consequences have been pointed out (De Jonghe, 2010).

Taken all together, we expect a decrease in cross-selling strategies and the following hypothesis is proposed:

H1: *The effect of non-interest income on net interest margin in European commercial banks has decreased after the financial crisis in 2007/2009.*

Cross-selling strategies exist when there is a negative relationship between non-interest income and interest margin. The decrease of cross-selling represents a weaker correlation between non-interest income and net interest margin after the crisis compared to before.

4. Research Methodology

This chapter describes the research design applied in our paper including how the data has been collected, processed and adjusted. We detail the applied model used to test the developed hypothesis in chapter three. In the next section we present definitions of dependent, independent and control variables. Finally, we discuss the limitations of our methodology.

4.1 Research design

This paper investigates if cross-selling behaviors have changed after the financial crisis in commercial banks within 12 European countries. A quantitative method has been used to corroborate the hypothesis developed in the previous chapter and thus, to give an appropriate answer to our research question. In order to run the regressions, secondary data has been gathered mostly from Bankscope and from Datastream international. These databases provide accounting and economic information that allows the use of a quantitative statistical method to evaluate the association between variables.

To accomplish the main purpose of our research, the relationship between non-interest income and interest income has to be addressed. To achieve this, the determinants of net interest margins have to be considered. That is why the dealership model of Ho and Saunders (1981) is an important part of our applied model, which has been extended to include the diversification activities.

4.2 Collection of data

4.2.1 Secondary data

The principal source of data used in our study comes from Bankscope. The three-month interbank rate per country, which serves as a proxy for interest rate risk, has been gathered from Datastream International. The drawback of using secondary data sources such as this is that it has been previously processed and transformed and so its quality cannot be totally ensured. Another drawback is the missing accounting and financial information. However, Bankscope is commonly used in the research field, and it has been employed in several previous papers, which emphasizes the reliability of the data. Using Bankscope and Datastream International increases the reliability since the likelihood of human mistakes is low (Collis & Hussey, 2014). It is also important to highlight that the Lerner index, which serves as a proxy for market structure has been gathered from The Federal Reserve Bank of St. Louis in the U.S. GDP per country was collected from The World Bank. In both cases the data was taken directly from the official websites, which can be considered reliable sources.

4.2.2 Sample

Annual report data from bank income statements and balance sheets have been collected from Bankscope. The timeframe covers six years, the pre-crisis (2004-2006) and post-crisis periods (2011-2013). A total of 336 commercial banks have been included for each year, for a total of 2,016 observations for the entire period. The sample includes 12 commercial banking markets in Europe: Austria, Belgium, Denmark, France, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom, as in Lepetit et al. (2008). Additionally, we have eliminated banks were the variables of interest were not available. The elimination reduced our sample to 1,004 observations. In order to minimize the effect of measurement errors, we have removed extreme values. Five outliers from the dependent variable have been excluded and two from commissions and fee income (See Appendix A). The final sample constitutes 997 observations covering both periods. Table 2 illustrates the number of observations for each of the years covered in our study.

The critical period of the financial crisis has been identified between 2007 and 2009 in accordance to similar studies (Brunnermeier et al., 2012; Chen et al., 2013). Two timeframes have been identified, pre- and post-crisis. Pre-crisis period covers the three years before the outbreak in 2007, from 2004 to 2006 (Curado et al., 2014). Post-crisis period has been identified to start after the latest investigation (Entrop et al., 2015), covering from 2011 to 2013.

Table 2: Number of observations pre- and post-crisis

Period	Year	Frequency	Percent	Cumulative
	2004	36	3.6	3.6
Pre-crisis	2005	120	12.0	15.6
	2006	147	14.7	30.4
	Total	303		
	2011	226	22.7	53.1
Post-crisis	2012	238	23.9	76.9
	2013	230	23.1	100
	Total	694		

The scope of our study is limited to commercial banks, as non-traditional activities in commercial banks are the same activities as considered in previous literature. These activities mainly consist of fees, commissions, trading and securitization (e.g. Carbó & Rodríguez, 2007; Lepetit et al., 2008; Maudos & Solís, 2009; Nguyen, 2012; Entrop et al., 2015). In contrast, to some relevant studies (Maudos & Fernández, 2004), we have excluded savings banks from our sample. Savings banks do not earn interest income from traditional activities to the same extent as commercial banks and earnings income from traditional activities is essential to observe cross-selling strategies.

It is likely that the regulatory environment has an impact on the figures reported and gathered for this study (Ho & Saunders, 1981). To account for the potential differences among regulatory environments, the sample have been delimited to banks reporting under International Financial Reporting Standards (IFRS). By delimiting to IFRS, the sample achieves comparability and verifiability (Agostino et al., 2011: Picker et al., 2013).

4.2.3 Processing of data

Data from Bankscope has been constrained to banks with all available financial information between 2004-2006 and 2011-2013. The first step when processing the data was to calculate all variables in our applied models. Each variable has been calculated in Excel using the financial information from Bankscope. To ensure validity of the data and to reach authenticity in the findings, protocols and procedures have been established. For instance, by double-checking all gathered data and the developed formulas in Excel. A checklist has been established to ensure results are comparable, by following an identical path when processing the data (Collis & Hussey, 2014). As mentioned, Bankscope and Datastream have been used when collecting data and these official sources raise the level of validity of our research.

Since we are using a statistical method which allows us to analyze and to test the data in a more precise and accurate manner, the probability of finding errors or differences if the test were repeated is low. This brings credibility to the findings and increases the level of reliability (Collis & Hussey, 2014).

4.3 The theory of the dealership model

The Ho and Saunders (1981) dealership model plays a crucial role in our research. It brings to the table important aspects that influence our dependent variable, net interest margin. These aspects are closely tied to the traditional activities performed by banks, lending and deposits, which pursue earnings on interest margin. In order to compare this sort of income with income obtained from non-traditional activities, the major determinants of interest income have to be included to make the analysis accurate.

The essence of the dealership model is to consider banks as risk-averse agents. Risk-aversion should not be confused with a dislike of risk, but rather meaning that they want to be compensated for taking on higher levels of risk. Compensation and risk is not expected to increase proportionally, but rather the requirement of compensation will increase at a faster rate when the risk is growing. In order words, banks are assumed to be maximizers of the expected utility of profit or compensation. Furthermore, banks seek to hold a stable wealth portfolio. This wealth portfolio is dependent on the base wealth, the credit inventory and the market position.

$$W = Y + I + C \quad \text{(Formula 1.1)}$$

Where (Y) represents the base wealth, (I) is the credit inventory and (C) represents the money market position. The difference between a bank's lending and deposits constitutes the credit inventory (I), which could either be positive or negative. When a surplus of credit inventory exists, banks will place the excess of cash generated by deposits in the money market and thereby be subjected to interest rate risk. The same goes with a deficit of credit inventory. The bank will borrow money from the money market (other banks or central banks) and again be subjected to interest rate risk. In the original Ho and Saunders model, interest rate risk is the only risk taken into account. Interest rate risk, the volatility of rates in money market, comprises the uncertainty of holding unequaled deposits and loans at the end of each period if the short-term rate of interest changes. The larger credit inventory (I), the greater interest rate risk the bank faces.

If the banks accept a long-term deposit at a long-term rate and if deposits arrive at different times from new loan demands, banks will invest the excess of cash in the money market at the short-term rate. In this scenario the credit inventory (I) will decrease and the money position (C) will increase, keeping wealth (W) stable. By doing that, the bank bears a reinvestment risk, if the short-term rate falls. Another scenario is when the demand for new loans is greater than demand deposits. In this scenario, banks will borrow money from the money market at a rate that could fund the loans. The credit inventory (I) would increase, while the money position would decrease (C) and the bank will bear a refunding or refinancing risk contingent on if the short-term rate will rise. What banks achieve with the two above described scenarios is to keep wealth (W) stable, by either increasing or decreasing credit inventory (I) and money position (C).

In practice, a bank will never stop providing lending or deposits. It is expected to accept new deposits and make new loans. Consequently, it will adjust the rate, in other words the price, for providing the immediate service. The price set by the bank includes a true price (p) and an additional fee for immediacy of services (a or b) in order for the bank to make a profit. This relationship goes for both deposits and lending as follows:

$$PL = p - b$$

$$PL = p + a$$

By managing their fees (a + b) for services delivered, banks can set loans and deposits prices, and thereby generating the ability to control the supply and demand of new loans and deposits. To provide immediate service of lending and deposits, banks will demand a positive spread, which constitutes of their set fees (a + b) to compensate for the risk. The fee added to or reduced from the true price of lending or deposits adjusts the in- and outflow of money. Since the demand for bank loans (outflow of capital) tends to arrive at different times than the supply of deposits (inflow of capital), an uncertainty is created and therefore a costs for banks. A cost arises from the idea that a bank has to hold either a long- or short-term position at the money market. With the above considered, the bank has to

determine the optimal, expected utility-maximizing deposits and loan rates or deposit-loan spread (s) (Ho & Saunders, 1981).

As mentioned earlier, if banks receive more new deposits than loan demand, it means that the credit inventory (I) will be reduced by the amount of deposits, and the bank's cash position (c) will consist of initial position plus the new inflow of deposits and the fees (a) charged by the bank. By contrast, when new loans are greater than new deposits, credit inventory (I) will increase by the amount of new loans. The bank's cash position will consist of the initial position reduced by the new loans and added with the fee (b) banks charge for providing the immediate service (Stoll, 1978). Since the demand and supply of new loans and deposits depend on the set fees (a+b), they are stipulated according to the expectation of maximize the utility of wealth (Ho & Saunders, 1981).

The size of credit inventory is independent of the size of the spread (a+b), meaning that credit inventory is not a determinant in formula 1.2. Credit inventory has an impact on the spread adjustment (a+b) that is relative to the true price (p). This means that when greater deposit inflow than loan demand exists, the bank will raise its fee (a) in order to discourage more deposit inflow and decrease its fee (b) on loans in order to encourage more loans, so that the spread (a+b) will remain the same. To conclude, the spread (a+b) will be unchanged even if the true price (p) will change. This pricing behavior of banks exists since banks want to hedge or match maturities (time for in- and outflow of deposits) of its assets and liabilities. When the credit inventory is equal to zero, the bank is fully hedged and no fee adjustments will take place. Hedging seeks to match the maturities of liabilities and assets with the idea to evade the refinancing and reinvestment risk that takes place if assets are either too long or too short (Ho & Saunders, 1981).

Ho and Saunders (1981) analyze the determinants of the optimal spread for deposits and loan services by developing formula 1.2. The authors only consider the existence of one sort of risk, interest rate risk. In later investigations, net interest margin is measured since the term “margin” is used when referring to more than one product. When looking at the determinant of bank interest margins or spread, Ho and Saunders (1981) base their examination on the purest bank interest rate risk.

The developed model includes the following terms:

$$S = a + b = \frac{\alpha}{\beta} + \frac{1}{2} R \sigma_1^2 \mathrm{Q} \qquad \text{(Formula 1.2)}$$

The spread for deposits and loan services is equal to the sum of fees (a+b) for the provision of intermediation services for both deposits and lending. The equation includes the four factors that determine the pure spread. First, (α/β) represents the market structure, supply and demand, where α is the intercept and β the slope of the symmetric of loans and deposits entrance function in banks. This is related to the elasticity of the market and competition. A

lower proportion of the ratio indicates higher market competition, higher elasticity and lower spreads. If there is an inelastic demand and supply function in the market, it implies a higher ratio and greater spreads due to the absence of competition at the banking market. The second item in the equation is R, which is the risk aversion coefficient. Different banks have different profiles and therefore some of them are considered more risk averse than others. R represents the compensation or the expected utility that banks will require by incurring lower or higher levels of risk. The third item is σ, which symbolizes the variance or fluctuation of the interest rate on deposits and loans. It is also called volatility and is the actual risk concerned in the model. By studying the formula, it follows that a higher risk, requires higher compensation and thereby a higher spread. Finally, (Q) represents the size of the transaction. The second term of the formula that encompass the second, third and fourth items, is called the risk-adjustment. These three factors are inter-connected, the greater the size of the transaction (Q), the higher the level of risk aversion or expected compensation (R) and larger variance of the interest (σ), the higher margins are (Ho & Saunders, 1981).

In order to determine if the level of cross-selling has decreased or increased after the financial crisis 2007/2009, the relationship between bank net interest margin and income generated from non-traditional activities needs to be examined. The initial dealership model is of importance for our purpose since cross-selling rests on the idea that bank's optimal interest margin will be scarified over income generated from non-traditional activities (Lepetit et al., 2008). It is essential to include the factors that account for a bank's interest income, which is generated throughout the process of lending, and deposit activities in the applied model (Ho & Saunders, 1981). When analyzing the determinants of bank interest margins, the dealership model has been used for years as a reference framework for many empirical studies (Angbazo, 1997; Wong, 1997; Maudos & Fernández, 2004; Carbó & Rodríguez, 2007; Gambacorta, 2008; Lepetit et al., 2008; Maudos and Solís, 2009; Lin et al., 2012, Nguyen, 2012; Entrop et al., 2015). It is commonly found that the model has been extended with different variables for different purposes. Authors have adapted the original model to their own interests by adding additional considerations or variables and excluding others beneficial to their research. It has been used to explore the relationship between the net interest margins with non-interest income (e.g. Lepetit et al., 2008), as applied in our research. Our paper adapts this dealership model, where additional factors that account for activities that generate non-interest income are subsequently incorporated to the model.

4.4 Regression models

With the aim of testing the change in cross-selling behavior after the crisis, we apply two regression models using a period interaction variable for identifying the difference in slopes between the two periods. The multiple regressions enable the analysis of the non-interest income with interest margin (e.g. De Jonghe, 2010; Ciarrapico & Cosci, 2011). Performing multiple regressions enables us to study the relationship between several predictor variables and our dependent variable, net interest margin (Newbold et al., 2010). The estimated models incorporate both the determinants of net interest margin developed by Ho and Saunders (1981) and proxies for non-interest income (e.g. Lepetit et al., 2008 and Nguyen, 2012).

One of the potential problems when using multiple regressions is if there are strong inter-correlations among the independent variables. If two independent variables act simultaneously with a change in the other, it is not possible to determine which of the variables that is related to the change in our dependent variable (See Appendix B). Multicollinearity could cause misleading estimations of the coefficients, making the data biased (Newbold et al., 2010). To test for collinearity between our independent variables, variance inflation factor (VIF) have been used. The results are presented in Appendix C. The highest VIFs are 3.815 and 3.472 respectively for the interaction variables after excluding the period dummy. It was found that one of the main variables was strongly correlated with a control variable, DIV_ASSET and LTA. Variables that are collinear increase their standard errors of their coefficient, making them unstable and biased (Newbold et al., 2010). The control variable loan to total assets (LTA), was therefore excluded from the regressions. Moreover, to ensure that the error terms are not auto-correlated, a Durbin-Watson test has been performed (Newbold et al., 2010), concluding that no autocorrelations exist among the error terms.

Another underlying assumption for the use of regression models is that the variance of error terms has to be constant. In other words, to achieve adequate results from the regression, heteroscedasticity cannot exist (Cortinas & Black, 2012). When data has heteroscedasticity, the estimated coefficients can be inefficient and thereby, wrong conclusions can be drawn making the tests of hypotheses for these coefficients no longer valid (Newbold et al., 2010). A test has been performed for detecting heteroscedasticity. The results inclined that the data was heteroscedastic. To minimize the risk for wrongly made conclusions and underestimation of p-values, standard errors have been adjusted (Newbold et al., 2008).

Model 1

$$\mathrm{NIM}_{i,t} = \beta_0 + \beta_1 \mathrm{LERNER}_{j,t} + \beta_2 \mathrm{EQUITY}_{i,t} + \beta_3 \mathrm{IRR}_{j,t} + \beta_4 \mathrm{LLR}_{i,t} + \beta_5 CRISIS + \beta_6 DIV\_\mathrm{ASSET}_{i,t} + \beta_7 \mathrm{DIV\_ASSET} \times \mathrm{CRISIS} + \varepsilon_{i,t}$$

Model 2

$$\mathrm{NIM}_{i,t} = \beta_0 + \beta_1 \mathrm{LERNER}_{j,t} + \beta_2 \mathrm{EQUITY}_{i,t} + \beta_3 \mathrm{IRR}_{j,t} + \beta_4 \mathrm{LLR}_{i,t} + \beta_5 CRISIS + \beta_8 \mathrm{DIV\_INCOME}_{i,t} + \beta_9 \mathrm{DIV\_INCOME} \times \mathrm{CRISIS} + \varepsilon_{i,t}$$

Model 1 and 2 are estimated with the aim to capture the interaction of non-interest income in order to investigate a potential change in cross-selling behavior. The two applied models include the determinants of net interest margin (Ho & Saunders, 1981). The variables are market structure (LERNER), level of risk-aversion (EQUITY), interest rate risk (IRR) and an additional risk, credit risk (LLR). According to the dealership model, banks are seen as risk-averse dealers, meaning that banks will require compensation for greater risk. Higher compensation indicates higher rates and thereby higher margins. Another risk that banks are exposed to, except from the interest rate risk, is credit risk. Since default risk is a significant factor, it is likely that credit risk affects how banks set their net interest margins. Credit risk constitutes the risk of clients failing to make required payments. Riskier loans in respect to credit risk imply higher rates on bank loans and thereby the bank will require a greater margin. To compensate for credit risk and interest rate risk, banks exercise control over loans and deposits by adjusting fees (a and b) for the immediacy services (Maudos & Fernández, 2004).

There are different ways to measure the incidence of non-interest income in commercial banks. Previous literature has used different proxies to investigate income from non-traditional activities. Some of the papers used asset items as proxies (e.g. Nguyen, 2012) while others used income items (e.g. Lepetit et al., 2008; Maudos & Solís, 2009) for non-interest income. However, DeYoung & Rice (2004b) include both asset and income items, since the increase in non-interest income has occurred together with changes in every area of commercial banks, including banks assets (DeYoung & Rice 2004a).

We have used two traditional proxies, measuring non-interest income as a percentage of assets (DIV_ASSET) and as a percentage of income (DIV_INCOME), as DeYoung and Rice (2004b). We desire to analyze their association with the dependent variable in a separate manner by using data from both the income sheet and balance sheet. DIV_ASSET accounts for other earning assets that will in the long run generate non-interest income. DIV_INCOME accounts for diversification income and is also used as a proxy for non-interest income. Both serves as proxies for non-interest income. Model 1 incorporates only DIV_ASSET that includes other earning assets, while in Model 2 DIV_ASSET is replaced with DIV_INCOME, which only generates commission and fee incomes. It is of high importance to include these variables in order to examine if cross-selling is still exercised

and to analyze the relationship between non-interest income and the dependent variable (NIM).

The first model investigates the effect of diversification assets (DIV_ASSET). To determine if cross-selling has experienced changes in the post-crisis compared with pre-crisis, we need to determine if diversification asset has a weaker correlation with net interest margin post-crisis compared to pre-crisis. This will be achieved by analyzing if there are significant differences in the slopes of DIV_ASSET during the analyzed periods. Thereby, Model 1 and 2 include an interaction variable each, which enables us to test for differences in the slope of coefficients (Newbold et al., 2010) after the financial crisis. Model 1 incorporates an interaction variable calculated as DIV_ASSET multiplied with CRISIS, where CRISIS is a dummy variable and equal 1 for post-crisis and 0 for pre-crisis. Similarly, the second model investigates the effect of diversification income specifically and the interaction variable DIV_INCOME is multiplied with CRISIS. The coefficients of the interaction variables (IDA and IDI) are estimations of the difference in the coefficients post-crisis compared to pre-crisis. If the coefficients of the interaction variables are significant, we can conclude that there is a difference in the slopes and that cross-selling strategies have changed (Newbold et al., 2010).

4.4.1 Definition of variables

Net interest margin (NIM) is the dependent variable in both models presented above. It is calculated as the net interest income divided by total earning assets (Lepetit et al., 2008; Nguyen, 2012). The dependent variable is continuous and can adopt any value. Interest income and earning assets are both generated from lending and deposits and represent a bank's traditional activities. NIM is explained by several independent variables that are discussed below.

The proxy of diversified assets (DIV_ASSET) relates to income from many kinds of non-traditional activities, and is measured as the ratio of other earnings assets divided with total asset for bank *i* at time *t* (Maudos & Fernández, 2004; Nguyen, 2012). Diversification asset is used as a proxy for non-interest income since other earning assets will generate non-interest income. The proxy of diversification income (DIV_INCOME) only relates to income from commissions and fee activities, and is measured as the ratio of net fees and commissions to operating income for bank *i* at time *t*. DIV_ASSET is a broader proxy for non-interest income than DIV_INCOME.

Market structure (LERNER) is measured by the Lerner index for each European country j at time t. LERNER encompasses the market power in the environment where each bank operates (FRBS, 2016). The ratio will range from 0 to 1 (Nguyen, 2012), where 0 represents a highly competitive market and ratio of 1 indicates no elasticity or competition at all.

The ratio of equity to total assets for banks i at time t is used as proxy for risk aversion (EQUITY) (Angbazo, 1997; Maudos & Fernández, 2004; Maudos & Solís, 2009; Lepetit et al., 2008; Lin et al., 2012). Interest rate risk (IRR) is calculated as the three-month interbank rate for each European country j at time t. The ratio of loan loss reserves to gross loans (LLR) for bank i at time t, has been used as a proxy for credit risk (Maudos & Fernández, 2004; Nguyen, 2012; Maudos & Solís, 2009; Lepetit et al., 2008).

CRISIS is a dummy variable, which equals 1 for post-crisis and 0 pre-crisis. All observations between 2004 and 2006 equals pre-crisis, meanwhile 2011-2013 is considered as post-crisis.

The first interaction variable (IDA) is calculated as DIV_ASSET multiplied with CRISIS. The second interaction variable (IDI) represents DIV_INCOME multiplied with CRISIS. When the dummy variable CRISIS equals 0, the interaction variables will have a value of 0. When crisis is equal to 1, the interaction variable will have a value equal to DIV_ASSET or DIV_INCOME post-crisis (Newbold et al., 2010).

4.4.2 Control variables

Bank net interest margins are expected to be explained by additional variables to the ones described above. Therefore, control variables are added in order to account for the possibility that these also might correlate with the dependent variable. The set of control variables chosen for this study are ASIZE, LLPA, DTA and GDP. These control variables have been used by past studies that investigate cross-selling, such as Nguyen (2012) and Maudos and Solís (2009).

The first control variable ASIZE is calculated as the logarithm of each bank's total assets. ASIZE aims to capture variation due to bank size. It is expected that larger banks have easier access to the most recent technology and tend to be more diversified (DeYoung, 2004a), and by including the size of the bank, it can capture any potential economies or diseconomies of scales (DeYoung, 2004a; Sufian & Chong, 2008). The ratio of total deposits to total assets (DTA) is included to capture a bank’s dependence on funding on deposits (Lepetit et al., 2008). Thirdly, the ratio of loan loss provisions to total assets (LLPA) accounts for bank riskiness loan. It is expected that banks with a higher risk of loans will require a higher net interest margin and therefore have an impact on the dependent variable. Gross domestic product (GDP) is expected to influence several factors related to the demand and supply of loans and deposits. As described by Ho and Saunders (1981), the demand and supply function for loans and deposits has a great impact on the fees (a + b) set by each bank and thereby the margins. When the growth of GDP decreases or slows down, it is likely that the demand and supply function of loans and deposits get affected by lower credit quality and higher risk of defaults. It will increase the risk and thereby, the bank might require higher compensation and a higher margin (Sufian &

Chong, 2008). Due to this, we find it possible that the growth of GDP explains our dependent variable, net interest margin.

4.4.3 Predictions of the determinants of Ho and Saunders and non-interest income

In order to test the developed hypothesis, the determinants of net interest margin are considered, in accordance with the theory by Ho and Saunders (1981). The three determinants considered are market structure, risk aversion and interest rate risk (Ho & Saunders, 1981). All of the determinants are predicted to be positively associated with net interest margin. Credit risk is added as an additional risk and we predict a positive relationship between credit risk and interest margin since higher risk indicates higher margins.

Market structure determines the condition of the supply and demand for loans and deposits in the banking market. Banks that compete against each other to show attractiveness to customers characterize a highly competitive market. Intense competition implies a lower lending rate or higher deposit rate. It is achieved by reducing the fees for loans or deposits. Lower lending rates generate higher demand for loans and this increased demand affects net interest margin positively. Based on the evidence presented by previous research and public papers (Ho & Saunders, 1981; EC, 1997; IMF, 2000; Lepetit et al., 2008: Cosci et al., 2009; Maudos & Solis, 2009; Nguyen, 2012; Entrop et al., 2015), we predict that the market structure in the banking industry positively affects the net interest margin, thereby we expect a coefficient above zero ($\beta 1>0$).

The second determinant of interest margin is risk-aversion. Banks operate in an environment where in- and outflows of money could arrive at different times. When loans and deposits arrive unequally, deposits and loans do not match. This means that the uncertainty of deposits and loans being unmatched implies a risk for banks in the forms of reinvestment- or refunding risk. Since banks are risk averse, they will cover themselves against this uncertainty by requiring compensation by raising their rates, which means a positive margin for handling the uncertainty. Banks with higher compensation will have a greater spread and be more profitable, due to their rise in net interest margins (Ho & Saunders, 1981; Angbazo, 1997; Lepetit et al., 2008; Nguyen, 2012). Hence, we predict risk-aversion to be positively associated with interest margin ($\beta 2>0$).

Interest rate risk is the third determinant representing the purest risk within the principal activity in commercial banks. To achieve an equilibrium between the given loans and received deposits, banks appeal to the money market to achieve a stable wealth portfolio. In the money market, banks face either the risk of reinvesting or refinancing if the short-term rate at the money market rises or falls (Ho & Saunders, 1981). This means that when a surplus of deposits exist, banks will place the money in the money market and thereby be subjected to interest rate risk. Conversely, if there are greater loans compared to deposits,

banks will borrow money from the money market and again be subjected to interest rate risk. Thereby, we expect interest risk rate to be positive, since banks, which face larger interest rate risk, expect larger compensation ($\beta 3>0$).

Credit risk have been included in several papers as an additional risk to the dealership model, with the aim to take into account the risk of loans not being repaid. It is widely described as the risk that some of the loans will not be paid back, meaning that return on loans is uncertain and thereby credit risk is expected to be positively associated with interest margins (Angbazo, 1997; Maudos & Solis, 2009; Carbó and Rodríguez, 2007, Lepetit et al., 2008). To compensate for credit risk and interest rate risk, banks exercise control over loans and deposits by adjusting the rates for the immediacy services (Maudos & Guevara, 2004). We predict a positive sign for credit risk, since higher credit risks entails greater fees for loan and accordingly greater interest margins ($\beta 4>0$).

Cross-selling strategies are likely when income from diversification is negatively correlated with net interest margin. This means that the income from diversification increases at the expense of income from traditional activities (Stiroh, 2004; Carbó & Rodríguez, 2007; Lepetit et al., 2008; Maudos & Solís, 2009; Nguyen, 2012). For non-interest income two proxies are considered, diversification asset and diversification income. With support from literature (e.g. Lepetit et al., 2008; Nguyen, 2012), diversification asset is expected to have a negative coefficient ($\beta 6<0$), as well as diversification income ($\beta 8<0$).

4.5 Limitations

Our study covers a specific area, limited to 12 European countries. European countries arguably represent a better laboratory than banks in the U.S, since they might have a more varied regulatory environment, which allows banks to offer a wider range of products and services (Carbó & Rodríguez, 2007). When accounting for differences in regulatory environment among European countries, it is relevant to point out that banks in these countries are subject to follow some common rules settled by common official institutions (ECB, 2016) which brings a certain level of comparability. As a part of robustness test, we also include the level of enforcement in each country (Brown et al., 2014). This level of enforcement reflects how much each country follows the rules and standards. This research considers of only commercial banks reporting under IFRS (e.g. Lepetit et al., 2008) since our aim is to observe the relationship between interest income and diversification income. To this end, commercial banks account for both.

The timeframe is set to six years, three in the pre-crisis period and three in the post-crisis period with the aim to compare and analyze the change of cross-selling behavior within commercial banks. Our findings only reflect changes in cross-selling in our timeframe. Further the change in cross-selling behavior is not considered for other European countries

in additional to the 12 that we cover. It is important to highlight that in order to achieve a large enough sample size that reveals a statistically significant relationship, we include 2006 and 2011 in our sample periods. These years might be considered extreme years, and are still affected by the recent financial crisis 2007/2009.

Our paper is using a multiple regression. Similar studies have used different methods, such as two-way fixed effect regression and generalized method of moments (Lepetit et al., 2008; Nguyen, 2012). Thereby, our study does not account for inter-bank differences to the same extent as using a two-way fixed effect model. We have accounted for bank size, level of leverage, overall riskiness and macroeconomic risk by adding them as control variables. Studies using two-way fixed effect regressions in the net interest margin literature account for different sorts of risk among periods of time (Lepetit et al., 2008; Nguyen, 2012). For example, Lepetit et al. (2008) includes the determinants of lending risk premium and default spread. Risky loans and zero-default bonds of equivalent maturity are also included in their research. In the same manner, Nguyen (2012) also includes additional risks such as risk-adjusted profitability.

The negative relationship between non-interest income and net interest margin could also be caused by other factors than actual cross-selling strategies. This presents an opportunity for future research, especially exploring how the change in the behavior correlates with risk.

5. Empirical findings and analysis

This chapter illustrates the descriptive statistics for each period. Later on, the empirical findings are presented and analyzed. Thereafter, the results are connected to the developed hypothesis. Finally, a sensitive analysis of our model is described. Throughout, findings are compared with earlier investigations.

5.1 Descriptive statistics

Table 3: Descriptive statistics for pre- and post crisis

Pre-crisis

	N	Minimum	Maximum	Mean	St. Deviation
NIM	303	-0.0059	0.1418	0.0199	0.0143
LERNER	303	0.1204	0.3845	0.2536	0.0610
EQUITY	303	0.0105	0.7140	0.0702	0.0547
IRR	303	0.0048	0.0479	0.0305	0.0099
LLR	303	-0.0039	0.1587	0.0210	0.0194
DIV_ASSET	303	0.0050	0.9561	0.3783	0.2295
DIV_INCOME	303	-0.0972	0.8315	0.2773	0.1607
ASIZE	303	5.0592	9.1718	7.2262	0.9826
DTA	303	0.0004	0.9723	0.4364	0.2219
LLPA	303	-0.0274	0.0653	0.0024	0.0060
GDP	303	0.0080	0.0470	0.0248	0.0088

Post-crisis

	N	Minimum	Maximum	Mean	St. Deviation
NIM	694	-0.01989	0.1216	0.0198	0.0137
LERNER	694	0.0510	0.3709	0.2396	0.0668
EQUITY	694	-0.4276	0.7323	0.0867	0.0771
IRR	694	0.0001	0.0287	0.0079	0.0052
LLR	694	0.0000	0.4792	0.0415	0.0470
DIV_ASSET	694	0.0004	0.9779	0.3682	0.2224
DIV_INCOME	694	-0.3268	1.1111	0.2888	0.1921
ASIZE	694	4.1903	9.2934	6.9425	1.1078
DTA	694	0.0000	0.9487	0.4887	0.2273
LLPA	694	-0.1709	0.6056	0.0077	0.0271
GDP	694	-0.0400	0.0280	-0.0011	0.0177

Note: Variable definition: NIM = net interest income/total assets for bank i at time t; LERNER = percentage of Lerner index for country j at time t; EQUITY= total equity/total assets for bank i at time j; IRR= each country's average three-month interbank rate for country j at time t; LLR=loan loss reserves/gross loans for bank i at time t; DIV_ASSET= other earning assets/total assets for bank i at time t; DIV_INCOME= net fees and commission/net operating income for bank i at time t; ASIZE = logarithm of total assets for banks i at time t; DTA= Deposits to total assets for bank i at time t; LLPA= loan loss provision divided with total assets for bank i at time t; GDP = annual percentage gross domestic product for country j at time t.

Table 3 shows the descriptive statistics for the main variables separated into pre and post-crisis. The average net interest margins pre-crisis amounted to 1.99 percent and 1.98 percent after the crisis. The small negative change in net interest margin suggests a decrease in income from banks traditional activities (Lepetit et al., 2008; Nguyen, 2012). The reason for the decline in interest margin is raised focusing on cross-selling and non-interest income. Bank involvement in diversification activities has shown to be rather stable. The average diversification asset (DIV_ASSET) has however decreased slightly after the financial crisis, amounting to 36.82 percent compared to 37.83 percent. Diversification income (DIV_INCOME) has increased with 1.15 percent. Before the crisis, the average commission and fee income amounted to 28.8 percent and after the crisis to 27.73 percent.

The remaining variables of interest differ in some degrees when comparing the two periods. In the early 90's, the banking competition started to get tougher (EC, 1997; Ciarrapico & Cosci, 2011), and the average market power (LERNER) has decreased from 25.36 percent to 23.96 percent. A lower LERNER ratio suggests that modern competition is higher and the competitive pressure seems to be continuing. As observed from table 3, net interest margins have fallen in the European banking market, which might be a result of higher competition, which is supported by the lower LERNER ratio. Interest rate risk (IRR) has a sharply lower ratio (0.79) after the financial crisis compared to pre-crisis (3.05). Credit risk (LLR) has increased after the crisis and the average ratio has almost doubled. When banks cross-sell, it might be likely that banks reduce their lending rates in order to attract customers. Mispricing of loans leads to higher credit risk, as shown in table 3 (e.g. Lepetit et al., 2008).

5.2 Regression result

Table 4 shows multiple regressions for difference in slopes. The table above presents the results for regression Model 1 and 2 including interaction variables.

Table 4: Regression results

Variables	Expectations	Coefficient	SE	Expectations	Coefficient	SE
		Model 1			**Model 2**	
Constant		0,0291***	(0,0051)		0,0226***	(0,0056)
LERNER	(+)	0,0105*	(0,0058)	(+)	0,0112**	(0,0059)
EQUITY	(+)	0,0492***	(0.0130)	(+)	0,0459***	(0,0152)
IRR	(+)	0,1266**	(0,0640)	(+)	0,1163*	(0,0681)
LLR	(+)	0,0749***	(0,0182)	(+)	0,0829***	(0,0241)
CRISIS		-0,0073***	(0,0019)		-0,0044**	(0,0021)
DIV_ASSET	(-)	-0,0316***	(0,0042)			
IDA	(+)	0,0163***	(0,0048)			
DIV_INCOME				(-)	-0,0198***	(0,0051)
IDI				(+)	0.0076	(0,0055)
R^2		**0.3827**			**0.2973**	
N		**997**			**997**	

*Note: * Significance level of 10 %. ** Significance level of 5%. *** Significance level of 1%. The prediction of the sign for each variable is marked with (+) or (-). All results are robust for heteroskedasticity and all results are robust for autocorrelation using Durbin-Watson test. Coefficient of the posited variables by equation (standard errors in parentheses). Variable definition: NIM= net interest income/total assets for bank i at time t; LERNER = percentage of Lerner index for country j at time t; EQUITY= total equity/total assets for bank i at time j; IRR= each country's average three-month interbank rate for country j at time t; LLR=loan loss reserves/gross loans for bank i at time t; CRISIS = dummy variable which equals 1 for bank i in post-crisis t and 0 pre-crisis; DIV_ASSET= other earning assets/total assets for bank i at time t; DIV_INCOME= net fees and commission/net operating income for bank i at time t; IDA= DIV_ASSET*CRISIS; IDI= DIV_INCOME*CRISIS; Complete regression with control variables are presented in Appendix D.*

Model 1

$$\mathrm{NIM}_{i,t} = \beta_0 + \beta_1 \mathrm{LERNER}_{j,t} + \beta_2 \mathrm{EQUITY}_{i,t} + \beta_3 \mathrm{IRR}_{j,t} + \beta_4 \mathrm{LLR}_{i,t} + \beta_5 CRISIS + \beta_6 DIV\_\mathrm{ASSET}_{i,t} + \beta_7 \mathrm{DIV\_ASSET} \times \mathrm{CRISIS} + \varepsilon_{i,t}$$

The coefficient of CRISIS represents the shift in mean of net interest margin (NIM) post-crisis compared to pre-crisis. From Table 4, we can observe that CRISIS has a negative coefficient of -0.0073 and a p-value below 0.05 and we can conclude that the coefficient is not equal to 0. The result indicates that net interest margins are lower after the crisis compared to before the crisis. The negative coefficient of CRISIS supports the trend in a continuous decline in banks interest margins (e.g. Ciarrapico & Cosci, 2011; Nguyen, 2012). The decline in interest margins may be a result of down-adjusted lending rates to attract customers to buy their non-traditional services, affecting interest margin negatively (Lepetit et al., 2008). Before the financial crisis, banks with higher level of diversification had lower lending rates. If the same relationship holds, lower interest margins might indicate that bank non-interest income has increased (ECB, 2014). Continued competitive pressure offer another reasonable explanation to the decline in interest margins, as banks will set lower rates to keep and attract customers. This is supported by the decrease in LERNER ratio between the two periods, suggesting that competitive pressures remain and may even have intensified.

The variable DIV_ASSET will measure the relationship between diversification assets and the dependent variable NIM (Newbold et al., 2012). Other earning assets will not directly affect the income statement and therefore the results of that year**.** The result for banks is likely to be impacted during the upcoming years, when the asset generates non-interest income. DIV_ASSET is observed to have a negative coefficient of -0.0316 at a 1 percent significance level. The negative sign of the coefficient implies that diversification assets are negatively related to interest margins, which supports that cross-selling strategies are still taking place within European commercial banks. For every percentage unit change in diversification asset, there is a 0.0316 percentage unit decrease in net interest margin. The same negative relationship has been found between net interest margin and proxies for non-interest income in several studies before the crisis (e.g. Carbó & Rodríguez, 2007; Lepetit et al., 2008; Maudos & Solís, 2009; Nguyen, 2012). Using different methods, Maudos and Solís (2009) and Nguyen (2012) found a similar negative relationship between their non-traditional activities and interest margin. In order to investigate whether cross-selling has decreased, we have analyzed the interaction of diversification assets.

From Table 4 in Model 1, the coefficient of DIV_ASSET*CRISIS (IDA) can be observed. The IDA variable has a positive coefficient of 0.0163 at a 1 percent significance level. IDA is an estimate of the difference in coefficient for diversification assets on net interest margin post-crisis compared to pre-crisis. The p-value is below 0.05, and we can conclude that there is a difference in the slope coefficient for diversification assets post-crisis

compared to pre-crisis. The positive change in the slope means that diversification assets have a weaker negative correlation with net interest margin post-crisis compared to pre-crisis.

The determinants of net interest margin are all positive and significant. As observed from Table 4, market structure (LERNER) is positively related to the dependent variable. Even if banks have new sources of market power in non-traditional activities, the result indicates that the function of lending and deposits still has a great impact on interest margin (Ho & Saunders, 1981). Risk aversion (EQUITY) is positive and significantly associated with interest margin and when banks take on risks, they require to be compensated (Ho & Saunders, 1981). Banks required additional compensation for every additional risk taken within the money market (IRR) during the pre- and post-crisis periods. This will increase the earned amount from interest income (e.g. Angbazo, 1997; Carbó & Rodriguez, 2007; Lepetit et al., 2008; Nguyen, 2012; Lin et al., 2012). A positive credit risk (LLR) will increase the dependent variable since higher risk is assumed in the lending activity. Banks will require greater compensation for the credit risk and hence the interest income. It is aligned with the statement that banks charge greater loan rates for loans with higher levels of risks (Lepetit et al., 2008).

Model 2

$$\mathrm{NIM}_{i,t} = \beta_0 + \beta_1 \mathrm{LERNER}_{j,t} + \beta_2 \mathrm{EQUITY}_{i,t} + \beta_3 \mathrm{IRR}_{j,t} + \beta_4 \mathrm{LLR}_{i,t} + \beta_5 CRISIS + \beta_8 \mathrm{DIV\_INCOME}_{i,t} + \beta_9 \mathrm{DIV\_INCOME} \times \mathrm{CRISIS} + \varepsilon_{i,t}$$

In Model 2, we are replacing diversification asset (DIV_ASSET) with diversification income (DIV_INCOME) and thereby testing the relationship between interest margins and income from non-traditional activities by using another proxy for non-interest income. It is likely that a bank mainly cross-sells services that give rise to income from commissions and fees (Sabato et al., 2009; Ciarrapico & Cosci, 2011). From Model 2 in Table 4, DIV_INCOME has a negative coefficient of -0.0198 at a significance level of 1 percent. It implies that DIV_INCOME is negatively related to net interest margin. For every percentage unit change in diversification income, there is a 0.0198 percentage unit decrease in net interest margin. In a majority of studies, non-interest income has been negatively correlated with net interest margin (Carbó & Rodríguez, 2007; Lepetit et al., 2008; Maudos & Solís, 2009; Nguyen, 2012). The result from DIV_INCOME coefficient suggests that banks cross-sell, using commission and fee income. In order to tests whether non-interest income has a weaker negative correlation with NIM after the crisis, the interaction variable DIV_INCOME*CRISIS needs to be analyzed.

The coefficient of DIV_INCOME*CRISIS (IDI) has a positive coefficient of 0.0076. Nonetheless, a p-value above 0.05 and no change in slopes for diversification income post-

crisis compared to pre-crisis can be concluded. However, it is important to highlight that the negative coefficient of DIV_INCOME supports that cross-selling is still applied, but whether cross-selling using commission and fee income has increased or decreased could not be concluded. In Model 2 when DIV_ASSET is replaced by DIV_INCOME, the coefficient of CRISIS amounts to -0.0044 and a p-value below 0.05. Interest margin is found to be lower post-crisis compared to pre-crisis in Model 2, as in Model 1.

When replacing DIV_ASSET with DIV_INCOME in Model 2, the sign of the determinants are still significantly positively associated with interest margin. The signs are aligned with findings in previous papers, even though different statistical methods have been applied (Maudos & Guevara, 2004; Lepetit et al., 2008). The positive sign of market structure (LERNER) reflects that banks with greater market power set higher interest margins. The coefficient of risk-aversion (EQUITY) and interest rate risk (IRR) is significantly positively related to NIM. When replacing DIV_ASSET with DIV_INCOME in the second model, the credit risk (LLR) correlates stronger with NIM. It indicates that higher interest rate risk in the money market will lead to higher interest margins, in accordance with the dealership model (Ho & Saunders, 1981).

5.3 Cross-selling after the financial crisis

In chapter three, one hypothesis has been formulated based on findings from previous literature. The major arguments support a decrease in cross-selling behavior within European commercial banks after the financial collapse. Thereby, the following hypothesis was formulated:

H1: *The effect of non-interest income on net interest margin in European commercial banks has decreased after the financial crisis in 2007/2009.*

As observed from Table 4, Model 1, the coefficient of IDA is positive (0.0163) and has a p-value below 0.05, so we can conclude that there is a difference in the slope coefficient for diversification assets post-crisis. The positive sign of the coefficient for IDA means that diversification asset has a weaker negative correlation with NIM after the crisis, compared to before. However, from Table 4, Model 2, IDI is not statistically significant and we cannot support any change of the diversification income relationship with net interest margin after the crisis.

Since DIV_ASSET and DIV_INCOME are two different kinds of proxies for non-interest income and Model 2 with DIV_INCOME has less explanatory power, we find that Model 1 with DIV_ASSET is useful for the purpose of investigating cross-selling. The statistically significant weaker correlation between DIV_ASSET and NIM after the crisis suggests that the effect of non-interest income on NIM has decreased. We can accept our hypotheses that

the effect of non-interest income on net interest margin in European commercial banks has decreased after the financial crisis in 2007/2009. Thereby, our results suggest that cross-selling behavior has decreased after the financial crisis.

It is likely that cross-selling strategies could be tied to the fact that some banks prefer to increase their diversification assets in a higher proportion, with the potential intention to generate non-interest income in the long run. That behavior could be perceived as a strategy and as an opportunity for cross-selling. However, diversification income earned in one year might perhaps be interpreted as a more opportunistic and tactical decision.

It is important to remark that our paper is not further exploring the reasons of why cross-selling has changed after the financial crisis. The fundamental aim of our paper is test for the change, which means the decrease in the application of cross-selling.

Cross-selling is associated with higher credit risk since the strategy involves lower lending rates to attract customers to buy diversification activities (Lepetit et al., 2008). Credit risk contributes to systemic risk, which is one of the negative consequences of cross-selling and diversification income (De Jonghe, 2010; DeYoung & Torna, 2013). Our results are aligned with the De Jonghe (2010) argument that new regulation is required in order to decrease bank's involvement in non-traditional activities. If no regulation is applied in respect to cross-selling and systemic risk, banks will continue to apply the strategy (De Jonghe, 2010), which is supported by our results since cross-selling is being exercised to a greater extent. Regulators have shown interest to the current relationship between interest margin and diversification income. Still after the crisis, the current situation has not been investigated.

5.4 Sensitive analysis

To ensure the validity of the results, some additional tests have been performed. We have repeated regressions by considering other aspects (See appendix E). We conclude that the relationship between net interest margin and non-interest income remains valid.

The timeframe have been considered in the sensitivity analysis. The regressions were run excluding the year 2011, since 2011 might be considered as an extreme year in respect to the financial crisis. When running the regressions including the years 2004-2006 and 2012-2013, all conclusions regarding the variables of interest remain unchanged.

It is likely that the size of the bank will impact the relationship between the dependent variable and diversification income**.** In the main regressions, the control variable ASIZE accounts for this. As a further test, the regressions have been performed including only banks with assets above 10 billions. The relationship between net interest margin and non-interest income remains valid as well as the change in cross-selling.

Finally, it is likely that the regulatory environment where each bank operates has an impact on net interest margin (Ho & Saunders, 1981). In order to account for this, the sample only encompasses commercial banks reporting under International Financial Reporting Standards (IFRS). Additionally, we test if different levels of enforcement per country affect our results. The enforcement environment is based on the scores built up by Brown et al. (2014). Two groups have been created. One group includes countries with a lower level of enforcement, which means that those countries might be less willing to follow the standards. The other group encompasses those countries with a higher level of enforcement. The relationship between net interest margin and non-interest income remains valid.

6. Conclusion

This chapter presents a concrete conclusion of our study. The research question is answered based on the results obtained in chapter five. Finally, suggestions for further research are also developed with the idea of complementing our findings and bring about ideas for additional research.

The purpose of our study was to investigate changes in diversification strategies within European commercial banks after the financial crisis 2007/2009. The aim was achieved by answering the research question whether cross-selling behavior has changed within the European banking market. To enable the investigation of cross-selling, the model by Ho and Saunders (1981) was applied to analyze the relationship between proxies for diversification activities and net interest margins. Previous literature has assessed the existence of cross-selling behavior in the European banking industry before the financial crisis (e.g. Lepetit et al., 2008; Nguyen, 2012), while we test for changes in the application of cross-selling behavior after the recent financial collapse. Specifically, the thesis formed the hypothesis that a change in cross-selling behavior would manifest in a change in the relationship between non-interest income and net interest margins. A sample of 997 banks was gathered from the Bankscope database. A few variables were collected from other sources such as, Datastream International and the World Bank. The timeframe covers two periods of three years each, 2004 to 2006 and 2011 to 2013 respectively. In order to test and answer the hypothesis and reach the conclusion of our research question, we applied a regression model using a period interaction variable for identifying the difference in slopes between the two periods. The regression models included the established determinants of net interest margins (Ho & Saunders, 1981) and variables representing non-interest income. We found that diversification assets and diversification income were statistically significantly negative related to net interest margins. This supports the existence of cross-selling strategies within banks as revealed in previous studies (e.g. Carbó & Rodríguez, 2007; Lepetit et al., 2008; Nguyen, 2012). By separately analyzing the two different proxies for non-interest income, it is found that diversification assets had a less negative effect on interest margins after the crisis. No statistical change was found for diversification income. However, the statistically significant weaker correlation between diversification asset and net interest margin after the crisis suggests that the effect of non-interest income on net interest margin has decreased. Thereby, we conclude that the application of cross-selling strategies has decreased in European commercial banks after the financial crisis in 2007/2009.

All of the determinants of the dealership model of Ho and Saunders (1981) displayed the expected statistically significant relationships. Despite the introduction of new sources of income, the LERNER variable still exhibits a statistically significant correlation with NIM. This provides further support for the assumption of the Ho and Saunders model (1981) that

competition for lending and deposit customers greatly impacts interest margins. We found that risk-aversion (EQUITY) and interest rate risk (IRR) was positively related to interest margins. This supports that when banks take higher risks in the money market, they will require greater compensation, which is translated in higher interest margins (e.g. Angbazo, 1997; Carbó & Rodriguez, 2007; Lepetit et al., 2008; Nguyen, 2012; Lin et al., 2012). According to Ho and Saunders (1981), banks will charge higher loan rates for loans associated with greater risk (Lepetit et al., 2008), which is confirmed by a positive credit risk (LLR) relationship with interest margins.

Our findings are relevant to regulators. European Supervisory Authorities (ESA) and the European Central Bank (ECB) have expressed concern about cross-selling behaviors and called for guidelines for protecting banking customers in this respect to bank cross-selling strategies. These regulatory institutions have shown an interest in developing a framework to supervise these strategies in developing new guidelines. Regulators may want to consider that such behavior has already decreased.

There will be many reasons for why cross-selling behavior has decreased after the financial crisis. However, since we found a change in cross-selling behavior in respect to diversification assets but not in respect to diversification income, future research could deeper explore these findings. Our different results for assets versus diversification income would be interesting to approach in relation to different levels of risk. It is likely that different diversification activities are associated with different levels and sorts of risk, which would have different impacts on bank interest margins. According to Ho and Saunders (1981), banks require greater compensation for higher risk, and thereby the applied model could be expanded with more type of risks. Further research could approach this point by also having access to more detailed data, such as size and type of transactions (Ho & Saunders, 1981), in order to classify the data based on the specific level of risk.

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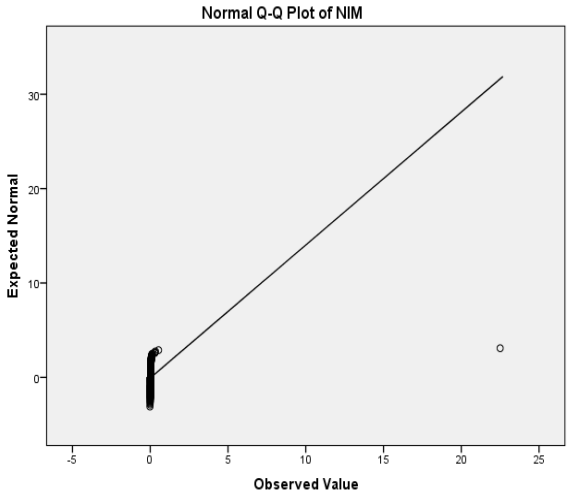
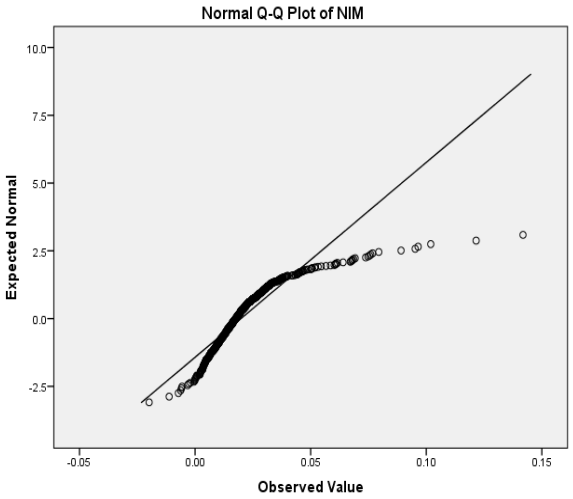
Appendix A: Outliers

Plot 1: The dependent variable (NIM) before removing extreme values.



Plot 2: The dependent variable (NIM) after removing seven extreme values.



Appendix B: Correlation Matrix

	NIM	LERNER	EQUITY	IRR	LLR	DIV_ASSET	DIV_INCOME	ASIZE	DTA	LLPA	GDP
NIM	1										
LERNER	0.136***	1									
EQUITY	0.307***	0.029	1								
IRR	0.021	0.108***	-0.099***	1							
LLR	0.262***	0.042	0.032	-0.269***	1						
DIV_ASSET	-0.387***	-0.070**	0.031	-0.008	-0.084***	1					
DIV_INCOME	-0.148**	-0.017	-0.031	-0.072**	0.072**	0.194***	1				
ASIZE	-0.345***	-0.124***	-0.480***	0.104***	-0.162***	0.045	-0065**	1			
DTA	0.186***	0.053	-0.053	-0.060	-0.084***	-0.172***	0.103***	-0.190***	1		
LLPA	0.234***	0.045	0.127***	-0.107***	0.394***	-0.104***	-0.022	-0.120***	-0.036	1	
GDP	-0.084***	-0.170***	-0.101***	0.642**	-0.312***	0.067**	-0.085***	0.218***	0.013	-0.156***	1

Appendix C: Variance inflation factor (VIF)

Model 1		Model 2	
Variables	**VIF**	**Variables**	**VIF**
LERNER	1.137	**LERNER**	1.137
EQUITY	1.377	**EQUITY**	1.379
IRR	1.939	**IRR**	1.927
LLR	1.340	**LLR**	1.342
DIV_ASSET	1.060	**DIV_INCOME**	1.029
IDA	3.472	**IDI**	3.815
ASIZE	1.498	**ASIZE**	1.501
DTA	1.148	**DTA**	1.120
LLPA	1.213	**LLPA**	1.209
GDP	2.035	**GDP**	2.028
CRISIS	3.385	**CRISIS**	3.404

Appendix D: Regression result with control variables

Variables	Expectations	Coefficient	SE	Expectations	Coefficient	SE
		Model 1			Model 2	
Constant		0.0291***	(0.0051)		0.0023***	(0.0056)
LERNER	(+)	0.0105*	(0.0058)	(+)	0.0112**	(0.0059)
EQUITY	(+)	0.0492***	(0.0130)	(+)	0.0459***	(0.0152)
IRR	(+)	0.1266**	(0.0640)	(+)	0.1163*	(0.0681)
LLR	(+)	0.0749***	(0.0182)	(+)	0.0829***	(0.0241)
CRISIS		-0.0073***	(0.0019)		-0.0044**	(0.0021)
DIV_ASSET	(-)	-0.0316***	(0.0042)	(-)		
IDA	(+/-)	0.0163***	(0.0048)			
DIV_INCOME	(-)			(-)	-0.0198***	(0.0051)
IDI	(-)			(+/-)	0.0076	(0.0055)
ASIZE		-0.0018***	(0.0004)		-0.0019***	(0.0005)
DTA		0.0094***	(0.0025)		0.0140***	(0.0026)
LLPA		0.0495	(0.0609)		0.0604	(0.1131)
GDP		-0.0114	(0.0329)		-0.0404	(0.0333)
R^2		0.3827		0.2973		
N		997		997		

*Note: * Significance level of 10 %. ** Significance level of 5%. *** Significance level of 1%. The prediction of the sign for each variable is marked with (+) or (-). All results are robust for heteroskedasticity and all results are robust for autocorrelation using Durbin-Watson test. Coefficient of the posited variables by equation (standard errors in parentheses). Variable definition: NIM= net interest income/total assets for bank i at time t; LERNER = percentage of Lerner index for country j at time t; EQUITY= total equity/total assets for bank i at time j; IRR= each country's average three-month interbank rate for country j at time t; LLR=loan loss reserves/gross loans for bank i at time t; CRISIS = dummy variable which equals 1 for bank i in post-crisis t and 0 pre-crisis; DIV_ASSET= other earning assets/total assets for bank i at time t; DIV_INCOME= net fees and commission/net operating income for bank i at time t; IDA= DIV_ASSET*CRISIS; IDI= DIV_INCOME*CRISIS*

Appendix E: Results from the sensitive analysis

I. Regressions result by delimiting for size of banks: Above 10 billion Euros

Variables	Expectations	Coefficient	SE	Expectations	Coefficient	SE
		Model 1			**Model 2**	
Constant		0.023**	(0.0057)		0.0186***	(0.0064)
LERNER	(+)	-0.001	(0.0047)	(+)	-0.0005	(0.0050)
EQUITY	(+)	0.0697**	(0.0277)	(+)	0.0961**	(0.0328)
IRR	(+)	0.1221***	(0.0495)	(+)	0.1134**	(0.0538)
LLR	(+)	0.0105	(0.0196)	(+)	-0.0144	(0.0212)
CRISIS		-0.0094***	(0.0020)		-0.0035	(0.0026)
DIV_ASSET	(-)	-0.0287***	(0.0043)			
IDA	(+)	0.0186***	(0.0049)			
DIV_INCOME				(-)	-0.0040	(0.0069)
IDI				(+)	0.0012	(0.0075)
R^2		**0.4723**			**0.3663**	
N		**475**			**475**	

*Note: * Significance level of 10 %. ** Significance level of 5%. *** Significance level of 1%. The prediction of the sign for each variable is marked with (+) or (-). All results are robust for heteroskedasticity and all results are robust for autocorrelation using Durbin-Watson test. Coefficient of the posited variables by equation (standard errors in parentheses). Variable definition: NIM= net interest income/total assets for bank i at time t; LERNER = percentage of Lerner index for country j at time t; EQUITY= total equity/total assets for bank i at time j; IRR= each country's average three-month interbank rate for country j at time t; LLR=loan loss reserves/gross loans for bank i at time t; CRISIS = dummy variable which equals 1 for bank i in post-crisis t and 0 pre-crisis; DIV_ASSET= other earning assets/total assets for bank i at time t; DIV_INCOME= net fees and commission/net operating income for bank i at time t; IDA= DIV_ASSET*CRISIS; IDI= DIV_INCOME*CRISIS*

II. Regression result after excluding year 2011

Variables	Expectations	Coefficient	SE	Expectations	Coefficient	SE
		Model 1			**Model 2**	
Constant		0.0267***	(0.0063)		0.0207***	(0.0070)
LERNER	(+)	0.0232***	(0.0076)	(+)	0.0252***	(0.0079)
EQUITY	(+)	0.0514***	(0.0177)	(+)	0.0486**	(0.0214)
IRR	(+)	0.1460*	(0.0804)	(+)	0.0794	(0.0897)
LLR	(+)	0.0663***	(0.0239)	(+)	0.0735**	(0.0315)
CRISIS		-0.0064**	(0.0027)		-0.0057**	(0.0028)
DIV_ASSET	(-)	-0.0314***	(0.0043)			
IDA	(+)	0.0152***	(0.0051)			
DIV_INCOME					-0.0201***	(0.0050)
IDI				(+)	0.0067	(0.0056)
R^2		**0.3968**			**0.3056**	
N		**771**			**771**	

*Note: * Significance level of 10 %. ** Significance level of 5%. *** Significance level of 1%. The prediction of the sign for each variable is marked with (+) or (-). All results are robust for heteroskedasticity and all results are robust for autocorrelation using Durbin-Watson test. Coefficient of the posited variables by equation (standard errors in parentheses). Variable definition: NIM= net interest income/total assets for bank i at time t; LERNER = percentage of Lerner index for country j at time t; EQUITY= total equity/total assets for bank i at time j; IRR= each country's average three-month interbank rate for country j at time t; LLR=loan loss reserves/gross loans for bank i at time t; CRISIS = dummy variable which equals 1 for bank i in post-crisis t and 0 pre-crisis; DIV_ASSET= other earning assets/total assets for bank i at time t; DIV_INCOME= net fees and commission/net operating income for bank i at time t; IDA= DIV_ASSET*CRISIS; IDI= DIV_INCOME*CRISIS*

IV. Regressions result by considering level of enforcement

i. Low level of enforcement:

Variables	Expectations	Coefficient	SE	Expectations	Coefficient	SE
		Model 1			**Model 2**	
Constant		0.0267***	(0.0105)		0.0227**	(0.0110)
LERNER	(+)	0.0139	(0.0107)	(+)	0.0068	(0.0098)
EQUITY	(+)	0.0433**	(0.0194)	(+)	0.0363*	(0.0190)
IRR	(+)	-0.0216	(0.1397)	(+)	-0.0031	(0.1373)
LLR	(+)	0.0691***	(0.0267)	(+)	0.0809***	(0.0264)
CRISIS		-0.0045	(0.0040)		-0.0033	(0.0051)
DIV_ASSET	(-)	-0.0192***	(0.0065)			
IDA	(+)	0.0128*	(0.0078)			
DIV_INCOME				(-)	-0.0361*	(0.0153)
IDI				(+)	0.0153	(0.0051)
R^2		**0.3894**			**0.3731**	
N		**315**			**315**	

*Note: * Significance level of 10 %. ** Significance level of 5%. *** Significance level of 1%. The prediction of the sign for each variable is marked with (+) or (-). All results are robust for heteroskedasticity and all results are robust for autocorrelation using Durbin-Watson test. Coefficient of the posited variables by equation (standard errors in parentheses). Variable definition: NIM= net interest income/total assets for bank i at time t; LERNER = percentage of Lerner index for country j at time t; EQUITY= total equity/total assets for bank i at time j; IRR= each country's average three-month interbank rate for country j at time t; LLR=loan loss reserves/gross loans for bank i at time t; CRISIS = dummy variable which equals 1 for bank i in post-crisis t and 0 pre-crisis; DIV_ASSET= other earning assets/total assets for bank i at time t; DIV_INCOME= net fees and commission/net operating income for bank i at time t; IDA= DIV_ASSET*CRISIS; IDI= DIV_INCOME*CRISIS*

ii. High level of enforcement:

Variables	Expectations	Coefficient	SE	Expectations	Coefficient	SE
		Model 1			**Model 2**	
Constant		0.0324***	(0.0068)		0.0226***	(0.0071)
LERNER	(+)	0.0015	(0.0079)	(+)	0.0054	(0.0080)
EQUITY	(+)	0.0612***	(0.0159)	(+)	0.0642***	(0.0178)
IRR	(+)	0.1129	(0.0675)	(+)	0.0956	(0.0706)
LLR	(+)	0.0650	(0.0511)	(+)	0.0580	(0.0566)
CRISIS		-0.0106***	(0.0027)		-0.0074***	(0.0028)
DIV_ASSET	(-)	-0.0326***	(0.0050)			
IDA	(+)	0.0184***	(0.0063)			
DIV_INCOME				(-)	-0.0168***	(0.0046)
IDI				(+)	0.0092	(0.0063)
R^2		**0.3904**			**0.2943**	
N		**682**			**682**	

*Note: * Significance level of 10 %. ** Significance level of 5%. *** Significance level of 1%. The prediction of the sign for each variable is marked with (+) or (-). All results are robust for heteroskedasticity and all results are robust for autocorrelation using Durbin-Watson test. Coefficient of the posited variables by equation (standard errors in parentheses). Variable definition: NIM= net interest income/total assets for bank i at time t; LERNER = percentage of Lerner index for country j at time t; EQUITY= total equity/total assets for bank i at time j; IRR= each country's average three-month interbank rate for country j at time t; LLR=loan loss reserves/gross loans for bank i at time t; CRISIS = dummy variable which equals 1 for bank i in post-crisis t and 0 pre-crisis; DIV_ASSET= other earning assets/total assets for bank i at time t; DIV_INCOME= net fees and commission/net operating income for bank i at time t; IDA= DIV_ASSET*CRISIS; IDI= DIV_INCOME*CRISIS; Complete regression with control variables are presented in Appendix D.*