BANKS’ PRICING STRATEGIES AND INCOME DIVERSIFICATION: THEORETICAL AND EMPIRICAL EVIDENCE

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Abstract

This thesis makes three different contributions to the literature on bank income diversification and its effect on bank performance. Firstly, the study makes a theoretical contribution by incorporating non-interest income components into Ho and Saunders (1981) model in the presence of pricing strategies, including bundling and loss-leader strategies, as well as being well-informed and less-informed customers. The model distinguishes fees and commissions income and trade income by proposing the conditions that create the negative relationships with net interest margin. The study also empirically tests the theoretical relationships for the European banking system and the results state that both fees and commissions income and trade income negatively affect interest margin.

Secondly, this study examines the relationship between interest and non-interest income sides by considering the switching cost for customers created by loan maturity for non-interest products. Theoretically, the study derives an equation that long-term loans create a switching cost for the sale of non-traditional products. The theoretical contribution is empirically tested for the UK banking system using unique UK banking data over the period 2005 - 2012. The empirical results suggest that by shifting loan maturity from short term to long term creates a switching cost for non-interest product sale. This empirical finding leads to test switching cost created by long-term loan, particularly for trade products. Shifting the maturity from short term to long term creates switching cost for trade products either.

Thirdly the study contributes by investigating the aftermath of findings on the relationship between interest and non-interest income sides, and switching cost created by increasing loan maturity. The third study in this thesis contributes to the literature by examining the effect of non-interest income, conditional on deposit and loan maturities, on bank performance using UK banking data as a laboratory from 2005 to 2012. The study finds that fees and commissions income do not explain bank performance. However, when the fees and commissions variables are conditional on longer loan maturity, it alleviates the risk-adjusted bank performance. Trade income increases the bank performance. However when it is dependent on deposits and loans with long maturities, it has an adverse effect on bank performance. The result of direct maturity diversification indicates that, while the UK banks do not benefit from deposit diversification, the maturity diversification of loan is linked to a higher bank performance.
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Chapter 1

Introduction

This thesis provides both a theoretical and empirical study aimed at re-examining the relationship between interest and non-interest income and their effect on bank performance. The thesis has a particular emphasis on the strategies that create such relationship. This section establishes the basis for the fundamental issues highlighted throughout the thesis.

Banks are viewed as the dealers in the financial system, acting as intermediaries between lenders and borrowers. The traditional banking or intermediation activity generates interest income. However, after the 1980’s, a sweeping wave of deregulations and liberalization struck banking sectors worldwide. As a consequence, banks were allowed to engage in activities other than the traditional activities; non-traditional activities including insurance, securities business, factoring and so on, were further allowed by the 1988 Second Banking Coordination Directive in Europe. This decision allowed banks to also compete with one another in the area of non-traditional income. In addition to the competition among banks, the European Union’s full recognition of a single banking license was established. The high competition imposed pressure on the lending activities of the banks thus reducing the interest income of banks. The new environment has led banks to search for alternative sources of revenue and invest in the non-interest revenue side. Another significant structural change was the rapid expansion of financial innovations by the advent of higher technology in the banking sector. The development of financial in-
novation resulted in the greater integration of banks with the financial markets and this, in turn, increased the share of non-traditional income in total income derived from trading activities, brokerage and investment banking (Boot and Thakor, 2009).

The increasing function of the non-interest income side caused banks to struggle to find new strategies to improve total revenue. Banks used their experience and knowledge achieved in terms of loans for the sale of non-interest products. To sell non-interest products to their core customers, banks need pricing strategies that connect both sides. Banks implement new pricing strategies to attract customers and sell both traditional and non-traditional products. One of these strategies in selling non-interest products to their core customers is implementing bundling strategy. Bundling strategies became particularly prevalent in the banking sector in the 2000’s. Another pricing strategy that allows banks to cross-sell is the loss leader strategy. Banks attract customers by keeping interest rate level low enough and compensate it later by charging higher for non-core products. The common feature of these strategies for banks is considering gross margin rather than interest margin. Hence, pricing strategies considering gross margin rather than interest margin directly impact the relationship between interest income and, fees and commissions income, as well as trade income.

income to be insignificant (Lepetit et al., 2008b; Maudos and Solis, 2009). These studies examine the effect of non-interest income components by using the data for the late 1990’s and early 2000’s. The increasing popularity of bundling strategy and its possible effect on change in relationships after 2000’s are not considered by recent studies. Therefore, there is a gap in the literature on recent empirical relationships and the theoretical differentiation between fees and commissions income and trade income in the presence of bundling strategies.

These two pricing strategies are not the only strategies that banks implement to achieve their non-interest product sale objectives. Another approach for banks is creating switching costs for bank products. There is a large and growing literature that documents the switching cost approach of banks. A critical dimension of a relationship to create switching cost is the duration. One part of the studies in the literature examines the role of duration in switching (Petersen and Rajan, 1994; Berger and Udell, 1995; Degryse and Van Cayseele, 2000; Ongena and Smith, 2001; Farinha and Santos, 2002; Pozzolo, 2004; Degryse and Ongena, 2005). Another part of the literature analyses the indirect effect of duration by comparing the price of inside and outside banks, which is determined with respect to relation and payment performance over time (Black, 2006; Barone et al., 2011; Ioannidou and Ongena, 2010). Regarding the importance of duration, it is reasonable to think that banks may create a switching cost for non-interest products in the long-term. In this sense, banks need a tool to create that switching cost for non-interest products and this would be created by banks’ traditional activity. In this sense, long term loans would be a good candidate for this. The advantage of long term loans is allowing banks a chance to evaluate their customers using information gathered in the loan process. Having private information relative to outside banks also give banks the advantage of being able to analyse the consumption patterns of customers and the modelling of it. Even in the absence of using private information about customers, the likelihood of selling non-interest products to customer may increase due to factors such as inertia by loyalty or probability of rejection by other banks. The common feature of
pricing strategies discussed above and creating switching costs is banks’ willingness to loss from the interest income side and compensate it from the non-interest income side by charging more from it. This cross-selling strategy is carried out sometimes in the long-term like loss leader and switching cost strategies, but is sometimes valid in the simultaneous sale of interest and non-interest products, like bundling.

These strategies pave the way of income diversification for banks. The shift of income from interest towards non-interest has contributed to higher levels of bank revenue. Moreover, income diversification by shifting to non-interest income is expected to contribute to bank risk and performance by lowering the income volatility. Even diversification benefits are expected through shifting towards non-interest income. On the other hand the literature finds that policy of banks to be one of the shortcomings that may have negative effects on the diversification policies (Boyd and Graham, 1988; Lown et al., 2004; Stiroh, 2004; Lepetit et al., 2008).

In order to benefit from income diversification with regard to riskiness, banks need non-interest income with lower volatility than interest income, or from another perspective, income diversification permits bank to diversify risk if interest and non-interest income are negatively, or positively but weakly correlated. Otherwise, unanticipated income shocks may increase bank risk by negatively and simultaneously impacting both interest and non-interest income sides. One of the strategies of banks that may increase the risk of bank by increasing the covariance is the cross-selling strategy to core customers. Selling non-interest products to the core customer increases the covariance coefficient, which in turn has a negative effect on bank risk against shocks. Therefore, the advantage of cross-selling by increasing revenue may, on the other hand, reduce bank performance. A positive and higher covariance between interest and non-interest income may diversify bank revenue but question risk/return trade-off. The switching costs created by long term loans for non-interest products, discussed above, contribute to cross-selling and may negatively influence bank performance. However, an interesting characteristic of long term deposits and loans is giving the chance of improving the ability in evaluat-
ing/scoring customer. Banks, as the lender, obtain the information about their
customer by monitoring their activities. As the level of information increase, the
more accurate analysis of customers can be carried out by the bank. Furthermore,
banks can spread their fixed costs by also selling non-interest products especially
through cross-selling. Thus, cross-selling to long term deposit and loan customers
has some advantages; chance of evaluation of customer more appropriately and
spreading fixed cost, and disadvantages; higher correlation between interest and
non-interest income sides through cross-selling. The overall effect of cross-selling to
long term customers on bank performance depends on the balance between the ad-
vantages and disadvantages. The dominancy of one side may determine this overall
effect of cross-selling to long term customer on bank performance. It is interesting
and critical to question how cross-selling to long term customer may impact bank
performance.

1.1 Objectives

The context of this thesis is embedded within a large proportion of the literature ex-
amining the interest - non-interest income nexus concerning issues related to output
diversification by implementing pricing strategies, creating switching cost for cross-
selling through core product maturity and the effect of cross-selling, conditional on
long term deposits and loans, on bank performance. This thesis contributes to the
literature by providing three studies, two of which include theoretical extension,
with the more specific objectives being as follows:

i Theoretical incorporation of fees and commissions, and trade incomes into Ho
and Saunders (1981) dealership model and the role of the pricing strategies
and price information level of customers in shaping the relationship between
non-interest income and interest margin. Particularly highlighting the role of
bundling policies in shaping this relationship. In addition, to focus on the
empirical test of theoretical relationships for the European banking system by
analysing twelve countries.

ii To theoretically evaluate the role of long term loans in creating switching cost for non-interest products and testing theoretical findings for the UK banking system.

iii To empirically investigate the direct and indirect (conditional on non-interest income components) roles of deposit and loan maturities on bank performance for the UK banking system.

1.2 Motivations

Financial systems affect countries’ economic growth. Saving and investment decisions are generally determined by the interest rates offered and charged by banks, respectively. Some outputs of these decisions are unemployment rate, change in welfare and economic growth performance. Thus, interest margin level as a result of intermediation activity must be the level which is optimal to improve social welfare. The lower interest margin, which requires efficiency, is positively linked with social welfare. The efficient intermediation activity is critical for banks to have better financial soundness. After the global financial crisis, the finance sector pays more attention to banks’ financial soundness. Therefore, factors affecting financial soundness are topics of considerable importance for individual banks. Subject to factors affecting financial soundness, profitability and riskiness of banks are two critical factors. In this sense, strategies and relations considering both interest and non-interest income sides are also of great importance. The need for the ability to improve bank performance by increasing revenue and reducing risk forces us to understand the relationship between the income sides and strategies that create this relationship. Analysing this relationship helps to understand bank profitability and therefore shed light on the factors impacting the financial soundness of banks. Following this motivation, this study also explores other avenues to cross-selling. By considering the conditions that make the cross-selling objectives of banks easier, it is
reasonable to think that banks need private information about customers and time to evaluate information and persuade customers. This implication directly leads us to long term loans. None of the studies in the literature focus on the cross-selling created by loan maturity and its possible effects on bank performance. Examining this relationship allows us to understand the conditions that satisfy cross-selling and also the effect of this relationship on bank performance. Revealing the conditions that satisfy cross-selling and their effect on bank performance help banks, supervisors and regulators to pay more attention to possible cross-selling issues created by long term deposits and loans.

1.3 Contribution of the Research

This thesis contributes to the literature in three ways. First, this study proposes the modelling net interest margin by incorporating bundling strategies into Ho and Saunders’ bank dealership model to highlight the increasing function of bundling strategies. The study also empirically tests theoretical relationships for European Banking system and results obtained reveal that interest margin is negatively linked with trade income, as well as fees and commissions income. Second, this thesis attempts to evaluate the switching cost effect of long term loans for non-interest products by theoretically modelling it. An empirical analysis is undertaken for testing theoretical findings for the UK banking system during the period 2005 - 2012 using unique UK banking data. The empirical findings present evidence for the theoretical findings so that banks create switching costs for non-interest products by shifting loans from short term to long term. All the other empirical findings are compatible with the theoretical findings. Finally, this thesis contributes to the existing diversification-performance literature which is mostly focused on the direct income and geographical diversification by examining the effect of deposit and loan maturities that pave the way for cross-selling on bank performance for the UK banking system over the period from 2005 to 2012. Adjusted return on asset, adjusted return on equity and Z-score of bank are the variables that measure the bank per-
formance. The results indicate that fees and commissions income does not explain banks’ performance. However, when the fees and commissions income is conditional on longer loan maturity, it negatively affects the bank performance. Trade income, as another non-interest income component, increases the bank performance. In contrast, trade income, conditional on longer deposit or loan maturity, reduces the bank performance. Also, this study estimates for the first time the direct effect of both deposits and loans maturities on bank performance. This thesis separately measures the effect of maturities of deposits and loans in order to address the main problem in case of their different effects on bank performance. The empirical results show that maturity diversification of loan is associated with the higher bank performance, whilst reliance on deposit diversification is insignificant to explain bank performance and even reduce risk adjusted return on equity.

1.4 Organisation of the Thesis

This thesis studies the relationship between interest and non-interest income and their effects on bank performance. It contains three substantive empirical analyses in chapters 2, 3 and 4. Chapters 2 and 3 include theoretical extensions. Each chapter includes its introduction, literature reviews, data, variables, results and conclusion sections.

Chapter 2 theoretically examines the relationship between interest income and non-interest income components by separately incorporating the fees and commissions income and trade income into Ho and Saunders’ dealership model. Theoretical relationships are also tested for twelve European countries over the period 2004 and 2011. Before the empirical results, the reasons for using System GMM method in empirical results are explained in detail.

through long-term loans. Unlike the second chapter, the non-linear 3SLS method, as econometric method, is used in this chapter and therefore, the characteristics and the reasons for using Nonlinear-3SLS method are explained and discussed.

Finding a significant relationship between loan maturity and switching cost for non-interest income triggered the fourth chapter that empirically analyses the maturity effect, conditional on non-interest income components, on bank performance for the same period and country explained in the third chapter: analysis of UK banking system over the period 2005 - 2012.

The last chapter is the concluding chapter. It presents the summary and discussions of the findings of chapter 2, 3 and 4. Concluding chapter also shortly presents policy implications for the banks, supervisors and regulators, limitations of the studies and recommendations of the thesis for further studies.
Chapter 2

The Effect of Trade and Fee Income on Net Interest Income: Theoretization of Bundling Strategies

Abstract

In the last two decades the banking system has experienced significant transformation. Banks altered their pricing strategies of interest and non-interest products so as to respond to the high competition. Therefore the relationship between interest and non-interest income has changed. The aim of this study is to highlight the recent trend in pricing strategies on interest and non-interest products in the banking sector. The study separately incorporates the fees and commissions, and trade products into the bank dealership model in the presence of bundling and loss leader strategies. The theoretical findings are tested empirically by investigating the determinants of banks’ net interest margin for 12 European countries. The System GMM is used to estimate the model. The results show that trade income, as well as the fees and commissions income, of the banks negatively affected net interest margin for the period 2004 - 2011. These results suggest that any analysis of bank performance based on interest income should consider the trading income and pricing strategies that create a link between them.
2.1 Introduction

The banking sector plays a fundamental role in economic growth through intermediation activity. The intermediation function of a bank is observed in the process of channeling capital from customers with surpluses to those with deficits. The recent financial crisis that engulfed the markets in the USA and Europe highlighted the importance of scrutinizing banks’ operations, portfolios, revenue lines and risk management processes. Broadly speaking, banks generate profits from two main revenue lines (activities), namely, interest and non-interest activities. Selling interest bearing products, such as loans, is the traditional income source of the banks. Non-lending activities are classified as non-traditional or non-interest income generating activities\(^1\).

The intensifying competition in the banking sector led to a reduction in banks’ interest margins. Banks have resisted decreasing margins by searching for alternative competitive policies in areas other than loan competition. Hence, during the last two decades, the expansion of banks in providing wide varieties of non-interest services was conspicuous. This was an income line that helped banks to diversify their income as well as ease the pressure on their profit caused by the shrinking interest margin. This policy has led banks to also compete in the area of non-traditional income. Since the 1990’s, banks have diversified their non-traditional products (Carbo and Fernandez, 2007; Albertazzi and Gambacorta, 2009; Lepetit et al., 2008) and the share of the non-interest income, as another income source of the bank in net operating revenues has increased dramatically, (Bikker and Haaf, 2002).

Bundling is one of the strategies that banks adopt to maneuver following the high-level competition that links the traditional and non-traditional income sides. Price bundling is the price strategy of selling two or more products together at a discount. Particularly in loan cases, banks struggle to sell diversified products by

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\(^1\)Banks were allowed to perform non-traditional activities by the provision of the 1988 Second Banking Coordination Directive for Europe. Along with allowing a broad range of products and services in banking, the European banking system was designed for higher competition.
cross-selling. Customers may need products that relate to applied loans or even products that are not related to loans. The buying of even unrelated fee or trade products with the loan may be attractive for customers because separately buying a loan and these products can be more costly. Search costs and paying more for separate purchases are the two primary costs that motivate customers to buy products in a bundle. In this regard, banks set a lower price for a package and try to attract customers by price bundling. Banks consider their gross margin rather than interest margin and balance the prices of the loan, fees and commissions, and trading product in such a way that their bundle price is lower than the price in the sum of their separate sale. This balance of prices is expected to change the interest margin.

Another pricing strategy is charging fees and commissions directly from the loan as if fees and commissions are an inseparable part of the lending activity. Many researchers find a negative relation between net interest income and fees and commission (Lepetit et al., 2008; Maudos and Solis (2009). Their results suggest that increases in fee income activities reduce the net interest margin since banks offset the loss of revenue from the reduction in margin by increasing fees and commissions. Banks may even charge interest lower than its market cost if they charge fees and commissions together with the loan through bundling. Firms should determine the prices based on the value of joint consumption if their consumption together is mandatory (Cournot, 1938).

Keeping interest rates low enough is the first step to attracting customer’s interest to loans. This is done by advertising interest rates only, or in some instances, the fees and commissions are available as small-print price. In the case of any deal, banks charge fees and commissions from the less-informed customers, as the inevitable cost of this loan or as if they are composite goods. Then, they offer a total price to customers in the agreement process. Similar to the price bundling strategy, banks’ pricing strategy in here is considering gross margin rather than interest margin by pure bundling as a profit maximizer. In both cases, bundling may offer
economies of scale and market power.

Other than bundling types, banks may also implement loss leader strategy. Banks may create a relationship with the customer by underpricing their traditional product. An established relationship can be used to extract surplus in the long term (Petersen and Rajan, 1995).

Shifting of income from the loan side to the fee and trade income side by these pricing strategies helps the bank to pave the way for benefiting from the diversification of their income though most of the studies in the literature do not find evidence of it. Diversifying income is expected to be beneficial against unexpected income shocks. Moreover, diversification may help banks to increase their market power. However, diversifying income by cross-selling sometimes unexpectedly increases the bank risk due to the resultant income shocks. These risks and market power effects of cross-selling bring the relationship between loan and non-interest income components to the forefront. Understanding this relationship requires focusing on the pricing strategies that undertake the bridge role. The theoretical extensions of Ho and Saunders’ dealership model do not consider the effect of bundling policies, which are a common pricing strategy in the banking sector nowadays. Moreover, the current literature highlights the cross-selling generally for fee income activities and finds a negative relationship between fee income and interest margin. This study fills the gap in the theoretical literature by incorporating bundling policies and distinguishing between fee and trade products with reference to pricing. This study also empirically presents this relationship for the European banking system by using System GMM methodology.

The contribution of this chapter is threefold. First, this study proposes the modelling net interest margin by incorporating pure and price bundling strategies into Ho and Saunders’ bank dealership model to highlight the increasing function of bundling in the banking sector. The theoretical study also highlights the different characteristics of non-interest income components by distinguishing fee and trade products on pricing strategies. Secondly, the theory proposes that the presence
of less-informed customers allows banks to increase gross margin, as the primary motivation of bank, rather than interest margin. Last but not least, the study conducts an empirical investigation of the proposed theoretical relationship using the European banking data. From the empirical perspective, the results illustrate that fees and commissions income is negatively associated with interest income as in the theoretical model. Unlike the interest margin literature, this study also finds a negative link between trading income and net interest margin. These empirical results confirm that the conditions that create a negative relationship between interest and non-interest income activities in the theoretical part are satisfied.

The rest of this chapter is organized as follows: Section 2.2 shows the literature on net interest margin and bundling. Section 2.3 describes the extended version of bank dealership model and then maximizes the model. Section 2.4 presents the data used in this study. Section 2.5 defines the variables used in the empirical investigation. Section 2.6 presents System GMM Model as the econometric method used in estimations. Section 2.7 tests the theory by empirical study and analyses the results. Section 2.8 concludes.

2.2 Literature

2.2.1 Literature on Net Interest Margin

The existing theoretical literature on net interest margin is widely represented by the forms of Ho and Saunders (1981) bank dealership model. Ho and Saunders (1981) provide a theoretical framework within which to analyze the relationship between interest rate volatility and bank interest margin in a single output framework. McShane and Sharpe (1985) change the source of the risk as money market risk is due to uncertainty rather than risk from interest rates on deposits and credits. Allen (1988) extended the dealership model by employing the multi-output framework. She incorporates the alternative loan with interdependent demands and tests the substitution effect between loans. In her study, there are N-type and M-type loans.
so that customers choose one of them. When the price of M-type loan increases, the demand for N-type loan increases as substitute products, and vice versa. Angbazo (1997) incorporates the credit risk and its interaction with interest rate risk into the extended Allen (1988) model. He extends the bank dealership model by considering both credit and interest rate risks. Maudos and Guevara (2004) incorporate the operating costs of the banks into the theoretical model in a single product framework to take the productive nature of the banking firm into account. Their theoretical foundation shows that firms with higher operating costs increase their interest margin.

By increasing the function of non-interest products on net interest margin, Ho and Saunders' bank dealership model is also extended by incorporating non-interest products to the model. Firstly, Carbo and Fernandez (2007) extend the bank dealership model by incorporating non-traditional activities, as a product diversification/specialization instrument, into the model. Theoretically, the authors implement a multi-output framework of Allen (1988). They modify the model from two types of loans to the traditional and non-traditional activities. One of the loans symbolizes traditional income and the other loans symbolizes non-traditional income. Likewise with Allen (1988), these are substitute products. Authors theoretically find that as non-traditional income increases, the net interest margin of the bank decreases. This study does not consider any effect of operating costs on margin. Maudos and Solis (2009) combine both operating cost, proposed by Maudos and Guevara (2004), and diversification, proposed by Carbo and Fernandez (2007), into a single model by using a multi-output framework. Wong (2011) theoretically tests the optimal bank interest margin in case of risk aversion and also regret aversion. Regret aversion is the incorporation of disutility from suboptimal ex-post alternatives to the utility function. Regret aversion, if available, increases or decreases the optimal bank interest margin more than the purely chosen risk aversion. For high probabilities of default, regret aversion tends to limit risk taking. Entrop et al. (2015) investigate how interest risk exposure from maturity transformation is priced
in banks’ immediacy fee. They incorporate loans and deposits with differing maturities into the dealership model of Ho and Saunders (1981). Different maturity makes bank tender to the valuation risk. The immediacy fee in their extended model depends on bank-specific microeconomic exposure to risk.

From the empirical perspective, region or country specific studies find mixed results on factors affecting net interest margin. Ho and Saunders (1981) empirically estimate their model by bank-specific explanatory variables including the implicit interest payments, the cost of holding required reserve and default risk associated with loans in the first stage of two stages regression model by using the US commercial bank data from the fourth quarter of 1976 to the fourth quarter of 1979. These factors are not explicitly shown in the theoretical model. The results show that interest spread is positively affected by interest rate risk. Angbazo (1997) empirically tests the determinants of bank interest margin for a sample of US banks, too. The author finds that bank interest margin reflects both default and interest rate risk which confirms his theoretical foundation mentioned above. The bank dealership model of Angbazo (1997) is also empirically tested by some other studies. Interest rate risk, measured using rate volatility, is positively related to bank interest margins (Saunders and Schumacher, 2000; Maudos and Guevara, 2004; Carbo and Fernandez, 2007; Hawtrey and Liang, 2008).

Maudos and Guevara (2004) empirically test their contribution of operational cost to the Ho and Saunders (1981) and, Saunders and Schumacher (2000) by analyzing the determinants of net interest margin in a single stage. They use the fixed effect model to capture the bank specific effects using a within-group estimator. Unlike the Herfindahl-Hirschman Index and other market power measurements, they directly measure the degree of competition using the Lerner index and find that an increase in Lerner index, implies an increase in market power, also increases the net interest margin. Interest rate risk, implicit payment, and risk aversion also increase the interest margin. Arnold and van Ewijk (2012) contribute to the margins literature of developed countries by adding another new variable, deposit to liability ratio,
as “quest-for-growth” rationale. Rather than a classical explanation of decrease in net interest margin by competition, they suggest causality that runs from Return on Equity (ROE) maximization, to asset growth, to lower margin, and this is a transformation of the bank from relationship to transaction banking. Gischer and Juttner (2003) find that banks’ interest margins are negatively associated with the degree of global competition, fees to interest income ratio and cost structure for the period 1993 and 1998. Some other authors also imply the competition as a cause for deteriorating margins (Demirgüç-Kunt and Huizinga, 1999; Berger et al., 2004; Guevara et al., 2005). However, Maudos and Guevara (2004) explain the lower margins in the European banking system as the result of the relaxation of competitive conditions rather than higher competition.

Some of the literature focuses on non-interest income effect. Carbo and Fernandez (2007) empirically test the model for the European banking with seven countries for a sample of 19,322 banks. They find that diversification raises the market power of a bank which results in a reduction in net interest margin due to the cross-subsidization. Lepetit et al. (2008) make another important empirical contribution to the diversification side by using the European banking data. Their sample includes 602 banks from twelve European countries and uses data from 1996 to 2002. They find that there is a relationship between some non-interest activities and net interest margin. In this study, non-interest income is decomposed as fees and commissions, and trade income. According to the results, fees and commissions income is inversely associated with interest margin, however trading based revenues are not statistically significant. Their results also indicate that credit risk increases interest margin of banks. Hawtrey and Liang (2008) empirically test the net interest margin for fourteen European countries in the period of 1987 - 2001. The scale of the loan and managerial efficiency decrease the net interest margin but market power (measured by Lerner index), risk aversion, operating cost, credit risk, volatility of interest rate, opportunity cost, and implicit interest rate are the factors that increase net interest margin.
For the Asian banks, including banks in Indonesia, Malaysia, the Philippines, Thailand and Vietnam, Nguyen (2012) notes that banks with lower market power concentrate on revenue diversification, while banks with market power focus on traditional income sources. Brock and Rojas Suarez (2000) test the factors that affect interest margins across six Latin American countries. They find that capital-to-asset ratio has no explanation for interest margins, however liquidity ratio and cost ratio are positively related to margin.

Some studies compare the regional differences for interest margin. Garza-Garcia (2010) examines the determinants of net interest margin for developing and developed countries. The results indicate that the main determinants of the net interest margin in developing countries are capital adequacy, implicit interest payments, the efficiency level, credit risk, cost of holding reserves and the level of taxes. However, the main factors affecting net interest margin in developed countries are the efficiency level, operating costs, interest rate risk, the bank size, economic growth, the inflation rate, and the level of tax. They also find that operating expenses are the key variable for net interest rate margins for the entire sample including developed and developing countries. Amongst others, this study finds that there is no relationship between the Lerner index and net interest margin. Claeys and Vander Vennet (2008) compare Central and Eastern European (CEE) Banks with Western European banks. Capital is a significant factor for both Western European and CEE banks. In spite of the fact that the effect of lending risk is valid for both sides, its magnitude changes between countries. The effect of the loan to asset ratio is higher in accession (to the European Union) countries. Authors also find that higher margins in Central and Eastern European banks are positively related to inefficiency and lower competition. In the study of Demirguc-Kunt and Huizinga (1999), macroeconomic indicators, the degree of foreign ownership, taxation, financial structure variables and regulatory variables are empirically tested on international differences in net interest margin for eighty developed and developing countries over the period 1988 - 1995. They find that foreign banks have lower
margins than their domestic competitors in developed countries and higher margins for developing countries. However, in contrast to the study of Demirguc-Kunt and Huizinga (1999), Denizer (1999) Barajas et al. (2000) Drakos (2002) and Schwaiger and Liebeg (2008) point out a positive relationship between foreign ownership and interest margin for Central and Eastern Europe (CEE) countries.

A group of studies has looked at selected countries, with varying results. For Argentina, Cato (1998) finds that operating costs, exchange rate risk and the cost of liquidity are positively linked to bank spread. Maudos and Solis (2009) believe that net interest margin decreases with net fees and commissions but increases with market power for Mexican banking system. Kansoy (2012) finds that implicit interest payment and operation costs increase the interest margin, but credit risk reduces the margin for the Turkish banking system. For the German banking system, Entrop et al. (2015) empirically show that banks consider macroeconomic risk of interest volatility and reflect their prices. For the larger private commercial banks, intermediation fees are not tender to the on balance interest rate risk.

### 2.2.2 Literature on Bundling

Bundling is the sale of two or more products as a package rather than selling them separately. It was proposed by Stigler (1968) and then analyzed by Adams and Yellen (1976) in the reservation price paradigm which means equal to the sum of separate reservation price for bundle components. Markets, where different components are purchased from different suppliers, are unbundled markets (Wilson et al., 1990). Sale of products as a bundle or as separate components is called mixed bundling (Guiltinan, 1987).

Studies in the literature show us that bundling contributes to companies in many aspects. Adams and Yellen (1976) submit that it even limits consumers independent demand for the goods, and McAfee et al. (1989) advance that bundles serve as a price discrimination device. Estelami (1999) and, Evans and Salinger (2005) show its cost saving advantage. According to Estelami (1999), bundling reduces
the consumer costs from 18% to 57%. The magnitude of reduction in consumer costs is determined by some items, values of those items in bundle and the level of variation. Furthermore, Carlton and Waldman (2002) point out its property of entry deterrence in the availability of a complementary product. Similarly, Guiltinan (1987) states that bundling emerges from increasing customer satisfaction, improved image and search economies. Oppewal and Holyoake (2004) find that, if all else is equal, consumers choose to buy components from the same store. Where there is availability of additional information regarding the components, they will be more eager to buy these components separately from different stores. There is a positive correlation between the availability of more stores nearby and buying components from separate stores.

Rose (1989) emphasizes that based on South African data for the period 1999 - 2004, cash flow from the non-traditional side, especially cash from insurance, reduces the firm level risk. The author also finds that the average number of elements in the bundle increases product price. According to Okeahalam (2008), an increase in the number of clients reduces the service charge. The author also finds that increase in competition in banking sector reduces both fee and bank assurance product prices. Last but not least, there is a positive relationship between the average number of components in the bundle and product prices.

Economides (1996) shows that for the buyers of composite goods, the firm may charge a higher price by selling complementary products. Selling of the product is determined by the degree of complementarity and the price of the bundle. Lewbel (1985) notes that complementarity is not sufficient and also not required for optimal bundling. They generalize Adams and Yellen’s complementary product perspective to allow those goods that can also be a substitute rather than only a complement. A monopolist can make an optimal profit by bundling or unbundling of substitute goods. Venkatesh and Kamakura (2003) indicate that firms should put two medium or strong substitute products in the bundle as an offer. In the case of relatively high or low marginal costs, the firm should offer two complements purely as a bundle;
otherwise, the offer in the mild case is not optimal.

Matutes and Regibeau (1992) and, Gans and King (2006) find that profits decrease as a result of price bundling discounts off each competitor. However, Balachander et al. (2009) note that competitors make more profits through bundling discounts than independent price promotions of each product. According to the authors, bundling discounts should be optimal for customer surplus. They also claim that the endogenous loyalty of customers is affected by bundle discounts. This loyalty induces lower competition on discounts and provides higher profits.

Mankila (2004) shows student customer retention by considering the Bank’s price bundling policy. A survey methodology with 386 subjects from Goteburg University and Chalmers University of Technology between December 1999 and February 2000 was used to understand this problem. Results show that the individual price discount model is the most preferred bundling model for students. However, student bundles are not used by the student, and therefore, the bundles have little effect on the retention of students by a particular bank. This result may be related to the lack of competition and differentiation in the banking sector. Another Swedish study was made by Wappling et al. (2010) to investigate product bundling strategies offered to customers. Authors conducted fourteen telephone interviews in the automobile, travel, and banking sectors. Banks’ bundling strategies are influenced by market orientation. Customers are less sensitive to the production-oriented approach of sellers.

Yan and Bandyopadhyay (2011) make a theoretical contribution by presenting an optimal pricing decision on the availability of the complementary product. First, they determine a pricing strategy for bundling and unbundling strategy and then use comparative statistics to find the optimal strategy. If the complementarity level of two goods is high, the firm should increase its discount and charge relatively lower prices. The value of the bundling strategy increases with discount price sensitivity.
2.3 Theoretical Model

2.3.1 Assumptions and Scenarios

The bank acts as a dealer between borrowers and lenders in the credit market. The main objective of the bank is the maximization of wealth. The planning horizon is a single period so that bank interest rates are constant and either deposit or loan transactions occur, which means banks face asymmetric arrivals of demand for loans and the supply of deposits. If a loan demand arrives without deposit, the bank borrows from the money market with the risk of increases in the market interest rate. However, if the deposit comes first, the bank invests this deposit in the money market with the risk of decreases in the market interest rate. Thereby, in both cases the bank has the risk of the change in interest rate: decrease of interest rate in lending and increase of interest rate in borrowing. Bank is a risk averse and its utility function is twice differentiable. Only one transaction occurs in one period; supply of deposit or loan demand. In the seminal Ho and Saunders model, loan interest rate, \( r_L \), is the market interest rate, \( r \), plus immediacy fee, \( r_L = r + b_L \).

Deposit interest rate, \( r_D \), is the market interest rate minus immediacy for deposit, \( r_D = r - \alpha \). The interest spread is the difference between deposit interest rate and lending interest rate; that is \( r_L - r_D = \alpha + b_L \). Transaction (supply of deposit or loan demand) sizes are equal to amount Q. The deposit supply and loan demand are assumed to be linear. The model calculates the change in utility of a bank by using the Taylor expansion, in case of asymmetric arrival of deposit and loan. Then the model finds the optimal value of \( \alpha \) and \( b_L \) by utility maximization. All the assumptions above are valid for all scenarios. There are four scenarios associated with the arrival of a customer. These scenarios present either being well-informed or less-informed customer and different pricing strategies. The first scenario is the base scenario. In the base scenario, loan and fee product demand is considered as well as supply of deposit. L-type loan and F-type loan (Fee product) are sold by pure bundling. In the second scenario, the potential less-informed loan customer
is also incorporated into the pure bundling model in such a way that less-informed customers consider only the price of the core product. The third scenario incorporates the loss leader strategy as a cross-selling strategy by assuming all customers are well-informed about total cost of the loan. This scenario incorporates trade products as substitute products. Scenario 4 is motivated to the price bundling of loan, fee and trade product in availability of well-informed customer only assumption. After the scenarios, the change in utility of the banks are calculated for four cases.

**Scenario 1 - Pure bundling of Loan and Fee Products - Well-informed Customers** There are three prices in this scenario: one price for deposit, one price for loan (L-type loan) and one price for fees (F-type loan) associated with loan: $\alpha$, $b_L$ and $b_F$, respectively. Scenario assumes that all potential loan customers are well-informed loan customers. In this study, a well-informed customer is defined as one who takes the total cost of the loan or bundle transaction into account rather than focusing only on loan price. This being well-informed customer implies that the probability of selling a loan to a well-informed customer also depends on the fees and commissions charged for loan transactions. Being well-informed customer concept is valid for price bundling, too. A well-informed customer considers not only the cost of core product, but also fees and commissions associated with loan in arriving to the bank. The theoretical structure incorporates fees and commissions, $b_F$, by having same price elasticity with loan. As such, fees and commissions are assumed to be the inseparable component of a loan transaction and thus directly affect loan price. This approach is a type of pure bundle such that these two products are sold together and there is no discount for the bundle. The arrival of the customer to the bank is distributed by the Poisson distribution. The probabilities of arrival of deposit and loan are as follows:
\begin{align*}
Pr(\alpha) & = a - \beta \alpha \\
Pr(b_L) & = a - \beta(b_L + b_F)
\end{align*}

(2.1)

where \( a, \beta > 0 \). "a" is the market base. Utility functions for banks are derived in two cases by dividing the customers as depositor and well-informed loan demander. The first probability equation implies that probability of arrival of deposit is negatively linked with fee for the provision of immediacy of service, \( \alpha \). \( \beta \) is slope of deposit supply and loan demand. The second probability equation shows that the well-informed loan customer arrives by looking at total cost of loan by considering the sum of loan and fee price or shortly \( b_L + b_F \).

**Scenario 2 - Pure bundling of Loan and Fee Products - Availability of Well-informed and Less-informed Customers**

Different from the first scenario, the bank may face two types of loan customers: well-informed and less-informed loan customers, and optimize its utility by making allowances for both types of customers. The probability of arrival of a well-informed customer also depends on the fees and commissions charged for loan transaction or total price of bundle. However, less-informed customers only consider loan price but do not consider fees and commissions charged on loan transactions, because banks only advertise their core product; loan products. The arrival of the customer to the bank is distributed by Poisson distribution. The probabilities of arrival of loan and deposit demand are as follows:
\[ Pr(\alpha) = a - \beta \alpha \]
\[ Pr(b_L) = a - \beta b_L \]
\[ Pr(b_L) = a - \beta (b_L + b_F) \]

(2.2)

where \( a, \beta > 0 \). The first probability equation implies that the probability of arrival of deposit decreases with fees for the provision of immediacy of service, \( \alpha \). \( \beta \) is self-price sensitivity. The second probability equation shows that arrival of less-informed loan customer decreases only with loan price, \( b_L \), and self-price elasticity. This customer type disregards the fees and commissions related to the loan transaction. The third probability equation indicates that the probability of the arrival of the well-informed loan demander decreases with fees associated with the loan, as well as loan price.

**Scenario 3 - Loss Leader Strategy with Trade Products - Well-informed Customers** In this scenario, banks implement loss leader strategy. There are four prices for this scenario: deposit price, loan price, fees and commissions from loan, and trade product prices: \( \alpha, b_L, b_F \) and \( b_N \), respectively. All the customers are assumed to be well-informed. In this model, trade product price, \( b_N \), acts in a manner that is similar to the Allen (1988) model: substitute product price. Trade product acts as another loan type, N-type loan, and is the substitute of loan product: L-type loan. This implies that the effects of the trade product and loan product on each other are similar to the substitute product effect. The theoretical structure incorporates fees and commissions, \( b_F \), by having same price elasticity with loan again. For simplicity, fees and commissions are charged for L-type loans but not N-type loans. The probabilities of arrival of deposit and loan demands are as follows:
\begin{align*}
Pr(\alpha) &= a - \beta \alpha \\
Pr(b_L) &= a - \beta (b_L + b_F) + \delta_N b_N \\
Pr(b_N) &= a - \beta b_N - \delta_L (b_L + b_F)
\end{align*}

(2.3)

where $a$, $\beta$, $\delta_L$ and $\delta_N > 0$. The first probability equation implies that the probability of arrival of deposit inversely related to fees for the provision of immediacy of service, $\alpha$. The second probability shows that the arrival of well-informed loan customer decreases by the total cost of loan transaction or $b_L + b_F$. For this scenario, arrival also depends on the price of N-type products, $b_N$, and its cross-price elasticity: $\delta_N$. The third probability shows that demand of trade product decreases with its own price. However, it increases with the total cost of substitute product and cross-price elasticity: $b_L + b_F$ and $\delta_L$, respectively.

**Scenario 4 - Price Bundling with Trade Products - Well-informed Customers**

There are four prices for this scenario: deposit price, loan price, fees and commissions, and trade product prices: $\alpha$, $b_L$, $b_F$ and $b_N$, respectively. Being that the well-informed of all the potential customers is the assumption of this scenario, too. In this scenario, the bank may sell loans, fee products and trade products in a package by discount. Theoretically, this policy of banks is reflected in the model by price bundling. It is assumed that price bundling is the single cross-selling policy of the bank such that there is no other pricing strategies that combine L-type and N-type products, such as loss leader strategy. It is also assumed that banks use advertising to inform customers for their bundling policy. The concentration of the bank is the gross margin rather than the interest margin for the package. The arrival of the customer to the bank is distributed by Poisson distribution. The probabilities of deposit supply and loan demands are as follows:
where \( a, \beta > 0 \). Discount rate \( u \) is lower than 0 and is assumed to be exogenous. The first probability equation implies that arrival of deposit decreases with fees for the provision of immediacy of service, \( \alpha \). \( \beta \) is price elasticity of deposit supply and loan demand. The second probability equation indicates that the probability of arrival of well-informed loan demander decreases with loan price and fees associated with loan. The third probability equation states that the demand of trade product decreases with its own price. The fourth equation reveals the probability for demand of price bundling. Bundle includes loan, fees and commissions, and trade products. In case of simultaneous demand for loan and trade products, probability decreases with increase in price of loan, \( b_L \), fees associated with loan, \( b_F \), and price of trade product, \( b_N \), but increases with the discount factor, \( u \).

**Utilities for the Scenarios**

For each different probability of arrival of customer, the bank has different utilities. The total price information level of customers (well-informed or less-informed) does not change the expected utility but changes the probability of arrival of customers and therefore, it affects probability. Changes in the expected utilities are presented in four cases: utility from arrival for deposit, L-type loan demand, N-type loan demand and bundle demand. Change in the utilities are calculated as follows:

The initial wealth of the bank \( W_0 \) is determined by initial loans \( L_0 \), initial deposits \( D_0 \) and initial net money market assets \( M_0 \), as in the Ho and Sounder’s
original model. The initial wealth equation is

\[ W_0 = (L_0 - D_0) + M_0 = I_0 + M_0 \quad (2.5) \]

\( I_0 \) is the net credit inventory, which is the difference between the market values of loans and deposits at time 0. Initial wealth is equal to sum of credit inventory and net money market assets.

Final wealth of the bank at time \( t \) is

\[
W_T = (1 + r_I + z_I)I_0 + (1 + r + z_M)M_0 \\
= (I_0 + M_0) + (r_I I_0 + r M_0) + z_I I_0 + z_M M_0 \quad (2.6)
\]

\( r_I \): expected return of net credit inventory

\( r \): market interest rate

\( z_I \): random variables affecting rate of return for credit inventory or uncertainty faced by bank

\( z_M \): market risk

\( E(z_I) = E(z_M) = 0 \) and they are normally distributed

since \( I_0 + M_0 = W_0 \), \( r_W = \frac{r_I I_0 + r M_0}{W_0} \) and \( z_I I_0 = z_L L_0 \) (as in the original model).

where \( r_W \) is average profitability of initial wealth. Then equation (2.6) becomes

\[
W_T = W_0(1 + r_W) + z_I I_0 + z_M M_0 \quad (2.7)
\]

To derive the optimal behaviour of the bank for margin, initially Taylor series expansion is applied around: \( E(W_T) = E(W) \)
That is;

$$EU(W) = U(W) + U'(W)E(W - W) + \frac{1}{2}U''(W)E(W - W)^2$$

$$\Delta EU(W) = U(W) + U'(W)E(z_I I_0 + z_M M_0)$$
$$+ \frac{1}{2}U''(W)E(z_I I_0 + z_M M_0)^2$$ (2.8)

Equation (2.8) shows the expected utility, before a new transaction is carried out. Accordingly, the effect of asymmetric arrivals of deposit and loan on utilities from each case is determined as follows:

*Case 1: When a new deposit D arrives first*

When a new deposit $D(=Q)$ arrives to the bank,

$$W_T = (1 + r_l + z_I)I_0 - (1 + r_D)Q + (1 + r + z_M)M_0$$
$$+ (1 + r + z_M)Q - z_I Q$$
$$= (I_0 + M_0) + (r_I I_0 + r M_0) + (z_I I_0)$$
$$+ z_M Q - z_I Q + z_M M_0 + (r - r_D)Q$$
$$= W_0(1 + r_W) + \alpha Q + z_I (I_0 - Q) + z_M (M_0 + Q)$$ (2.9)

For this case, $r_w$ is average profitability, where $r_w = r_L \frac{L_0}{I_0} + r_D \frac{D_0}{I_0}$ and $z_I = z_L \frac{L_0}{I_0} + z_D \frac{D_0}{I_0}$

$W_T$ decreases by the amounts $(1+r_D)Q$ and $z_I Q$. Former decrease is associated with interest given to depositor and latter is the decrease of wealth by credit inventory. Increase in wealth is related to interest received from the money market: $(1 + r + z_M)Q$. Change in expected utility is given by substituting the change of wealth into equation (2.8):
\[ \Delta EU(W|D) = U'(W)\alpha Q + \frac{1}{2}U''(W)[(\alpha Q)^2 \]
\[ + (Q - 2I_0)Q\sigma_I^2 + (Q + 2M_0)\sigma_M^2 \]
\[ + 2(I_0 - M_0 - Q)\sigma_{IM} ] \]
\[ = U'(W)\alpha Q + \frac{1}{2}U''(W)[(\alpha Q)^2 + P] \tag{2.10} \]

where
\[ P = (Q - 2I_0)\sigma_I^2 + (Q + 2M_0)\sigma_M^2 + 2(I_0 - M_0 - Q)\sigma_{IM} \]

**Case 2 - Request for L-type loan**

When a new loan L(=Q) transaction is made rather than a deposit,

\[ W_T = W_0(1 + r_w) + (b_L + b_F)Q + z_I(I_0 + 2Q) + z_M(M_0 - 2Q) \tag{2.11} \]

where
\[ r_w = r_L \frac{L_0}{I_0} + r_F \frac{F_0}{I_0} + r_D \frac{D_0}{I_0} \]
and
\[ z_I = z_L \frac{L_0}{I_0} + z_F \frac{F_0}{I_0} + z_D \frac{D_0}{I_0} \]

Increase in wealth is associated with the sum of the loan and fee prices charged on the loan: \(b_L + b_F\). Change in wealth also depends on \(z_M Q\) and \(z_I Q\), which reflect the change in wealth from the money market position and credit inventory, respectively. Then,

\[ \Delta EU(W|L) = U'(W)(b_L + b_F)Q + \frac{1}{2}U''(W)[((b_L + b_F)Q)^2 + GQ] \tag{2.12} \]

where
\[ G = (4Q + 4I_0)\sigma_I^2 + (4Q - 4M_0)\sigma_M^2 + 2(2M_0 - 2I_0 - 4Q)\sigma_{IM} \]
Case 3 - Request for N-type loan (trade product) only

When a new loan, N-type loan, N(=Q) transaction is made

\[ W_T = W_0(1 + r_w) + b_N Q + z_I (I_0 - Q) + z_M (M_0 + Q) \]  \hspace{1cm} (2.13)

\( r_w \) is average profitability, where \( r_w = r_L \frac{L_0}{I_0} + r_F \frac{F_0}{I_0} + r_D \frac{D_0}{I_0} \) and \( z_I = z_L \frac{L_0}{I_0} + z_F \frac{F_0}{I_0} + z_D \frac{D_0}{I_0} \)

Change in expected utility is as follows:

\[ \Delta EU(W|N) = U'(W) b_N Q + \frac{1}{2} U''(W) [(b_N Q)^2 + HQ] \]  \hspace{1cm} (2.14)

where

\[ H = (Q + 2I_0) \sigma_I^2 + (Q - 2M_0) \sigma_M^2 + 2(M_0 - I_0 - Q) \sigma_{IM} \]

Case 4 - Request for Bundle - L-type and N-type products together

If a customer demands both loan and trade products together with discount, then

\[ W_T = W_0(1 + r_w) + (b_L + L_F + b_N + u) Q + z_I (I_0 + 3Q) + z_M (M_0 - 3Q) \]  \hspace{1cm} (2.15)

where

\[ r_w = r_L \frac{L_0}{I_0} + r_F \frac{F_0}{I_0} + r_N \frac{N_0}{I_0} + r_D \frac{D_0}{I_0} \]

and

\[ z_I = z_L \frac{L_0}{I_0} + z_F \frac{F_0}{I_0} + z_N \frac{N_0}{I_0} + z_D \frac{D_0}{I_0} \]

Wealth increases with the prices of loans but decreases with discounts since \( u < 0 \). For the wealth, the risk factor is now impacted by the higher amount of total loan size: 3Q (L(=Q), (F=Q) and N(=Q)). Change in expected utility is given by:
\[
\Delta EU(W|L + N) = U'(W)(b_L + b_F + b_N + u)Q
+ \frac{1}{2}U''(W)[((b_L + b_F + b_N + u)Q)^2 + JQ]
\] (2.16)

where
\[
J = (9Q + 6I_0)\sigma_i^2 + (9Q - 6M_0)\sigma_M^2 + 2(3M_0 - 3I_0 - 9Q)\sigma IM
\]

2.3.2 Maximizations

Maximization in Scenario 1

**Proposition 1** In pure bundling of loan and fees and commissions, in the presence of well-informed customers, the effect of fees and commissions on net interest margin will be negative and reduce it by its own value.

Scenario 1 presents the probabilities in case of three products: deposit, loan and fee products in the assumption of well-informed customers. To derive the optimal values of \(\alpha\), \(b_L\) and \(b_F\), probabilities in scenario 1 are multiplied by change in expected utility for each probability. Then, optimization is made with respect to \(\alpha\), \(b_L\) and \(b_F\).

The maximization problem is as follows:

\[
\Delta EU(W) = (a - \beta\alpha)\Delta EU(W|D) + (a - \beta(b_L + b_F))\Delta EU(W|L)
\] (2.17)

First, the derivative of equation (2.17) with respect to \(\alpha\) is\(^2\)

\[
\frac{\partial \Delta EU(W)}{\partial \alpha} = -\beta[U''(W)\alpha Q + \frac{1}{2}U''(W)PQ] + (a - \beta\alpha)U'(W)Q
\] (2.18)

Then, by rearranging, we derive optimal \(\alpha\)

\(^2\)the second-order terms of the margins and costs of the Taylor’s expansion are negligible due to efficient portfolio assumption.
\[ \alpha^* = \frac{a}{2\beta} + \frac{R}{4}P \]  
(2.19)

where \( R = -U''/U' \) = absolute risk aversion

The derivative with respect to \( b_L \) is

\[ b_L^* = \frac{a}{2\beta} - b_F + \frac{R}{4}G \]  
(2.20)

Likewise, the optimum value of fees and commissions

\[ b_F^* = \frac{a}{2\beta} - b_L + \frac{R}{4}G \]  
(2.21)

Now, the optimal interest margin can be derived by the sum of \( \alpha \) and \( b_L \):

\[ \alpha + b_L = \frac{a}{\beta} - b_F + \frac{R}{4}(P + G) \]  
(2.22)

The first two terms of equation (2.22) shows the factors for the risk neutrality case. The first term denotes the monopoly power of the firm. An increase in "\( a \)" implies an increase in the ability of determining the true price higher which is associated with market power. Low \( \beta \) denotes inelasticity in demand for the bank product. Customers are willing to pay less as the sensitivity increase. As the bank’s market power increases with higher "\( a \)”, bank charges more interest from the loan demander or pays less interest to depositors. The interest margin also depends on risk factors including risk aversion, where \( U''(W) < 0 \), variance of stochastic output inventory (\( \sigma_I^2 \)), variance of money market interest rate (\( \sigma_M^2 \)) and output transaction size (\( Q \)). The longer versions that show the risk parameters of all the optimal interest margins and gross margins are presented at Appendix A.2. Charging fees and commissions, \( b_F \), is negatively associated with loan and its effect is unsurprisingly equal to its value. If the customer is well-informed, banks do not
obtain extra profit from advertising the core product only. On the other hand, gross margin, as the main focus of the bank, will be

\[ \alpha + b_L + b_F = \frac{3a}{2\beta} - (b_L + b_F) + \frac{R}{4}(P + 2G) \quad (2.23) \]

**Maximization in Scenario 2**

**Proposition 2** In being of less-informed loan customers, a bank can get higher gross margins by pure bundling of loan and fee income, when \( \frac{b_F}{4} > \frac{b_L}{2} \)

In scenario 2, the bank considers both well-informed and less-informed customers for their loan product. The maximization problem takes the form:

\[
\Delta EU(W) = (a - \beta \alpha) \Delta EU(W|D) \\
+ (a - \beta b_L) \Delta EU(W|L) \\
+ (a - \beta (b_L + b_F)) \Delta EU(W|L) \quad (2.24)
\]

First, the derivative of equation (2.24) with respect to \( \alpha \) is

\[
\frac{\partial EU(W)}{\partial \alpha} = -\beta [U'(W) \alpha Q + \frac{1}{2} U''(W) PQ] + (a - \beta \alpha) U'(W) Q
\]

(2.25)

Then, optimal \( \alpha \) is

\[
\alpha^* = \frac{a}{2\beta} + \frac{R}{4} P \quad (2.26)
\]

The derivative with respect to \( b_L \) is

\[
b_L^* = \frac{a}{2\beta} - \frac{3}{4} b_F + \frac{R}{4} G \quad (2.27)
\]
The optimum value of fees and commissions is derived by taking derivative with respect to $b_F$.

$$b_F^* = \frac{a}{2\beta} - \frac{3}{2}b_L + \frac{R}{4}G$$  \hspace{1cm} (2.28)$$

The optimal interest margin for scenario 2 is:

$$\alpha^* + b_L^* = \frac{a}{\beta} - \frac{3}{4}b_F + \frac{R}{4}(P + G)$$  \hspace{1cm} (2.29)$$

First term in equation (2.29) denotes the monopoly power of the firm. There is no differences between first and second scenario in terms of market power. Absolute risk aversion affects the margin by the same magnitude with first scenario. Charging fees and commissions, $b_F$, from loan is negatively associated with loan price and its effect is no longer equal to its value. Gross margin, as the main focus of the bank, will be

$$\alpha^* + b_L^* + b_F^* = \frac{3a}{2\beta} - \frac{3}{2}(b_L - \frac{b_F}{2}) + \frac{R}{4}(P + 2G)$$  \hspace{1cm} (2.30)$$

The difference between equation (2.30) and equation (2.23) gives the differences for gross margin with well-informed customers only and availability of both well-informed and less-informed customers:

$$Eq(2.30) - Eq(2.23) = \frac{b_F}{4} - \frac{b_L}{2}$$  \hspace{1cm} (2.31)$$

The equation above states that in the availability of both well-informed and less-informed customers, bank can increase their gross margin by lowering loan price and increasing fees and commissions.
Maximization in Scenario 3 - Loss leader strategy

**Proposition 3** If \( \frac{\beta b}{4\beta} G > \frac{b_F}{4} + \frac{\delta L + \delta N}{2\beta} b_N \), trade income reduces the interest margin of the bank by loss leader strategy.

Scenario 3: the bank considers cross selling of trade product by a strategy without bundling, which is called loss leader strategy. All potential customers are assumed to be well-informed. The maximization problem is as follows:

\[
\Delta EU(W) = (a - \beta \alpha) \Delta EU(W|D) + (a - \beta (b_L + b_F) + \delta N b_N) \Delta EU(W|L) + (a - \beta b_N + \delta L (b_L + b_F)) \Delta EU(W|N)
\]

(2.32)

First, the derivative of equation (2.32) with respect to \( \alpha \) is

\[
\frac{\partial \Delta EU(W)}{\partial \alpha} = -\beta [U'(W)\alpha Q + \frac{1}{2} U''(W) PQ] + (a - \beta \alpha) U'(W)Q
\]

(2.33)

Then optimal \( \alpha \) is

\[
\alpha^* = \frac{a}{2\beta} + \frac{R}{4} P
\]

(2.34)

The derivative with respect to \( b_L \) gives optimal \( b_L \):

\[
b_L^* = \frac{a}{2\beta} - b_F + \frac{\delta L + \delta N}{2\beta} b_N + \frac{R(\beta - \delta_L)}{4\beta} G
\]

(2.35)
The optimum value of fees and commissions

\[ b_F^* = \frac{a}{2 \beta} - b_L + \frac{\delta_L + \delta_N}{2 \beta} b_N + \frac{R(\beta - \delta_L)}{4 \beta} G \]  

(2.36)

The optimal value of trade product is

\[ b_N^* = \frac{a}{2 \beta} + \frac{\delta_L + \delta_N}{2 \beta} (b_L + b_F) + \frac{R(\beta - \delta_L)}{4 \beta} H \]  

(2.37)

The optimal interest margin for scenario 3 is:

\[ \alpha^* + b_L^* = \frac{a}{\beta} - b_F + \frac{\delta_L + \delta_N}{2 \beta} b_N + \frac{R}{4} P + \frac{R(\beta - \delta_L)}{4 \beta} G \]  

(2.38)

Charging fees and commissions, \( b_F \), is negatively associated with loan and its effect is equal to its value as in scenario 1 due to the customers’ being well-informed. For this scenario, interest margin is also determined by cross-price elasticity of N-type product, \( \delta_N \), and cross-price elasticity of L-type product, \( \delta_L \). Increase in the cross-price elasticity of N-type product (trade product), increases the interest margin of the bank. Interest margin without the trade product is known from the base scenario. If interest margin of the scenario 3 is lower than the interest margin of scenario 1, then the impact of trade income will be negative:

\[ Eq(2.38) - Eq(2.22) = \frac{b_F}{4} + \frac{\delta_L + \delta_N}{2 \beta} b_N - \frac{R\delta_L}{4 \beta} G \]  

(2.39)

if \( \frac{\delta_L R G}{4 \beta} > \frac{b_F}{4} + \frac{\delta_L + \delta_N}{2 \beta} b_N \), trade income reduces the interest margin of the bank.

The optimal gross margin is
\[ \alpha^* + b_L^* + b_F^* + b_N^* = \frac{2a}{\beta} + \frac{\delta_L + \delta_N - 2\beta}{2\beta} (b_L + b_F) + \frac{\delta_L + \delta_N}{2\beta} b_N + \frac{RP}{4} + \frac{R(\beta - \delta_L)}{4\beta} (2G + H) \]

Maximization in Scenario 4 - Price Bundling

Proposition 4 If \( \frac{R}{8}(G + H) > -\frac{b_N + u}{2} \), trade income reduces the interest income by price bundling

Scenario 4: bank considers price bundling of loan, fee product and trade product in the presence of well-informed customers only

The maximization problem takes the form:

\[ \Delta EU(W) = (a - \beta \alpha) \Delta EU(W|D) + (a - \beta (b_L + b_F)) \Delta EU(W|L) + (a - \beta b_N) \Delta EU(W|N) + (a - \beta (b_L + b_F + b_N + u)) \Delta EU(W|L + N) \]

The optimal \( \alpha \) is derived by taking derivative with respect to \( \alpha \):

\[ \alpha^* = \frac{a}{2\beta} + \frac{R}{4} P \]

The optimal \( b_L \) is given by derivative with respect to \( b_L \)

\[ b_L^* = \frac{a}{2\beta} - b_F + \frac{b_N + u}{2} + \frac{R}{8}(G + J) + \frac{\delta_L}{8\beta} RH \]
Similarly, the optimum value of fees and commissions is equal to value of $b_L$ by replacement of $b_F$ with $b_L$

$$b_F^* = \frac{a}{2\beta} - b_L + \frac{b_N + u}{2} + \frac{R}{8}(G + J) + \frac{\delta_L}{8\beta}RH$$ (2.44)

The optimal value of trade product is

$$b_N^* = \frac{a}{2\beta} - b_L + b_F + \frac{u}{2} + \frac{R}{8}(G + J) + \frac{\delta_N}{8\beta}RH$$ (2.45)

The optimal interest margin for scenario 4 is given by:

$$\alpha^* + b_L^* = \frac{a}{\beta} - b_F - \frac{b_N + u}{2} + \frac{R}{8}(2P + G + J) + \frac{\delta_L}{8\beta}RH$$ (2.46)

If interest margin of the scenario 4 is lower than interest margin of scenario 1, then the impact of trade income to the interest margin will be negative:

$$Eq(2.46) - Eq(2.22) = -\frac{b_N + u}{2} - \frac{R}{8}(G + H)$$ (2.47)

if $\frac{R}{8}(G + H) > -\frac{b_N + u}{2}$, trade income reduces the interest income in price bundling case.

Gross margin, as the main focus of the bank, will be

$$\alpha^* + b_L^* + b_F^* + b_N^* = \frac{2a}{\beta} - \frac{3}{2}(b_L + b_F - u) - b_N + \frac{R}{4}(P + G + J) + \frac{R(2\delta_L + \delta_N)}{8\beta}H$$ (2.48)

In summary, scenario 1 states that pure bundling of fees and commissions re-
duces the interest margin in the assumption of all customers’ being well-informed. According to scenario 2, banks can increase their gross margin by lowering the price of their loan product and compensating it by fees and commissions in the availability of less-informed customers. Scenarios 3 and 4 show the effect of loss leader and price bundling strategies, respectively. By using convenient strategies, banks may create a relationship between loan and non-interest products, including trade products. Trade income reduces the interest margin if the conditions given above are satisfied.

The theoretical contribution of this thesis is mainly associated with strategies in cross-selling by considering bundling strategies and differentiating non-interest income components. First, the original model of Ho and Saunders doesn’t consider the effect of non-interest income on net interest margin. Carbo-Valverde determinants’2007 incorporated the effect of the non-interest income on interest margin in the multi-output framework. Their study includes the effect of fees in the presence of loss-leader strategy. However, this thesis creates this relationship by considering the very popular strategy: bundling. Second, the study also differentiates bundling strategies, including pure and price bundling. Particularly price bundling contributes to the literature by distinguishing between fees and commission income and trade income. Incorporating trade income to the model, rather than considering fees and commissions only, this study reveals the bank strategy such that banks do not only try to charge some fees and commissions from loan activity, but also struggle to sell some complement or other independent products to the core customers, like insurance. Third, original model and other extensions have no assumptions on the information level of the customers. Banks benefit from the information level differences of the customers about the total cost of the loan by advertising the price of loan product only and charge fees and commissions from the lending activity. This study reveals this strategy by differentiating the customers as less-informed and well-informed and shows that compared to the assumption of all customers’ being well-informed, banks can improve their gross margin in the presence of less-informed
2.4 Data

Yearly banking data are collected from the Bureau Van Disk’s Bankscope Database. Macroeconomic details are obtained from the World Bank’s World Development Indicators (WDI). Unconsolidated commercial and saving bank financial data is used but in the absence of unconsolidated data, banks’ consolidated data were added to the data pool. The data is from 2004 to 2011. All bank data values are dollar values and were deflated by the gross domestic product deflator. The ratios were multiplied by 1000 to see the std errors more clearly. The sample consists of twelve European countries including Austria, Belgium, Switzerland, Czech Republic, Denmark, Finland, France, United Kingdom, Netherlands, Sweden, Turkey and Norway. From the 1970s and 1980s onwards, commercial banks in these countries have been allowed to engage in a wide range of financial services and, therefore, to diversify their output to a larger extent. Despite dramatic progress in banking regulations in Turkey particularly in the 2000’s, potential regulatory differences in Turkey is considered, and results show that there is no any change in significance of variables by removing/adding Turkey. The current sample thus also represents the European OECD countries. All of these European countries are OECD members, too. There are still regulatory and institutional differences across some countries, which makes a ‘country by country’ analysis advisable as a robustness check. The sample contains a total of 896 banks.

The sample used in this analysis is less than the actual total number of observations, but it considered the representativeness of sample. Some of the criteria reduces the number of observations. The criteria implemented in filtering are:

i Missing years from explanatory variables and independent variable were eliminated

ii Observations contradicting with their nature were also eliminated. For ex-
ample, personnel expenses are negative for some bank observations while all others are positive numbers.

iii Available bank data for less than 3 years in a row were eliminated for potential econometric problems in calculation.

iv Abnormal values of variables, including abnormality by M&A, especially for crisis years, were eliminated.

2.5 Variables

The model for profitability is presented below:

\[ NIM_{it} = \beta_0 + \beta_1 W_{it} + \beta_2 X_{it} + \beta_3 Y_{it} + \varepsilon_{it} \]  \hspace{1cm} (2.49)

where

NIM: net interest income / total assets
W: the bank characteristics
X: sectoral variables
Y: macroeconomic variables
2.5.1 Dependent Variable

Net Interest Margin (NIM): bank interest margin can be interpreted as an indicator of the bank profitability. It is calculated as the quotient between net interest income and total asset, like in Demirguc-Kunt and Huizinga (1999) and, Maudos and Guevara (2004). Ho and Saunders (1981) and Lepetit et al. (2008b) compute net interest margin as interest income minus interest expense divided by earning assets. Alternatively, Lepetit et al. (2008b) also calculate the dependent variable as the difference between interest from loans over net loans and interest expenses divided by total liabilities. Angbazo (1997) defines net interest margin as the difference between interest revenues over earning assets and interest cost (quotient between interest expenses minus loan loss provisions and interest bearing liabilities). Carbo and Fernandez (2007) calculates the profitability as loan to deposit rate which is the difference between interest income divided by loans and interest expense over deposits.

One of the alternative measurements of profitability is the net interest income over equity ratio as ROE. The difference between the return on asset and return on equity is the effect of share of debt and equity. Risk-averse banks may prefer to hold more equity rather than debt and take less risk. Therefore, higher return on equity is not always a good indicator to measure bank profitability performance, but it is still important measurement in regarding total risk/return trade-off. In this context, this study prefers to use ROA rather than ROE, because the main objective of the second chapter is not the risk/return measurement even effect of the risk is an important factor in the regression models in this chapter.
2.5.2 Explanatory Variables:

Bank Characteristics:

Market Power (LERNER) : the market structure and the effect of market power on net interest margin is measured by using Lerner index in this analysis. Lerner index is widely used as a direct measure of market power in the banking sector. The market power concept is appropriate if market includes the oligopoly case and the banking sector is a good sector to use market power measurement in terms of oligopoly. Maudos and Guevara (2004) and Maudos and Solis (2009) calculate market power by using Lerner index in explaining net interest margin.

\[
L_i = \frac{P_i - MC_i}{P_i} \quad (2.50)
\]

where

\( L_i \) = Lerner index
\( P_i \) = Total revenue of bank: Total revenue from interest and non-interest activities. Here, total revenue measures the bank price
\( MC_i \) = Marginal cost of producing an additional unit of product. Marginal cost is the derivative of the total cost function with respect to the output (Q).

Translogarithmic total cost equation takes the form:

\[
\ln TC = \beta_0 + b_1 \ln TA + \frac{1}{2} b_1 \ln TA^2 + \sum_{j=1}^{3} \beta_i \ln w_{ji} + \frac{1}{2} b_2 \ln TA \ln w_1 + \frac{1}{2} b_3 \ln TA \ln w_2 + b_4 \ln TA + \ln w_3 + \sum_{j=1}^{3} \sum_{k=1}^{3} \beta_{jk} \ln w_{ji} + Trend + Trend^2 \quad (2.51)
\]

where

\( TC \): total cost (total financial and operational cost)
\( TA \): total asset
\( w1 \): (total cost - personnel cost)/ total assets
The Lerner index formula measures a relative mark-up price over marginal cost. Market power in here is the ability of keeping prices higher relative to marginal cost. One homogeneity is constrained in this translogarithmic function.

Marginal cost is derived by taking the derivative of the total cost equation with respect to Q (in here TA).

\[ MC = b_0 + \frac{1}{2} b_1 \ln TA + \frac{1}{2} \sum_{i=1}^{3} b_i \ln w_i \]  

**Personnel Expenses (PERSONNEL)**: Calculated as personnel expenses to total asset ratio. The alternative to personnel expenses is the operating expense. The literature presents mixed results on operating expenses. Banks with higher operating expenses may add operating costs to their interest margin. Whereas, increases in operating costs may end with stronger provision by increasing the screening and monitoring of borrowers. Therefore, mainly, personnel expenses variable (PERSONNEL) is tested rather than operational costs (OPERCOST), as operational costs of the bank over total asset ratio, but OPERCOST is also tested for robustness check.

**Bank’s Risk Aversion (EQUITY)**: The quotient between equity and total asset is introduced to measure a bank’s risk aversion similar to McShane and Sharpe (1985), Angbazo (1997), Drakos (2002), Maudos and Guevara (2004) and Le Lepetit et al. (2008b). Higher capital to asset ratio reduces a bank’s deposit funding and provides a disincentive for taking more risk. From the standard capital structure theory perspective, holding more capital alleviates the cost of funding thus enhancing interest rates. In contrast, Admati et al. (2013) suggest that higher capital requirement reduces the risk premia in bank’s cost of funding.
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NIM: net interest income/total assets, LERNER: lerner index, FEES: net fees and commissions over net non-interest income, CASH: cash and due from banks/total Assets, EQUITY: equity/total assets, TRADE: net non-interest income minus net fees and commissions over total assets, TNII: net non-interest income over total assets, EFFICIENCY: operating cost to gross income
Liquidity Risk (CASH) : Liquidity is measured by cash and due from banks to total asset ratio. An increase in liquidity may reduce the bank’s liquidity risk, which alleviates the interest margin due to a lower liquidity premium charged on loans. A positive relationship, which implies increase in interest margin with risk aversion, is expected.

Average Size of Loans (SIZE) : In this extended version of bank dealership model, loan size (Q) is negatively associated with margin. Unfortunately, Bankscope data and annual reports of banks are insufficient to calculate the average size of the bank loan. To measure average size, the logarithm of loan is used as a proxy for loan size.

Fees and Commissions (FEES) : Banks determine their loan rates by considering fees and commissions to offset the loss from one part by increasing the price of the other side. Generally, banks add fees and commissions costs as inseparable components of loan transaction by bundling. Or, sometimes, banks underprice their loan to sell complement of loans as fee product. Therefore, it is reasonable to expect a negative relationship between fees and commissions, and interest margin. The effect of fees and commissions is measured by net fees and commissions to net non-interest operating income ratio.

Future Fees and Commissions (FEESNP) : To test the potential loss leader strategy of banks for the longer period effect, future fees and commissions income is also tested. FEESNP is the time t+1 value of FEES variable.

Trade Income (TRADE) : TRADE is the quotient between net non-interest income minus net fees and commissions over total assets. Lepetit et al. (2008b) and, Maudos and Solis (2009) find a negative but insignificant relationship between trade income and interest margin. However, very recent data is used in this analysis and the relationship between trade products with loans may change due to new pricing strategies or technology, during the newer period. On the other hand, the Bankscope
database differentiates insurance income and fees and commissions. Implementing
same formula used in the literature for the trade products but considering the com-
plementary feature of insurance income, this study expect a negative relationship
with interest margin.

**Future Trade Income (TRADENP)** : To understand the bank strategy more
appropriately, loss leader strategy for trade and interest products is also introduced
for longer periods. Banks generally advertise their core product and compensate it
with a non-traditional product. Banks feel confident charging fees from loan activ-
ities. However, there is no guarantee of this strategy for trade products. Therefore,
the potential significant relationship between interest and trade income requires
more detailed analysis to understand pricing strategy. Future period relationship
enhances the probability of loss leader strategy, but insignificance of relationship
between time $t+1$ values of trade income with time $t$ interest income questions the
loss leader strategy, while time $t$ relationship is significant. Bundling strategy only
implies same period relationship but loss leader strategy generally implies differ-
ent period relationship. In this vein, different period trade income variables are
also tested to find clues about price mechanisms. TRADENP, time $t+1$ value of
TRADE, measures the effect of trade income at time $t+1$.

**Efficiency (EFFICIENCY)** : Efficiency is proxied by the cost to income ratio
which is defined as the operating cost to produce gross income. Gross income is the
sum of gross interest and dividend income, and total non-interest operating income.

**Sector Variables**

**Development of Sector (ASSETSGDP)** : The effect of the banking sector
development is measured by total banking sector assets over GDP ratio. Total
banking sector assets are calculated for each country. Growth of the sector increases
the supply of funds and alleviates the margin.
Macroeconomic Variables

**GDP Growth Rate (GDPGROWTH)**: Higher GDP growth contributes to capital accumulation and may, hence, increase the amount of funds. Increasing the GDP growth of a country also attracts foreign capitals. These two factors enhance the supply of funds. Improvements in funding conditions are expected to reduce margins.

**Inflation (INFLATION)**: Higher inflation implies uncertainty in the economy and banking sector. In the higher inflation period, it is difficult to determine ex-ante interest rates. In this uncertainty, banks are willing to charge higher interest rates.

This study also uses time dummies to capture the specific effects of each year. Furthermore, because the sample includes twelve European countries, country-specific differences are captured by using country dummies in the models.

### 2.6 Methodology for Empirical Study

The classical ordinary least square regression model takes the form of

\[ y_{i,t} = \beta x_{i,t} + \varepsilon_{i,t} \]  \hspace{1cm} (2.53)

where \( y_{i,t} \) is the dependent variable and \( x_{i,t} \) denotes the set of explanatory variables. \( \varepsilon_{i,t} \) is the error term at time \( t \). OLS methodology gives unbiased results if there is no any unobserved heterogeneity in the error term. Otherwise estimates will become biased. The bias of an estimator is the difference between the estimator’s expected value and the true value of the parameter. However, in the presence of unobserved heterogeneity, unobserved effects panel model will be

\[ y_{i,t} = \beta x_{i,t} + \alpha_i + \varepsilon_{i,t} \]  \hspace{1cm} (2.54)
where $\alpha_i$ is the time invariant unobserved heterogeneity in the error term. For these models, fixed effect method requires that a strict exogeneity assumption must be satisfied for the consistency of the estimators. Consistent estimator is an estimator having the feature that as the sample size increases, the estimates converge to the true value of the parameter being estimated. Therefore the condition below must be satisfied for consistency

$$E(\varepsilon_{i,t}|\alpha_i, x_i) = 0$$

(2.55)

Suppose that model requires dynamicity such that one of the explanatory variable is the lag value of the dependent variable. In this case our model will be

$$y_{i,t} = \varphi y_{i,t-1} + \beta x_{i,t} + \alpha_i + \varepsilon_{i,t}$$

(2.56)

In this case, fixed effect model can’t be used to estimate the model, because $y_{i,t}$ is correlated with the past values of error term, $\varepsilon_{i,t-1}$, and this is the violation of strict exogeneity of the parameters (Roodman, 2006). Also, the weaker condition of zero contemporaneous correlation of the regressors with the composite error term, $\alpha_i + \varepsilon_{i,t}$, is violated, because there is a serial correlation in the composite error term. Time invariant unobserved effect, $\alpha_i$, is the source of the serial correlation.

To solve the endogeneity problem and obtain consistent estimators, instrumental variable (IV) technique is used. Instrumental variable is the variable that correlated with explanatory variable being estimated and uncorrelated with the error term. However, unobserved heterogeneity is still problem despite solving the endogeneity problem above by instrumental variables. Unobserved effect, $\alpha_i$, is correlated with lagged dependent variable. To settle the problem, Arellano and Bond (1991) propose the first difference to eliminate this bank-specific effect. After taking the first difference, the model is given by
\[ \Delta y_{i,t} = \varphi \Delta y_{i,t-1} + \beta' \Delta x_{i,t} + \Delta \varepsilon_{i,t} \]  

(2.57)

Here, the error term \( \varepsilon_{i,t} - \varepsilon_{i,t-1} \) is correlated with \( y_{i,t} - y_{i,t-1} \). In this sense GMM methodologies, as linear and dynamic methodologies, are introduced to remove this correlation. GMM is an estimation method that has an objective function in a quadratic form:

\[
\min_{M(\beta)} \beta' W M(\beta) 
\]  

(2.58)

where \( M(\beta) \) is a column vector of empirical moment conditions so that required minimization is determined by the parameter \( \beta \).

One of the alternatives to the taking first difference is the using forward orthogonal deviations, suggested by Arellano and Bover (1995). The forward orthogonal deviation is implemented where the average of future values of each variable are deducted from the current value. This methodology helpful in the availability of missing variables and it also protects the degree of freedom.

In the differenced GMM, the past values of dependent variable are used as the instruments for the current first differences of the dependent variable. The problem in first difference GMM is the weak instrument. There are two cases that create a less informative GMM estimation in the standard first differenced GMM. Variance of the firm specific effect increases relative to the transitory shocks. Secondly, as the coefficient of the lagged dependent variable approaches the unity, which means \( \varphi \) approaches to the 1, GMM may become a weak instrument. In this vein, Blundell and Bond (1998) show that weak instruments create a large finite sample bias in the estimation of the autoregressive model. Another dynamic method, System GMM, introduces an additional assumption which generates additional instruments. The additional assumption is
\[ E(\Delta y_{i,t-s}[\alpha_i + \varepsilon_{i,t}]) = 0 \] (2.59)

This assumption requires that lagged differences in the dependent variable are valid instruments for the level of the lagged dependent variable in the level equation. If this assumption is true, then by the increase in the number of instruments, the greater efficiency is achieved. Efficiency is the term associated with lower variance. Lower variance means individual data are those that are closer to the mean value. This implies that distributions of the estimates become more concentrated around the true value of parameter being estimated and therefore the probability of true estimation will increase. Unlike to differenced GMM, System GMM also estimate the time invariant regressors by using the level equation of the dynamic model.

System GMM also assumes that there will be no correlation of the unobserved effects and error terms across cross-section units. However, one of the difficulties of the System GMM is the over-identification problem. If the number of moment conditions is higher than the dimension of the parameter vector, the model is said to be over-identified. Identification issue allows us to test whether the model’s moment conditions match the data properly or not. In this vein, Hansen test is used to detect over-identification is available or not under the null hypothesis that all of the instruments are valid.

Lastly, the degree of serial correlation in \( \varepsilon \) will determine the validity of instruments. By construction, the residuals of differenced equation should include serial correlation, but serial independence is assumed in the original errors. We can test serial correlations under the null hypothesis that \( \varepsilon \) is not serially correlated which implies that \( \Delta \varepsilon \) will be AR(1), but not AR(2).

In summation, as Roodman (2006) suggests, the assumptions behind using The Difference GMM and The System GMM are

\( i \) The current realizations of the dependent variable are determined by past
realizations

ii Some explanatory variables may be endogenous

iii Some variables may not be strictly exogenous (predetermined variables)

iv Different from the fixed effect, the idiosyncratic disturbances may have specific patterns of serial correlation and heteroscedasticity.

Also, even though it is not a general requirement, practically good instruments for endogeneity and correlations, good instruments are internally available. Finding an instrument outside the model is also possible but practically preferred instruments are available within the model (Roodman, 2006).

The empirical model in this chapter displays a dynamic approach. Dependent variables and some explanatory variables have the potential to be affected by their past values. Carbo and Fernandez (2007) and, Maudos and Solis (2009) show that there is an endogeneity problem in net interest margin and Lerner index. Increase in market power is generally positively associated with interest margin. However, increases in margin and profitability also positively contribute to the bank’s market power. Another potential problem is the bank-specific factors in the error term. For example, some public banks may have their own specific objectives, which conflict with profit maximization objectives, or some other banks may specialize in deposit collection or giving credit. The estimators are designed for dynamic ”small T, large N” panels for the System GMM which is the situation seen in the first chapter. By considering this issues and features of GMM method, this study uses two step System GMM. Although two-step estimation is asymptotically more efficient, the reported two-step standard errors tend to be severely downward biased (Arellano and Bond, 1991; Blundell and Bond, 1998). Therefore, the two-step standard errors are computed in accordance to the Windmeijer (2005) finite sample correction due to the potential downward bias in small samples.
2.7 Results

Table 2.3 displays the estimation results by using the two-step System GMM for six specifications. The first specification is the base specification so that any fees and commissions, and trade income variables are not controlled. FEES and TRADE variables are separately tested in model 2 and 3, respectively. They are tested together in model 4. FEES2 is introduced for robustness check in model 5. Model 6 employs TRADE2 for robustness check.

In model 1 in Table 2.4, EFFICIENCY is controlled. Model 2 tests OPERCOST by replacing it with PERSONNEL. Model 3 tests the effect of ASSETGDP. Model 4, 5 and 6 control the effects of variables FEESNP and TRADENP.

Models including FEES variable state that the effect of FEES is negative and statistically significant which confirms the theoretical foundation. Banks set their interest rate lower in stimulation of customers as part of the pricing strategy for the core product. Generally offering attractive prices from the interest income side is offset by the fees and commissions side by charging some inseparable fees and commissions by bundling strategies. Banks may also offer some fee products that complement loans (some of the fees and commissions are listed at Appendix A.1). They also offer complements of loans through bundling strategy, particularly offering discount by price bundling. FEESNP has no explanatory power for interest income.

Models 3, 4 and 5 indicate that TRADE is inversely related to interest margin, and it is statistically significant. However, it is a time t+1 value and so TRADENP is insignificant to explain interest margin. The insignificance of time t+1 values strengthens the possibility of price bundling strategies. In the literature, the association between interest income and trade income are found statistically insignificant, though their coefficients are negative. Many studies in the literature test the earlier periods, especially 1990’s, rather than the current period and don’t measure the effects of popular pricing strategies. Negative and significant association between interest and trade income implies a policy that connects each other. In this regard, it is reasonable to explain this connection using bundling strategy. One of the trade
Table 2.3: Determinants of Net Interest Margin - 1

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
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<td>0.397***</td>
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<td>0.367**</td>
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<tr>
<td></td>
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<td>(0.142)</td>
<td>(0.161)</td>
<td>(0.162)</td>
<td>(0.164)</td>
<td>(0.143)</td>
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<td>39.79***</td>
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<td>(5.763)</td>
<td>(12.47)</td>
<td>(12.56)</td>
<td>(15.08)</td>
<td>(3.239)</td>
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<td>0.025***</td>
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<td>0.024***</td>
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<td>(0.00896)</td>
<td>(0.009)</td>
<td>(0.008)</td>
<td>(0.007)</td>
</tr>
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<td>0.573***</td>
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<td>0.546***</td>
<td>0.435***</td>
<td>0.519***</td>
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<td>(0.125)</td>
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<td>-0.008***</td>
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<td>(0.0002)</td>
<td>(0.0002)</td>
<td>(0.0003)</td>
<td>(0.0002)</td>
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<td>Personnell</td>
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<td>-0.157*</td>
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<td>(0.020)</td>
<td>(0.088)</td>
<td>(0.088)</td>
<td>(0.066)</td>
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<td>(7.73e-06)</td>
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<td>(4.518)</td>
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<td>38</td>
<td>35</td>
<td>39</td>
</tr>
<tr>
<td>AR(2)</td>
<td>0.343</td>
<td>0.343</td>
<td>0.365</td>
<td>0.366</td>
<td>0.331</td>
<td>0.343</td>
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</tbody>
</table>

NIM: net interest income/total assets, L.NIM: lag value of NIM, LERNER: lerner index, EQUITY: equity to total assets, INFLATION: annual inflation rate, GDPGROWTH: annual GDP growth, CASH: cash and due from banks to total assets, SIZE: logarithm of loans, PERSONNEL: personnel cost to asset ratio, FEES: net fees and commissions to net non-interest operating income, TRADE: net non-interest income minus net fees and commissions over total assets, FEES2: net fees and commissions to total asset, TRADE2: (non-interest operating income minus net fees and commissions)/net operating income

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Standard errors in parentheses.

...products that differentiates from fees and commissions is insurance income. Particularly, bundling of loan products and insurance products is very popular in banking.
Since banks consider the gross margin and making more profit from their transactions, they offer a bundle with attractive prices and connects these products. To implement this strategy, banks lower (at least) one of the products from the bundle in which case core product is expected to be advertised. This strategy creates a link between trade and loan products. Otherwise, assuming a natural relationship between these products is a low expectation, except for loss leader strategy which is emphasized in the theoretical part. Lowering the price by loss leader strategy is risky because even these two products may become complementary. In order to increase the likelihood of the sale of trade products with loan products, banks may instrument bundling as a catalytic. The insignificance of TRADENP supports the notion of bundling strategy such that the relationship between trade income and interest income is valid for the same period but not later. Thus, bundling creates a link between lending activity and trade income, as well as fee income. Banks compete both in the traditional and non-traditional side, and their services are typically supplied as a bundle (Carbo and Fernandez, 2007). The absence of the individual borrower data is a barrier to reaching certain strategies that connect these variables.

The first lag of the dependent variable is also statistically significant so that current performance is, unsurprisingly, positively affected by past performance.

The positive and significant coefficient of LERNER appears to support the notion that increase in market power also increases the net interest margin. Since some banks have a market power advantage in the market, they are more flexible to determine their interest rate, and they charge higher interest rates. Instead of bearing higher switching cost, the customer stands these high prices.

The coefficient of the EQUITY, as expected, is positive and significant. The positive coefficient implies the risk aversion of the bank. Banks that are unwilling to take more risk choose higher margins to compensate higher costs of equity financing. The alternative is external funding, and it can be more costly than equity funding in some circumstances.

Macroeconomic factors, INFLATION and GDPGROWTH, have opposite signs
Table 2.4: Determinants of Net Interest Margin (NIM) - 2

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV: NIM</td>
<td>0.303***</td>
<td>0.348***</td>
<td>0.303*</td>
<td>0.394***</td>
<td>0.312**</td>
<td>0.397**</td>
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<td>L.NIM</td>
<td>(0.172)</td>
<td>(0.134)</td>
<td>(0.169)</td>
<td>(0.144)</td>
<td>(0.153)</td>
<td>(0.177)</td>
</tr>
<tr>
<td>LERNER</td>
<td>12.79*</td>
<td>14.60***</td>
<td>30.75**</td>
<td>10.36*</td>
<td>22.51**</td>
<td>21.27*</td>
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<td>0.0195**</td>
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<td>0.0249**</td>
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</tr>
<tr>
<td>INFLATION</td>
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<td>0.526***</td>
<td>0.581***</td>
<td>0.570***</td>
<td>0.502***</td>
<td>0.573***</td>
</tr>
<tr>
<td>GDPGROWTH</td>
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<td>-0.703***</td>
<td>-0.640***</td>
<td>-0.759***</td>
<td>-0.646***</td>
<td>-0.710***</td>
</tr>
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<td>CASH</td>
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<td>-0.0130***</td>
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<td>-0.189**</td>
<td>(0.041)</td>
<td>(0.027)</td>
<td>(0.094)</td>
</tr>
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<td>0.087</td>
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* and ** indicate significance at the 5% and 10% levels, respectively. Standard errors in parentheses.

NIM: net interest income/total assets, L.NIM: lag value of NIM, LERNER: lerner index, EQUITY: equity/total assets, INFLATION: annual inflation rate, GDPGROWTH: annual GDP growth, CASH: cash and due from banks to total assets, SIZE: logarithm of loans, FEES: net fees and commissions to total asset, TRADE: (net-interest operating income minus net fees and commissions)/net operating income, EFFICIENCY: operating cost to gross income, OPERCOST: personnel cost to total assets, ASSETSGDP: total assets of banking sector over GDP of country, PERSONNEL: personnel cost to asset ratio, FEESNP: net fees and commissions to net non-interest operating income at time t+1, TRADENP: net non-interest income minus net fees and commissions over total assets at time t+1.

NIM reflects the difference between the interest rate charged on economic loans and the interest rate paid on deposits. The table above presents the results of a regression analysis, where the dependent variable is the net interest margin (NIM) and the independent variables include various bank and economic indicators.

The results indicate that several factors significantly influence the net interest margin. For instance, an increase in the lerner index is associated with a decrease in the net interest margin, suggesting that banks with higher market power tend to charge lower interest rates. Similarly, a decrease in the annual inflation rate is associated with an increase in the net interest margin, indicating that higher inflation periods tend to reduce the likelihood of the realization of ex-ante real interest rate.

Other factors such as the equity ratio, the total assets of the banking sector relative to GDP, and the personnel cost to asset ratio also have significant effects on the net interest margin. The results also highlight the importance of controlling for country-specific effects and time dummies to account for unobserved heterogeneity and time-varying factors.

Overall, the results provide insights into the determinants of net interest margins, which are crucial for understanding the profitability of banks and the functioning of financial markets.
low. The uncertainty of price levels is a risk for a bank. As such, banks charge higher interest rates in higher inflation periods. However, GDP displays a reduction in margins. As GDP increases, banks reduce their interest margin. This negative relationship is mainly associated with the increasing supply of funds by economic growth. In the higher growth periods, domestic and foreign capitals may increase and reach higher amounts of funds easier than the lower growth periods for the banks. The third model of Table 2.4 shows that the negative coefficient of ASSETS-GDP supports the negative link between GDPGROWTH and margin. Improvement in the banking sector is another signal of supply of funds. As the sector improves, available funds for banking sector increases and more funds are offered to customers through lower interest rates.

The variable CASH is significant for all regressions and presents a negative association. Higher liquidity reduces the liquidity risk of the banks and leads banks to charge lower rates.

The PERSONNEL variable is employed to see the effect of personnel cost. Models state that there is an insignificant relationship between personnel cost and margin. Thus, banks do not determine their interest price subject to personnel cost. Personnel cost increases the bank cost but on the other hand, increasing the number of personnel may increase the performance of the bank by better provision of loans. These two opposite effects may conflict and prevent a significant relationship.

EFFICIENCY is controlled in the first specification of Table 2.4. Result states that interest margin is independently determined from efficiency.

Some robustness checks are also performed. First, FEES2 (net fees and commissions over total asset) and TRADE2 (trade income to total net operating income ratio) variables are introduced, and results state that they are inversely related to interest margin, too. Second, operational cost, as another operational cost factor, is also tested by dropping personnel cost. The second model of Table 2.4 shows that it is also statistically insignificant to explain interest margin.
2.8 Conclusion

The aim of this chapter is to analyse the link between interest and non-interest income components, by separately incorporating fees and trade products into Ho and Saunders’ dealership model, in the presence of price bundling and loss leader strategies and test theoretical findings for the European banking system. Specifically, in the theoretical part, pricing strategies and conditions that satisfy the negative relationship of the lending side with trading side, as well as with fees and commissions side, are presented. Bundling is the new trend in the banking sector, and it directly affects traditional and non-traditional aspects of the bank revenue. One of the advantages of the bundling is offsetting the loss from one side by increasing the price of the other side or considering gross margin rather than interest margin for profit maximization. Moreover, bundling may enhance the market power of the bank or reduce the total cost by spreading the fixed cost.

The increasing function of the bundling strategy motivated this study to incorporate it into the dealership model and create a link between income components. Also, for the theoretical part, regarding the probability of being less-informed customer, conditions that satisfy higher gross margin for the bank are presented. The theoretical findings indicate that compared to the well-informed customers, in the assumption of availability of less-informed customers, banks are able to reach higher gross margins by underpricing the core product and charging more from fees and commissions in loan transactions. This finding explains the banks’ advertising of core products only or the fees and commissions’ sometimes being available as a small-print price.

The study also empirically examines the theoretical findings. An extended version of the bank dealership theory is tested for twelve European countries by using System GMM method. The results state that the conditions for the negative relationship between interest income and trade income are empirically satisfied. This negative relationship is valid for fees and commissions, too. However, the explanatory powers of fees and commissions and trade income are valid only for current
period but not the following period. These findings strengthen the possibility of bundling, as the main strategy of the bank, to create an association between interest and non-interest income aspects. Moreover, lowering the loan price for bundling guarantees selling a non-interest product but the loss leader strategy does not guarantee it. Despite the strength of the possible bundling strategy, the absence of individual borrower data is a barrier to understanding the precise reason for these links and the weights of each strategy that contribute to these links.

The empirical results show that the past value of margin, market power, using equity and inflation are positively associated with a higher margin. However, the economic growth of country, liquidity of the bank and size of the loan reduce the margin. Empirical estimations also suggest that operational expenses or personnel expenses are insignificant to explain margin.

Individual banks that heavily concentrated on interest income due to their revenue objectives should also consider the non-interest income side by mainly implementing bundling strategy. However, cross-selling activities may also increase bank risk. Therefore, cross-selling strategies are open to evaluation of risk/return trade-off. The availability of this negative relationship should lead banks to examine their riskiness due to the pricing strategies created this risk/return trade-off.

Further studies should focus on the weights of the pricing strategies that create these significant relationships between lending and the non-traditional side using the individual lending data. Understanding the pricing strategies behind these relationships more clearly also helps regulators to investigate the potential banking risks from pricing strategies. Regulations on some pricing strategies may protect the system against potential risks.

Secondly, further studies should also consider the size effects in transactions in any case of bundling or loss leader strategy. It is reasonable to expect that size of the total debt may change on bundling and loss leader strategies, due to the time differences between when transactions are carried out. In loss-leader strategy, the overall size of the debt may be lower, compared to the simultaneous sale of
traditional and non-traditional products by bundling. Moreover, bundling and loss leader strategies may affect switching costs in a different way by changing the market power of the firm. Change in market power also affects the profitability and risk of the bank.

Thirdly, this and other extensions of Ho and Saunders model theoretically assume a linear demand function. Further studies can examine the non-linear demand and supply functions.
2.9 Appendix A

Appendix A.1

Some Selected Bank Fees and Commissions Activities

**Mortgage fee:** It is fee charged for mortgage credit. It is charged when a customer provides collateral by another mortgage for current mortgage credit application and in finish of the payments. There are two types of fees charged under mortgage fee. First, banks charge mortgage fee in the application to cover its cost related to collateral. Second, banks charge fee after credit payments finish successfully to close collateral.

**Expertise fee:** When a bank customer applies for mortgage credit, banks test the value of mortgage whether mortgage value is correct. Banks work with independent expertise companies and test of the real value is a cost for bank. This cost is generally charged from credit applicant. To accelerate the expertise report about real value of the mortgage, customer may pay ”accelerated expertise fee” as well.

**Booking fee:** One of the most general fee types. It is related to the cost of opening a new credit file.

**Credit History Fee (Intelligence Fee):** Cost of the banks stem from searching credit history of the applicant.

**Credit Allocation and Assessment Fee:** Banks charge fee to cover the costs in assessment and allocation of credit.

**Flexible Payment Fee:** Banks charge fee from mortgage credits if a customer prefers flexible payment plan

**Payment Plan Change Fee:** If a customer requests a change in payment plan, banks may change the plan and charge money for this alteration.
**Advice Letter Fee:**  If any payment issue is available, banks send advice letter and priced this cost to creditor.

**Account fee:**  Banks may charge a fee for created account if application is completed successfully.

**Lawyer Fee:**  Application and payment process may require a legal procedures and they may charge lawyer fee.

**Some Selected Trading Activities**

**Insurance Income**  Since the formula of trading activities includes all non-interest income activities except, fees and commission income, insurance income is also assumed trading activities by considering the non-interest income components in the Bankscope database. Bankscope database differentiates fees and commissions income, insurance income and all other non-interest incomes. Insurance income is an income as a means of protection customers from financial loss.

**Trading cash instruments:**  Trading revenue on cash and derivatives instruments managing credit exposures includes the net gains/losses from trading cash instruments and derivatives contracts that the bank manages as credit exposures, such as debt securities and credit derivatives.

**Derivative trading activities:**  regularly dealing in interest rate contracts, foreign exchange contracts, equity derivative contracts, and other off-balance sheet commodity contracts

**Cash instruments:**  the net gain or loss from trading cash instrument

**Foreign Exchange:**  the net gain or loss from foreign exchange
Appendix A.2

Scenario 1. Base Case - Loan and Fee Products - Well-informed Customer

Optimum Interest Margin

\[
\alpha + b_L = \frac{a}{\beta} - b_F + \frac{R}{4}(P + G)
\]

\[
= \frac{a}{\beta} - b_F + \frac{R}{4}[(5Q + 2I_0)\sigma_I^2 + (5Q - 2M_0)\sigma_M^2]
\]

\[
+ (2M_0 - 2I_0 - 10Q)\sigma_{IM}]
\] (A.1)

Optimum Gross Margin

\[
\alpha + b_L + b_F = \frac{3a}{2\beta} - (b_L + b_F) + \frac{R}{4}(P + 2G)
\]

\[
= \frac{3a}{2\beta} - (b_L + b_F) + \frac{R}{4}[(9Q + 6I_0)\sigma_I^2 + (9Q - 6M_0)\sigma_M^2]
\]

\[
+ (6M_0 - 6I_0 - 18Q)\sigma_{IM}]
\] (A.2)

Scenario 2: Loan and Fee Products - Well-informed and Less-informed Customers

The optimal interest margin for scenario 2 is:

\[
\alpha + b_L = \frac{a}{2\beta} - \frac{3}{4}b_F + \frac{R}{4}(P + G)
\]

\[
= \frac{a}{\beta} - \frac{3}{4}b_F + \frac{R}{4}[(5Q + 2I_0)\sigma_I^2 + (5Q - 2M_0)\sigma_M^2]
\]

\[
+ (2M_0 - 2I_0 - 10Q)\sigma_{IM}]
\] (A.3)

Gross margin, as the main focus of the bank, will be

\[
\alpha + b_L + b_F = \frac{3a}{2\beta} - (b_L + b_F) + \frac{R}{4}(P + 2G)
\]

\[
= \frac{3a}{2\beta} - (b_L + b_F) + \frac{R}{4}[(9Q + 6I_0)\sigma_I^2 + (9Q - 6M_0)\sigma_M^2]
\]

\[
+ (6M_0 - 6I_0 - 18Q)\sigma_{IM}]
\] (A.4)

Scenario 3: Loss Leader Strategy with Trade Products - Well-informed Customers

64
The optimal interest margin for scenario 3 is:

\[
\alpha + b_L = \frac{a}{\beta} - b_F + \frac{\delta_L + \delta_N}{2\beta} b_N + \frac{R}{4} P + \frac{R(\beta - \delta_L)}{4\beta} G
\]

\[
= \frac{a}{\beta} - b_F + \frac{\delta_L + \delta_N}{2\beta} b_N + \frac{R}{4} [(Q - 2I_0) \sigma_I^2]
\]

\[
+ (Q + 2M_0) \sigma_M^2 + 2 (I_0 - M_0 - Q) \sigma_{IM}
\]

\[
+ \frac{R(\beta - \delta_L)}{4\beta} [(4Q + 4I_0) \sigma_I^2 + (4Q - 4M_0) \sigma_M^2]
\]

\[
+ 2(2M_0 - 2I_0 - 4Q) \sigma_{IM}
\] (A.5)

Optimal Gross Margin is

\[
\alpha + b_L + b_F + b_N = \frac{2a}{\beta} + \frac{\delta_L + \delta_N - 2\beta}{2\beta} (b_L + b_F) + \frac{\delta_L + \delta_N}{2\beta} b_N
\]

\[
+ \frac{R}{4} P + \frac{R(\beta - \delta_L)}{4\beta} (2G + H)
\]

\[
= \frac{2a}{\beta} + \frac{\delta_L + \delta_N - 2\beta}{2\beta} (b_L + b_F) + \frac{\delta_L + \delta_N}{2\beta} b_N + \frac{R}{4} [(Q - 2I_0) \sigma_I^2]
\]

\[
+ (Q + 2M_0) \sigma_M^2 + 2 (I_0 - M_0 - Q) \sigma_{IM}
\]

\[
+ \frac{\beta - \delta_L}{4\beta} R [(9Q + 10I_0) \sigma_I^2 + (9Q - 10M_0) \sigma_M^2]
\]

\[
+ 2(5M_0 - 5I_0 - 9Q) \sigma_{IM}
\] (A.6)

Scenario 4: Price Bundling Strategy with Trade and Fee Products - Well-informed Customers

The optimal interest margin is given by:
\[\alpha + b_L = \frac{a}{\beta} - b_F - \frac{b_N + u}{2} + \frac{R}{8} (2P + G + J) + \frac{R\delta_L}{8\beta} H\]

\[= \frac{a}{\beta} - b_F - \frac{b_N + u}{2} + \frac{R}{4} [(Q - 2I_0) \sigma_I^2 + (Q + 2M_0) \sigma_M^2]\]

\[+ 2 (I_0 - M_0 - Q) \sigma_{IM} + \frac{R}{8} [(15Q + 6I_0) \sigma_I^2 + 15Q - 6M_0) \sigma_M^2]\]

\[+ 2 (M_0 - 3I_0 - 15Q) \sigma_{IM}] \quad \text{(A.7)}\]

Gross margin, as the main focus of the bank

\[\alpha + b_L + b_F + b_N = \frac{2a}{\beta} - \frac{3}{2} (b_L + b_F - u) - b_N + \frac{R}{4} (P + G + J)\]

\[+ \frac{R(2\delta_L + \delta_N)}{8\beta} H\]

\[= \frac{2a}{\beta} - \frac{3}{2} (b_L + b_F - u) - b_N + \frac{R}{2} [(7Q + 4I_0) \sigma_I^2\]

\[+ (7Q - 4M_0) \sigma_M^2 + 2(2M_0 - 2I_0 - 7Q) \sigma_{IM}] \quad \text{(A.8)}\]
Chapter 3

Switching Cost Effect of
Long-term Loan in Cross Selling

Abstract
The purpose of this study is to investigate the switching cost effect of long-term loans on selling non-interest products. The study builds on the theoretical framework suggested by Kim et al. (2003) and its extensions in the literature. A theoretical model is developed to explain the switching cost for non-interest products in relation to long-term loans. The study provides an empirical test of the theoretical model using unique banking data from the UK banking sector covering the period 2005 - 2012. The results confirm that banks create a switching cost for non-interest product market by keeping interest rates level low enough for long-term loans and thus, locking the customers in for longer periods by shifting loans from short-term to long-term. The results reveal that switching cost by loan maturity have implications for bank management and regulators regarding banks profitability and the risk associated with switching cost for cross-selling.
3.1 Introduction

The relationship between banks and customers have undergone significant transformations in the last three decades. Dealing with banks became a necessity rather than a luxury for daily aspects for both individuals and businesses. Many factors contributed to such transformation among others the technology advancement; increasing competition; and progression in communications.

Accordingly, banks have tried to initiate new strategies to maximize their profits. One of these strategies is selling non-traditional products to the customers. Banks have used their traditional product as an instrument to promote the non-traditional side of the business to customers. In the sense that by selling a traditional product, it creates a planned path to the non-traditional product sale. In the process of building such bridge between the traditional and non-traditional products, banks implement pricing strategies to sell both types of products to the same customer. Selling non-traditional products and services to the loan customer, however, may require time or at least, a likelihood of selling non-traditional products and services to the loan customer rises over time. At this point, the long-term loan appears to be an excellent opportunity for banks to achieve this goal. The long-term loan allows banks to improve their communication thus persuading customers to buy non-interest products and services from that bank. Moreover, the bank may use available customer information to forecast their consumption pattern. Kane and Malkiel (1965) and Fama (1985) argue that a bank which lends to a firm obtain more information about borrower’s characteristics. Doing so, banks may intend to create a switching cost through long-term loans. They may attract customer by underpricing interest rate level as a first step to creating a switching cost. In another perspective, a higher switching cost arise once a bank initially engages in a loan agreement, thus opening the gate of selling a planned non-traditional products and services. A switching cost is a form of market power for the bank to increase its price (Klemperer, 1995). Thus, by locking the customer in and creating market power, banks can offset this loss with non-traditional product and service sale with
higher prices in the future.

Profitability and riskiness of banks are two main factors of banks’ financial soundness, particularly after the recent global financial crisis. Creating switching cost by lowering long-term loan prices directly affects the profitability of banks. Therefore, the factors that influence financial soundness become more of an issue. Moreover, income sources are of great importance for banks, as most of the empirical studies in the literature discuss increasing risk caused by income diversification (Stiroh, 2004; Le Petit et al., 2008), even income diversification is known by risk reducing property. This need to risk associated with income diversification usually implies the cross-selling strategies of banks. Strategies and relations that provide cross-selling for banks are highly crucial. In this point, the potential switching cost effect of long term loans for non-traditional product sale is critical for banks as well as regulators. Its importance increase when the magnitude of long-term loans is considered, which implies that higher size loans are more risky. There is abundant literature on switching cost, including those which have focused on the effect of the loan price and those which have examined internal and external information asymmetry. However, none of the studies highlight the switching cost effect of loan maturity, particularly considering long-term loan, despite the fact that switching cost is a longer period phenomenon. This study fills the gap in the literature by theoretically incorporating the switching cost effect of long term loans for non-traditional products and empirically examines the theoretical contribution for the UK banking system. Banks in the UK are less regional, state, co-operative or mutual banks hence; they are likely to adopt profit maximizing pricing and cross-selling strategies. Furthermore, compared to European countries, for the period that this study examines, 2005 - 2012, the UK banks were heavily reliant on non-interest income. Greater reliance on non-interest income in the UK banking system provides an incentive to test switching cost strategies for non-interest products.

The contribution of this study is twofold. First, this study theoretically extends the switching cost model set up in Kim et al. (2003) and extended by Zhao
et al. (2013), by incorporating the switching cost effect of long term loan for non-traditional product sale or shortly loanavity effect\(^1\). Second, this study tests the theoretical foundation associated with switching cost effect of loan maturity for the UK banking system over the period 2005 - 2012. According to the results, switching cost for non-traditional products increases by shifting of loans from short-term to long-term. The study also specifically examines the relationship between long-term loan and trade products, due to the potential differences seen between broad non-interest product category and trade products. The results confirm that a similar relationship is valid for trade products as well. Switching cost is created even for longer periods for trade products.

The rest of the chapter proceeds as follows: Section 3.2 of the study is comprised of a literature review on the effect of switching cost on bank strategy. Section 3.3 presents the extended version of the switching cost model. Section 3.4 describes the data. Section 3.5 defines and explains the dependent and independent variables used in regression analysis. Section 3.6 analyses the econometric method used in the regression models; non-linear three stages least square. Section 3.7 includes regression results and their analysis. Section 3.8 concludes.

### 3.2 Literature Review

The assessment of switching cost in the banking sector is of considerable interest to researchers. Klemperer (1987) explains market share by introducing switch cost as an instrument for corporate strategy. Ausubel (1991) examines the credit card interest rates and finds that credit card interest rates have been sticky relative to the cost of funds over the period 1983 and 1988. The switching cost is the candidate of a sticky interest rate due to the difficulties in locating banks which offer favourable rates. Borenstein (1991) finds that gas stations create price discrimination against the customer who has a lower likelihood of switching to another station. The author

\(^1\)loanavity the author created expression. The etymology of the word loanavity lies with the words loan and gravity combined. Loanavity is an inertia that increasing with loan maturity to purchase non-interest products and services from bank that customer purchase loan product.
emphasizes the importance of unwillingness to switch rival firm due to the switching cost. Barone et al. (2011), by using bank-firm level data on four Italian local credit markets, show that firms changing their main lender exposes them to significant switching costs. On average, 70 percent of the customers continue to choose the previous period main borrower bank as the current main borrower.

Some of the studies empirically compare the rates offered by the inside and outside banks, but there is no consensus on results. Ioannidou and Ongena (2010) compare the inside, and outside bank interest rates offered using the Bolivian credit registry between 1999 and 2003. The inside interest rate is the interest rate provided by the current bank and outside interest rates are the new bank’s interest rate offered to the customer. They find that interest rate is reduced by new banks in case of switching. However, new banks increase their interest rate sharply in the following periods. The study also finds that new bank turns to starting point interest rate after around three years. Black (2006), by analysing the US Survey of Small Business Finance, empirically finds that outsider firms offer higher than insider firm. Outside loan rates are 40 basis, on average, higher than inside/current bank. However, Barone et al. (2006) find that switched customers pay lower i.e. between 25 and 123 base points.

One part of the literature tests the loan price and relationship time association. Petersen and Rajan (1994) find that loan rates are independent of relationship time. Berger (1995) find that loan price is negatively associated with relationship time which is evidence against hold-up. Whereas, some other studies find results consistent with hold-up hypothesis such that loan price increases in accordance with time (Degryse and Ongena, 2005). Ongena and Smith (2001) and, Farinha and Santos (2002) highlights the importance of duration from a different perspective. They find that probability of replacing the bank increases in duration. The number of the banks that a customer has accounts with negatively affects the length of the relationship. The study also finds that high growth and leveraged firms switch their banks faster.
Another part of the empirical foundations is the amount of switching cost. Kim et al. (2003) empirically found that switching costs are about one-third of the average interest rate on loans. According to Shy (2002), data on price and market shares show that cost of switching between banks varies 0 to 11% of the average balance in the Finland market for bank accounts.

Gopalan et al. (2007) analyse the firm motivation for switching to a new bank by using micro-data. According to the authors, the main motivation for changing a bank are borrowing constraints. Hence, firms prefer to switch to another bank to obtain larger loan size. They find that firms are more likely to switch from small banks to large banks. The most opaque (transparent) a firm the highly (least) likely it will switch their banks.

Some studies make a theoretical contribution to the literature. Padilla (1992) develops a model in terms of which functionally identical products, ex-ante homogenous, become heterogeneous products through the presence of switching cost. Thus, ex-ante homogenous products are transformed to a differentiated product by switching cost. Sharpe (1990) theorizes the bank loan market in the presence of information asymmetry by considering inside versus outside lending. He elaborates that, a lender obtains private information about a firm in the process of giving credit. There are two periods in his model, in the first period, banks compete to win the borrower. They have only publicly available information. One of the banks wins the competition and lends to a customer. This bank obtains private information about the customer by observing the payments during the first period. The firm is defined as a good firm, if the firm makes payments successfully, however, the firm is defined as a bad firm, if they defaulted on the loan. Then, in the second period, competition changes due to the private information obtained by the lender bank or now the informed side lender. The informed side lender offers to the customer by considering the private information, whereas, other banks offer without having private information which places them at a disadvantage. In another study, Von Thadden (2004), shows that a unique, mixed strategy equilibrium can exist for the
second-period of competition. The outside or uninformed lender regards the possibility of winner’s curse. By offering a lower rate, they can win but attract mostly the bad firms. The insider firm offers low-interest for the good firms and high ones for the bad firms. In this case, the outside firm is mostly preferred by bad firms. To win some of the good firms, the outside lender needs to randomize its offer strategy. The insider lender, like the outside lender, randomizes to earn a higher rate on each offer that it wins.

Kim et al. (2003) seminal work, introduces the theoretically structural model, for switching cost as a factor of price-cost margin and bank loan share. A bank determines its pricing strategy by considering future periods and thus, future profits are determined by the current period pricing strategy of the bank. Bank alleviates its price to attract customers. Once the relation with the borrower is established, bank enhances its price in the following periods, when they lock these customers in. Thus, the strategy is offsetting the loss from lowering prices by creating switching cost over time. The study examines the effect of switching cost on price-cost margin. The effect of non-interest income is not the motivation of this study. They empirically test the magnitude of theoretical findings in Norwegian credit markets by analysing aggregate market shares and interest price over the period 1988 and 1996.

On the other hand, some other studies show that banks determine their loan price not only considering loan market conditions or future periods but also considering non-interest income. Banks lower their loan price by compensating it with cross-selling (Carbo and Fernandez, 2007; Lepetit et al., 2008; Maudos and Solis, 2009). The findings of these studies show that loan pricing is negatively associated with fees and commissions, but trade income is insignificant to explain interest margin. For this strategy, Farrell and Klemperer (2007) state that multi-product firms advertise their core product, but they also expect that core product customers also purchase non-core products, too. Zhao et al. (2013)’s theoretical study combines the effect of non-interest income, competition and switching cost on loan pricing. The study introduces a switching probability associated with non-interest income to ex-
amine the factors affecting the switching for non-interest products. The theoretical findings were empirically tested for the UK banking system over the period 1993 - 2008. Their empirical results show that banks charge more from the customers who faced high switching costs in the loan market in the latter period. As a result, the period 2000 - 2008 is considered a relatively weaker period of competitiveness in the banking sector. They also find that competitiveness and cross-selling are negatively associated with British banks.

3.3 Theoretical Model

3.3.1 Kim’s Model

The model assumes that there are some \( n \) banks operating in oligopoly and banks compete in a multiple stage pricing. Banks determine their price by considering each stage. Though multi-stage pricing is available, the model assumes that the good sold by the bank is unstorable and thus selling them later is not an option. Customers have inelastic demand in purchasing the good. There are infinite periods during which each customer can buy a single unit of the goods for these periods. Each side maximises their utility. For demand side, customer compares the price offered by banks and then, they pick out one of them to buy the loan. One of the primary considerations of Kim et al. (2003) model is that customers consider the switching cost among banks when they compare the prices of each bank. The existence of switching cost creates a barrier for customers to change their bank. This switching cost implies significantly higher probabilities of staying at the same bank than transitioning to another bank.

The transition probabilities from one bank to another are the demand side of the maximization problem. Price and switching cost are two factors that impact the bank selection and model considers these factors in transition probabilities. The maximization problem models the customer decision by considering price and switching cost, as well as the likelihood of potential purchase from one of the rival
banks in the market. In this theory, transition probabilities are Markovian. The switching cost is incorporated into the model by addition to the price.

If a customer stays at the same bank for the next period, it is stated by $P r_{i\rightarrow i,t}$. However, bank $i$ may attract customer from bank $j$ and its switching probability is denoted by $P r_{j\rightarrow i,t}$. These probabilities are the functions of prices charged by bank and switching cost. Loan price of the bank $i$ at time $t$ is denoted by $p_{l,i,t}$. Prices of rival banks are also impact the probabilities due to the cross-price elasticity and it is a (n-1) vector $p_{l,i,R,t}$. The probability of staying at the same bank rather than switching to another bank is formulated as:

$$Pr_{i\rightarrow i,t} = f(p_{l,i,t}, p_{l,i,R,t} + s) \quad (3.1)$$

where $s$ is a n-1 vector of switching cost and it equals the multiplication of scalar $s$ and (n-1) unity vector: $s \equiv s \cdot I$.

Customers do not have to stay at the same bank forever. The likelihood of switching from a rival bank $j$ to bank $i$ is given by:

$$Pr_{j\rightarrow i,t} = f(p_{l,i,t} + s, p_{l,i,R,t} + s_j) \quad (3.2)$$

where $s_j$ is an (n-1) vector of switching cost. Jth element of vector is 0 but all others are equals $s$.

In aggregate, transitions are unobserved. Thus, formulation of the probability of switching to purchase loan from bank $i$ unconditional on the rival’s identity, is given by:

$$Pr_{iR\rightarrow i,t} = \sum f(p_{l,i,t} + s, p_{l,i,R,t} + s_j) \frac{y_{l,j,t-1}}{\sum_{k \neq i} y_{l,k,t-1}} \quad (3.3)$$

where $Pr_{iR\rightarrow i,t}$ is switching of rival’s customer to bank $i$. $y_{l,j,t-1}$ is the output of
bank \( j \) at time \( t-1 \). The probability of purchasing loan by customer of a randomly selected bank that rival to bank \( i \) is the one who purchased previously from bank \( j \) is \( y_{l,j,t-1}/\sum_{k \neq i} y_{l,k,t-1} \).

Total demand for bank \( i \) is equal to the bank \( i \)’s previous period output with staying probability and new comers from its rivals with transition probability. Output of bank \( i \) at time \( t \) is:

\[
y_{l,i,t} = y_{l,i,t-1} Pr_{i \to i,t} + y_{l,i,R,t-1} Pr_{i,R \to i,t}
\] (3.4)

The first term is the estimation of keeping old customers at bank \( i \), calculated by multiplication of the previous period output with probability of staying and second term is the estimation of the output stem from new customers and is calculated by potential demand coming from rivals’ customers and transition probability. So, estimated total demand is the sum of the demand of the old customers and demand of customers who switch from rival banks. It is also necessary that market capacity changes with respect to factors, i.e. macroeconomic conditions, from one year to another. Therefore, total demand faced by bank \( i \) is also affected by loan market growth. Formulated total output is given by:

\[
y_{l,i,t} = \left[ y_{l,i,t-1} Pr_{i \to i,t} + y_{l,i,R,t-1} Pr_{i,R \to i,t} \right] g_t
\] (3.5)

where \( g_t \) is the market growth rate, \( g_t = \frac{\sum y_{l,i,t}}{\sum y_{l,i,t-1}} \). Market growth rate is exogenous for this model.

Having the aggregate data prevents banks from observing each customer’s transactions and the arrival or switch of customers. Thus, banks are unable to observe actual customer decisions. In the absence of observing each customer decision, net output changes presented by the aggregate data are used. Therefore, theory derives a demand that depends on market share of banks. To create this connection, first
order linear approximation is applied on the transition probabilities. The linear transition probabilities of bank $i$ and transition probabilities of a randomly selected rival’s customer are as follows:

$$Pr_{i \to i,t} = a_0^i + a_1 p_{l,i,t} + a_2 (\bar{p}_{l,iR,t} + s)$$  \hspace{1cm} (3.6)$$

and

$$Pr_{iR \to i,t} = a_0^i + a_1 (p_{l,i,t} + s) + a_2 (\bar{p}_{l,iR,t} + \frac{n-2}{n-1}s)$$  \hspace{1cm} (3.7)$$

where $a_0^i$ denotes bank specific effect related with heterogeneity of banks. The self-price elasticity of banks is denoted by $a_1$. It is expected to be negative for derivative of $Pr_{i \to i,t}$ with respect to $p_{l,i,t}$. The term $a_2$ implies the cross-price elasticity. Different than $a_1$, its sign is expected to be positive because increase in price of rival bank enhances the transition probability. $p_{l,i,t}$ represents loan price of bank $i$. $\bar{p}_{l,iR,t}$ is average price of loan charged by rival banks, and the switching cost is $s$. derivation is derived at footnote$^2$. Last function is not a function of a specific rival $j$. It is transition probability of a rival bank’s customer which is selected randomly.

Under inelastic total demand, the effect of an increase in $p_{l,i,t}$ should have the same effect as a decrease of the same size in a rival’s average price. Thus, we make a constraint that $-a_1 = a_2$. Then, after the elimination of $a_2$, transition probabilities become

$$Pr_{i \to i,t} = a_0^i + a_1 (p_{l,i,t} - \bar{p}_{l,iR,t} - s)$$  \hspace{1cm} (3.8)$$

$^2$Pr$_{j \to i,t} = a_0^i + a_1 (p_{l,i,t} + s) + a_2^j P^i (p_{l,R,t} + s_j)$. Since there are n-1 rival banks, $s_j$ is a n-1 vector of switching cost and each element is equals $s$, except jth element, which is 0. Then $Pr_{j \to i,t} = a_0^i + (p_{l,i,t} + s) + a_2^j (\sum_{j \neq i} p_{l,i,t} + (n-2)s)$. For $a_2^j = \frac{a_2}{n-1} Pr_{j \to i,t} = a_0^i + a_1 (p_{l,i,t} + s) + a_2 (\bar{p}_{l,iR,t} + \frac{(n-2)s}{n-1})$. Since this equation is not a function of rival j, it is transition probability of a randomly selected rivals’ customer and hence $Pr_{iR \to i,t} = a_0^i + a_1 (p_{l,i,t} + s) + a_2 (\bar{p}_{l,iR,t} + \frac{n-2}{n-1}s)$. 


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and

\[ P_{IR \rightarrow i,t} = a_0^i + a_1(p_{i,t} - \overline{p}_{i,iR,t} + \frac{s}{n-1}) \]  (3.9)

The switching probability of a customer from one bank to another increases with the lowering of the prices of rival banks. Thus bank \( i \) attracts customers of other banks by lowering its price:

\[
Pr = \left\{
\begin{array}{l}
\frac{\partial P_{i \rightarrow i,t}}{\partial p_{i,t}} < 0, \quad \frac{\partial P_{i \rightarrow i,t}}{\partial p_{iR,t}} > 0 \\
\frac{\partial P_{iR \rightarrow i,t}}{\partial p_{i,t}} < 0, \quad \frac{\partial P_{iR \rightarrow i,t}}{\partial p_{iR,t}} > 0
\end{array}
\right.
\]

The upper left partial derivative above implies that an increase in loan price of bank \( i \) reduces the probability of keeping their customers. A positive sign in upper right derivative implies that increase in loan price of rival bank increases the transition to the bank \( i \). The negative sign of lower left derivative denotes that increase in price of bank \( i \), increases the probability of switching to rival bank. The last derivative implies that increase in the rival’s price increases to transition to bank \( i \) from its rival.

Now, it is possible to reach market share equation of the bank \( i \). Output of bank \( i \) at time \( t \) is derived by putting equation (3.8) and equation (3.9) into equation (3.5). The new output demand is:

\[
y_{i,i,t} = \left[y_{i,i,t-1}(a_0^i + a_1(p_{i,t} - \overline{p}_{i,iR,t} - s))
\right.
\]

\[
+ \left. y_{i,iR,t-1}(a_0^i + a_1(p_{i,t} - \overline{p}_{i,iR,t} - \frac{s}{n-1}) \right] g_t \quad (3.10)
\]

First term in equation (3.10) is output staying from the previous year with staying probability. The second term is the output from new comers with transition probability.
If equation (3.10) is rearranged by considering \( g_t \equiv y_{l,t}/y_{l,t-1} \), then

\[
y_{l,i,t} = [(y_{l,i,t-1} + y_{l,iR,t-1})(a_0^i + a_1(p_{l,i,t} - \overline{p}_{l,iR,t})) - (y_{l,i,t-1}sa_1 + y_{l,iR,t-1}sa_1)]\frac{y_{l,t}}{y_{l,t-1}}
\]

\[
y_{l,i,t} = [y_{l,t-1}(a_0^i + a_1(p_{l,i,t} - \overline{p}_{l,iR,t}) - y_{l,i,t-1}sa_1 - \frac{y_{l,i,t-1}sa_1}{n-1} + \frac{y_{l,iR,t-1}sa_1}{n-1}]\frac{y_{l,t}}{y_{l,t-1}}
\]

(3.11)

Then, multiplying both sides with \( y_{l,t} \) gives the loan market share equation of bank \( i \).

\[
\sigma_{l,i,t} = (a_0^i + a_1(p_{l,i,t} - \overline{p}_{l,iR,t}) + \frac{s}{n-1}) - \sigma_{l,i,t-1}sa_1\frac{n}{n-1}
\]

\[
= -\sigma_{l,i,t-1}sa_1\frac{n}{n-1} + (a_0^i + a_1(p_{l,i,t} - \overline{p}_{l,iR,t}) + \frac{s}{n-1})
\]

(3.12)

where \( \sigma_{l,i,t} = y_{l,i,t}/y_{l,t} \) is the loan market share of bank \( i \) at time \( t \). Equation (3.12) implies that market share of bank \( i \) at time \( t \) is a function of market share at time \( t-1 \), the number of banks in the market, the switching cost, bank’s heterogeneity, bank’s own loan price and average rival price.

### 3.3.2 Present Value Maximization

Maximization Problem

A bank, as a profit maximizer, maximizes the present value of its profit. Present value is given by

\[
V_{l,i,t} = \sum_{t=\tau}^{\infty} \delta^{t-\tau} \pi_{l,i,t}
\]

(3.13)
where $\delta$ is one period discount factor, while $\pi_{i,t}$ is the bank $i$ profit at time $t$. Bank loan profit is equivalent to revenue minus cost:

$$\pi_{i,t} \equiv y_{i,t} p_{i,t} - c_{i,t}$$ \hspace{1cm} (3.14)

For the maximization of present value, bank $i$ determines a price so that its profit at time $\tau$ will be affected by time $t$ price. Thus, banks determine inter-temporal price for value maximization.

$$\frac{\partial V_{i,t}}{\partial p_{i,t}} = \sum_{t=\tau} \delta^{t-\tau} \frac{\partial \pi_{i,t}}{\partial p_{i,t}} = 0$$ \hspace{1cm} (3.15)

Here, $p_{i,t}$ affects not only time $t$ profit, but also subsequent periods’ profits.

Since $\pi_{i,t} \equiv y_{i,t} p_{i,t} - c_{i,t}$

$$\frac{\partial V_{i,t}}{\partial p_{i,t}} = \sum_{t=\tau} \delta^{t-\tau} \frac{\partial (y_{i,t} p_{i,t} - c_{i,t})}{\partial p_{i,t}} = 0$$

$$= y_{i,t} + \sum_{t=\tau} \delta^{t-\tau} (p_{i,t} - \frac{\partial c_{i,t}}{\partial y_{i,t}} \frac{\partial y_{i,t}}{\partial p_{i,t}}) = 0$$ \hspace{1cm} (3.16)

Another requirement for maximization is that present value must be optimal with respect to $\tau + 1$.

$$\frac{\partial V_{i,t}}{\partial p_{i,t+1}} = y_{i,t+1} + \sum_{t=\tau} \delta^{t-\tau+1} (p_{i,t} - \frac{\partial c_{i,t}}{\partial y_{i,t}} \frac{\partial y_{i,t}}{\partial p_{i,t+1}}) = 0$$ \hspace{1cm} (3.17)

where

$$\frac{y_{i,t+1}}{p_{i,t}} = \frac{y_{i,t+k}}{p_{i,t+k-1}} \frac{p_{i,t+k-1}}{p_{i,t+k-2}} \cdots \frac{p_{i,t+1}}{p_{i,t}}$$ \hspace{1cm} (3.18)

and $k = t - \tau$. 

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Since both of them are optimal and necessary conditions, then their linear combination will be optimal, too. For any combination of \( dp_{l,i,t} \) and \( dp_{l,i,t+1} \), this optimality will be also valid.

\[
\frac{\partial V_{l,i,t}}{\partial p_{l,i,t}} dp_{l,i,\tau} + \frac{\partial V_{l,i,t}}{\partial p_{l,i,t+1}} dp_{l,i,\tau+1} = 0
\]  

(3.19)

suppose a pair of \( dp_{l,i,\tau} \) and \( dp_{l,i,\tau+1} \) are chosen by keeping \( y_{i,\tau+1} \) constant:

\[
\frac{\partial y_{l,i,\tau+1}}{\partial p_{l,i,\tau}} dp_{l,i,\tau} + \frac{\partial y_{l,i,\tau+1}}{\partial p_{l,i,\tau+1}} dp_{l,i,\tau+1} = 0
\]  

(3.20)

or if we rearrange

\[
dp_{l,i,\tau+1} = -\frac{\partial y_{l,i,\tau+1}}{\partial p_{l,i,t}} / \frac{\partial y_{l,i,\tau+1}}{\partial p_{l,i,t+1}} dp_{l,i,t}
\]  

(3.21)

As it is known, for the demand side, output at time \( t \) is

\[
y_{l,i,t} = [y_{l,i,t-1}(a_{i0} + a_{i1}(p_{l,i,t} - p_{l,iR,t} - s)) + y_{l,iR,t-1}(p_{l,i,t} - p_{l,iR,t} + \frac{s}{n-1})] g_t
\]

= \([\frac{-y_{l,t-1}}{n-1}a_{1} + y_{l,t-1}a_{0}] g_t + y_{l,t-1}a_{1}(p_{l,i,t} - p_{l,iR,t} + \frac{s}{n-1})] g_t
\]

(3.22)

Then, optimality conditions are given by

\[
\frac{\partial y_{l,i,t+1}}{\partial p_{l,i,t}} = -\frac{\partial y_{l,i,t}}{\partial p_{l,i,t}} \frac{n}{n-1} s a_{1} g_{t+1} = y_{l-1} a_{1} \frac{n}{n-1} s a_{1} g_{t} g_{t+1}
\]  

(3.23)

\[
\frac{\partial y_{l,i,t+1}}{\partial p_{l,i,t+1}} = y_{l,t-1} a_{1} g_{t} g_{t+1}
\]  

(3.24)
Putting equation (3.23) and equation (3.24) into equation (3.21) gives

\[ dp_{l,i,\tau+1} = dp_{l,i,\tau} \frac{n}{n-1} sa_1 \]  

(3.25)

since \( y_{l,i,t+1} \) is unvarying in choose a pair of price differentials,

\[ \frac{\pi_{l,i,\tau}}{p_{l,i,\tau+1}} + \delta \frac{\pi_{l,i,\tau}}{p_{l,i,\tau}} dp_{l,i,\tau} + \delta \frac{\pi_{l,i,\tau+1}}{p_{l,i,\tau+1}} dp_{l,i,\tau+1} = 0 \]  

(3.26)

as \( y_{l,i,t+1} \) is constant

\[ \frac{\pi_{l,i,\tau}}{p_{l,i,\tau}} dp_{l,i,\tau} + \delta y_{l,i,\tau+1} dp_{l,i,\tau+1} = 0 \]  

(3.27)

If price differentials are removed,

\[ \frac{\pi_{l,i,\tau}}{p_{l,i,\tau}} + \delta y_{l,i,\tau+1} \frac{n}{n-1} sa_1 = 0 \]  

(3.28)

Writing the derivative of the time \( \tau \) profit explicitly, gives

\[ y_{l,i,\tau} + \left( p_{l,i,\tau} - \frac{\partial c_{l,i,\tau}}{\partial y_{l,i,\tau}} \right) \frac{\partial y_{l,i,\tau}}{\partial p_{l,i,\tau}} + \delta y_{l,i,\tau+1} \frac{n}{n-1} sa_1 = 0 \]  

(3.29)

As \( \frac{\partial y_{l,i,t}}{\partial p_{l,i,t}} = y_{l,t-1} a_1 g_t \), price-cost margin for loan will be

\[ pcm_{l,i,t} = -\delta \sigma_{l,i,t+1} \frac{n}{n-1} sg_{t+1} - \frac{\sigma_{l,i,t}}{a_1} \]  

(3.30)

where \( pcm_{l,i,t} = p_{l,i,t} - mc_{l,i,t} \) is the price-cost margin for loan. First term in equation (3.30) is the benefit obtained from the capturing customers in period \( t \) who are lock in for future periods. Price-cost margin is negatively linked with benefit from lock the customer in. If potential benefit increases, then bank is willing to lower its price-cost margin. The last term \( \frac{\sigma_{l,i,t}}{a_1} \) is the oligopoly power of the firm. The oligopoly power depends on the customers’ price sensitivity; \( a_1 \).
3.3.3 Non-interest Income Side - Loanavity Effect

The second part of the theory includes the non-interest income side of the bank associated with the loan transaction. In this part, the model is extended by the stickiness effect caused by loan maturity; the loanavity effect. Similar to Zhao et al. (2013), the static representation of the Monte-Klein model for bank $i$, the gross profit of the bank is given by:

$$\pi = P_L L + P_O O - C(L, O) - \varphi L$$

(3.31)

where

- $\pi$: profit of the bank
- $P_L$: price of the loan
- L: quantity of loans
- $P_O$: price of the non-interest products
- O: quantity of non-interest activities
- C(L,O): operating costs
- $\varphi$: cost of funds

Now, banks also consider the non-interest income side and therefore gross income is considered rather than only loan income. From the first-order conditions for profit maximization:

$$L \frac{\partial P_L}{\partial L} + P_L - \left( \frac{\partial C}{\partial L} + \varphi \right) = -\left( \frac{\partial P_O}{\partial O} - \frac{\partial C}{\partial O} \right) \frac{\partial O}{\partial L}$$

(3.32)

The non-parenthesis term on the left hand side denotes the marginal revenue from loan transactions. The parenthesis in the left hand side denotes the marginal costs of the loan transaction: marginal operational costs and marginal cost of funds. The parenthesis on the right hand side implies the difference between marginal revenue and marginal cost of the non-interest product transaction and it is multiplied by the derivative of non-interest product demand associated with the loan transaction.
Thus, the right hand side is the marginal revenue from non-interest activities for each unit increase in quantity of loans.

If the last equation is rewritten, then

\[
MR_L - MC_L = -(MR_O - MC_O) \frac{\partial O}{\partial L} 
\]  

Equation (3.33) implies that bank may lower its loan price by compensating it for cross-selling. After allowing contemporaneous cross-selling for the price-cost margin derived at equation (3.30), optimal strategy takes the form,

\[
pcm_{i,t} = -\delta \sigma_{i,t} + \frac{n}{n-1} \sigma_{i,t+1} - \alpha \left( \frac{\partial P_O}{\partial O} - \frac{\partial C}{\partial O} \right) \frac{\partial O}{\partial L} 
\]

where \(pcm_{i,t} = p_{i,t} - mc_{i,t}\) is the price-cost margin. The derived price-cost margin consists of the effect of switching cost, market share and the non-interest income generated by the loan transaction. The first term is the effect of switching cost on price-cost margin. Banks keep loan price levels low enough to attract customers. Later, compared to their rivals, banks charge higher to compensate the loss from decreases in loans by the power stemmed from locking in the customer. The second term represents the oligopoly power of a bank that is positively associated with market share. These two terms are derived from the equation (3.30). In the absence of switching cost pricing and cross-selling, a bank determines its price with respect to the oligopoly power. Because loan transactions are associated with cross-selling, the non-interest income associated with the loan is also considered in the determination of price-cost margin. In this point, theoretically, a new variable is introduced to the model by this study. Now, it is assumed that, different than others, the stickiness degree by loan maturity as a switching cost factor that customers are relatively unwilling to switch another bank for non-interest products and services; loanavity factor. This switching cost factor increases the probability of retaining customers to sell non-traditional products and services to. To create a relationship between
switching cost and loanavity, the following equation is presented:

\[ S_t = b_0 + \beta_0 H_t \]  

(3.35)

where

- \( b_0 \) denotes the time independent inertia
- \( \beta_0 \) implies the effect of long term loan share
- \( H_t \) denotes the loanavity degree

The difference between \( b_0 \) and \( H_t \) is the stickiness degree is such that \( H_t \) is associated with inertia stemmed from the loan maturity rather than general inertia to stay at the same bank for non-interest product and services. Attracting the customer by loan and selling non-interest product is an optimal strategy as long as lower loan price is compensated by non-interest income. In this point, probability of buying non-interest products and services from the bank that provides loan is

\[ Pro_{i \rightarrow i,t} = f(e_{o,i,t}, e_{o,j,t} - v) \]  

(3.36)

where \( e_{o,i,t} \) is the service quality of bank \( i \) and \( e_{o,j,t} \) is the service quality of bank \( j \) suggested by Zhao et al. (2013). \( v \) is an n-1 vector of incompatibility cost. Incompatibility cost arise when the consumer switch to rival bank at time \( t \) and does not obtain loans at time \( t \) from that rival bank. Each element of it equals to \( v \), except jth element. The probability of switching of rival bank customer to purchase non-interest product from bank \( i \) is:

\[ Pro_{j \rightarrow i,t} = f(e_{o,i,t} - v, e_{o,j,t} - v_j) \]  

(3.37)

Similar to loan side transactions, non-interest product side transitions are unobserved in aggregate. The formula of the switching probability to buy non-interest product from bank \( i \), though loan transaction is not carried out by bank \( i \), is given
by:

\[ Pro_{iR \rightarrow i,t} = \sum f(e_{o,i,t} - v, e_{o,i,R,t} - v) \frac{L_{j,t}}{\sum_{K \neq i} L_{K,t}} \]  

(3.38)

where \( L_{j,t} \) is the quantity of loans of bank \( j \) at time \( t \) and \( \frac{L_{i,t}}{\sum_{K \neq i} L_{K,t}} \) is the probability that randomly selected customer is the customer who will buy a loan from bank \( j \).

Total demand for non-interest product activities for bank \( i \) at time \( t \) is:

\[ O_{i,t} = L_{i,t} Pro_{i \rightarrow i,t} + L_{i,R,t} Pro_{iR \rightarrow i,t} \]  

(3.39)

\( L_{i,t} \) and \( L_{i,R,t} \) are bank \( i \)’s and its rival’s provision of loans at time \( t \), respectively.

After applying first order condition:

\[ Pro_{i \rightarrow i,t} = b_1((e_{o,i,t} - e_{o,j,t}) + v) \]  

(3.40)

\[ Pro_{iR \rightarrow i,t} = b_1((e_{o,i,t} - e_{o,j,t}) - \frac{v}{n - 1}) \]  

(3.41)

Equation (3.40) is the probability of a customer’s purchasing of non-interest products from the bank that purchased the loan. Equation (3.41) is the probability of the transition of a non-interest product customer, who purchases loans from rival bank. The coefficient \( b_1 \) is the sensitivity to the transition and thus it is expected to be positive because transition probability increases with quality factor.

After putting equations (3.40) and (3.41) into equation (3.39):

\[ O_{i,t} = b_1((e_{o,i,t} - e_{o,j,t})(L_{1,t} + L_{i,R,t}) + b_1v(L_{i,t} - \frac{L_{i,R,t}}{n - 1}) \]  

(3.42)

Taking the derivative of equation (3.42) with respect to \( L \) gives:

\[ \frac{\partial O_{i,t}}{\partial L_{i,t}} = b_1((e_{o,i,t} - e_{o,j,t}) + v) \]  

(3.43)
Until now, \( v \) is assumed to be time independent. From now on, it is assumed to be time dependent and bank-invariant and thus it is a function of the loanavity.

\[
v_t = v_0 + b_2 H_t \tag{3.44}
\]

Now, \( v_0 \) is the time independent switching cost. However, \( H_t \) is the time varying loanavity factor. When long term loans increase, it is expected that banks can sell non-interest products to their customers more easily. Then, putting equation (3.44) into equation (3.43)

\[
\frac{\partial O_{i,t}}{\partial L_{i,t}} = b_1((e_{o,i,t} - e_{o,j,t}) + v_0 + b_2 H_t) \tag{3.45}
\]

Substituting the equation (3.45) into price-cost margin in equation (3.34) is given by:

\[
pcm_{l,i,t} = -b_1v_0\Pi_{o,t} - b_0g_{t+1}\frac{n}{n-1}\delta_{l,i,t+1}H_t - \frac{\sigma_{l,i,t}}{a_1} + b_1\Pi_{o,t}(e_{o,i,t} - e_{o,j,t}) - b_1b_2\Pi_{o,t}H_t \tag{3.45}
\]

where \( \Pi_{o,t} = \left( \frac{\partial P_o}{\partial O_t} - \frac{\partial C_t}{\partial O_t} \right) \)

Replacing \( S \) with \( S_t \) in equation (3.12), new loan market share equation is derived,

\[
\sigma_{l,i,t} = e_0 + a_1(p_{l,i,t} - p_{l,iR,t}) + b_0a_1B + a_1\beta_0BH_t \tag{3.46}
\]

where \( B = \left[ \frac{1}{n-1} - \frac{n}{n-1}\sigma_{l,i,t-1} \right] \)

### 3.4 Data

The sample consists of an unbalanced panel with annual observation from 2005 to 2012 for UK commercial banks. Investment, saving and cooperative banks are excluded from the sample. All financial items are inflation adjusted to the base year 2005 by using GDP deflator. Since theoretical model is valid for single market,
sample is determined for only one banking market: UK banking market. Even European banking system created as an integrated market, it is difficult to assume that banking system as a single banking system. Another advantage of the UK banking system is that share of the non-interest income in total income is very high. In 2005, share of the non-interest income in total income is 37%. For the year 2006, its share decreases to the 28%, however, for the years 2010, 2011 and 2012, its shares are 41%, 48% and 42%, respectively. Compared to European countries, these shares are very high and it is an optimal country to analyse the pricing and switching cost strategies associated with both traditional and non-traditional income side.  

Thirdly, share of the public banks and mutual funds are also important in country selection. These institutions may have different aims, such as social and development objectives. Availability of non-profit aims is a barrier to clearly understand pricing strategies that maximize bank profit. Henceforth, UK banking sector is a good sample compared to other European countries.

Bankscope and other databases do not consist of maturity of deposit and loan maturities. To assess loan diversification, new data is compiled including deposit and loan maturities of individual banks from annual reports of each bank for 83 UK commercial banks. Some macroeconomic data are obtained from the World Bank’s World Development Indicators (WDI). Because different banks have different report styling, limitations of the bank number does not allow different maturity measurements. Therefore, maturities are classified only as less than 1 year and more than 1 year. Sample used in this analysis is less than the actual total number of observations but highly representative, accounting for 83 percent of total banking assets.

Some of the criteria reduce the number of total observations. Criteria implemented in filtering are:

a) Missing years of dependent and independent variables were eliminated

b) Available abnormal returns or very large unexplained changes in the values of any variables that distort the nature of the relationships were eliminated as outliers.
Mergers are dealt with as if they are composite bank for the entire period. However, banks in exceptional conditions during the financial crisis are eliminated.

c) Available bank data less than 3 years in a row were eliminated for potential econometric issues in calculation.

After the filtering, final dataset contains 555 observations.

3.5 Variables

The means and standard deviations of the variables used in this study are presented at Appendix B. Models for price-cost margin and loan market share derived in the theoretical part are as follows:

\[
pcm_{i,t} = e_0 - b_0 g_{t+1} + \frac{n}{n-1} \delta \sigma_{i,t+1} H_t - b_1 v_0 \Pi_{o,t} - a_1 \sigma_{l,i,t} \\
- b_1 \Pi_{o,t} ((e_{o,i,t} - e_{o,j,t}) - b_1 b_2 \Pi_{o,t} H_t
\]

and

\[
\sigma_{l,i,t} = e_1 + a_1 (p_{l,i,t} - \bar{p}_{l,iR,t}) + b_0 a_1 \left[ \frac{1}{n-1} - \frac{n}{n-1} \sigma_{i,t-1} \right] + a_1 \beta_0 H_t \left[ \frac{1}{n-1} - \frac{n}{n-1} \sigma_{i,t-1} \right]
\]

3.5.1 Dependent Variables

Price - Cost Margin (PCM) : For price-cost margin in loan side, total interest income minus total interest cost over total loan is introduced as the dependent variable. Since price-cost margin reflects the profitability for the bank, interest income minus interest expense reflects the price and cost for loan side.

In the theoretical part of this chapter, price-cost margin equation is derived that equals the price of loan minus interest costs generated by loans. Therefore, price-cost margin is tested in the empirical part. Interest rates charged by banks from the loan
activities and interest paid for these loan activities are not reported in the UK banks’
annual reports. In the unavailability of interest rates charged, total interest income
over the total loan is used and thus average interest rate is computed by each unit of
the loan. Similarly, in the absence of interest rates of deposits, interest expenditure
on each unit of loan is proxied by interest expense to loan ratio. Therefore, aligned
with the theoretical part of the third chapter, net interest income over total asset is
used to measure the price-cost margin of the banks.

**Market Share (LOANSHERE)**: Market share for loan is measured by loan of
each bank over total banking sector loans:

\[
\text{Loan share} = \frac{y_{l,i,t}}{\sum_{i=1}^{n} y_{l,i,t}}
\]

where \(y_{l,i,t}\) is the total loan of bank \(i\) at time \(t\) and \(\sum_{i=1}^{n} y_{l,i,t}\) is the total loan in banking sector at time \(t\), \(n\) is the number of banks
competing in that year. LOANSHERE is also an explanatory variable in the model
where price-cost margin is a dependent variable. Berger (1995) finds that firms
with higher market shares and differentiated products and services use this power
in pricing and earn higher profits.

### 3.5.2 Theoretical Explanatory Variables

**Loan Price (LOANPRICE)**: It shows the effect of loan price differences among
banks on the loan market share of the bank. It is measured by:

\[
pl_{i,t} - pl_{j,R,t}
\]

where

\[
pl_{j,R,t} = \sum_{j \neq i} w_{j,t}pl_{j,t}
\]

is average rival price and \(w_{j,t} = \frac{L_{j,t}}{\sum_{i=1}^{n} L_{i,t}}\) is the share of each
rival bank in loan market.

Loan price of the current bank with respect to other rival banks may affect
customer decisions to stay at the same bank or switch to another bank. Theoret-
ically, loan price sensitivity of customers negatively impacts market share. Hence
parameter \(a_1\) is expected to be negative and takes values between 0 and -1.

**BH** : It is equal to \(\left[\frac{1}{n-1} - \frac{n}{n-1}\sigma_{l,t,t-1}\right]H_t\) and it is the interaction of B and H. B is
measured by \(\frac{1}{n-1} - \frac{n}{n-1}\sigma_{l,t,t-1}\). \(H_t\) is the long term loan to total loan that is a critical
variable to measure loanavity effect.
### Variables and Definitions

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{pcm}_{i,t}$</td>
<td>price-cost margin for loan at time $t$ (net interest income over total loan)</td>
</tr>
<tr>
<td>$\sigma_{i,t}$</td>
<td>loan market share at time $t$</td>
</tr>
<tr>
<td>$\Pi_{o,t}$</td>
<td>non-interest income effect at time $t$ (net non-interest income over total asset)</td>
</tr>
<tr>
<td>$g_{t+1} = \frac{\sum_{j \neq i} w_{j,t} e_{j,t}}{n}$</td>
<td>switching cost factors at time $t$</td>
</tr>
<tr>
<td>$(e_{o,i,t} - \overline{e}_{o,j,R,t})$</td>
<td>efficiency differences (total income to total cost ratio differences)</td>
</tr>
<tr>
<td>$\Pi_{o,t} H_t$</td>
<td>product of net non-interest income over total asset and long term loan over total loan</td>
</tr>
<tr>
<td>$p_{i,t} - p_{i,R,t}$</td>
<td>the difference between interest prices between bank $i$ and its rivals at time $t$</td>
</tr>
<tr>
<td>$n$</td>
<td>number of banks in the market at time $t$</td>
</tr>
<tr>
<td>$g_{t+1}$</td>
<td>growth in loan market at time $t+1$</td>
</tr>
<tr>
<td>$\delta_{i,t}$</td>
<td>three month interbank interest rate at time $t$</td>
</tr>
<tr>
<td>$\sigma_{i,t+1}$</td>
<td>loan market share of the bank in the following period</td>
</tr>
<tr>
<td>$H_t$</td>
<td>long term loan share over total loan share at time $t$</td>
</tr>
<tr>
<td>TRADELONG</td>
<td>interaction of net trade income over total asset and long term loan share</td>
</tr>
<tr>
<td>LONGDEP</td>
<td>long term deposit ratio to total deposit ratio</td>
</tr>
<tr>
<td>OPEREXP</td>
<td>operational expense over total assets</td>
</tr>
<tr>
<td>STAFF</td>
<td>staff expense over total asset</td>
</tr>
</tbody>
</table>

### Non-interest Income and Quality (NONINTQUALITY)

It is the multiplication of NONINT and QUALITY variables. NONINT is non-interest revenue minus non-interest income cost over total asset. QUALITY shows the effect of quality differences among banks in providing non-interest products and services which is introduced by Zhao et al. (2013). It is measured by: $e_{o,i,t} - \overline{e}_{o,j,R,t}$ where $\overline{e}_{o,j,R,t} = \sum_{j \neq i} w_{j,t} e_{j,t}$ is average quality of products, calculated same method with average rival loan price.

### Non-interest Income and Long Term Loan (NONINTLONG)

It is the interaction of NONINT and LONGLOAN, where LONGLOAN is the long term loan over total loan of bank. Long term loan is the loan with maturity for more than one year. Total loan is the loan given by bank in a given year. Because long term loans keep customers at the same bank for more than one period, these customers are very good candidate for cross-selling. As such, share of the long term loan measures the loanavity. Short period loan and long period loan customers are expected to differentiate not for the current period, but for the following periods. Thus, the effect of the value of non-interest income at time $t+1$ and $t+2$ are also examined with long term loan share at time $t$ by NONINT1LONG and NONINT2LONG,
respectively. Value of loanavity is measured by $b_2$ coefficient.

**Switching Cost for Loan (SWITCH)**: This variable measures the switching cost for inter-temporal supply of loans. Different than other studies, now, variable includes the effect of long term loans in switching cost. It is measured by $b_0 g_{t+1} n^{-1} \delta_{i,t} \sigma_{i,t+1} H_t$, where $g_{t+1}$ is growth in loan market at time $t+1$, $n$ is the number of banks in the market for time $t$, $\delta_{i,t}$ is the three month interbank interest rate at time $t$, $\sigma_{i,t+1}$ is the loan market share of the bank at time $t+1$ and $H_t$ is the long term loan share as long term loan over total loan at time $t$.

**Trade Income and Long Term Loan (TRADELONG)**: It is the interaction of TRADE and LONGLOAN where TRADE is the trade revenue minus trade cost over total asset. This variable is created to see whether long term particularly creates a switching cost for trade products.

### 3.5.3 Non-theoretical Explanatory Variables

**Share of Long Term Deposits (LONGDEP)**: It is the ratio of long term deposits over total deposits. Long term deposit is the deposit with maturity of more than one year and total deposit is the sum of the short term and long term deposits. Since short term and long term deposits have different magnitudes, changes in the weights of maturities are tested. The coefficients $d_1$ and $d_{11}$ denote the effect of long term deposits on price-cost margin and loan market share, respectively.

**Operational Expense (OPEREXP)**: Effect of the operational expenses on price-cost margin is tested by operational expense over total asset of the bank. A negative relationship between operational expense and price-cost margin is expected due to the increase in costs.

**Staff Expense (STAFF)**: Staff expense, as one of the components of operational expense, is also controlled, especially for the effect of it on loan market share. It
is reasonable to expect that an increase in staff expense improves the relationships with current and potential customers and contributes to the bank by increasing loan market share. As such increases in staff expenses may be positively linked with market share.

For the years 2007, 2008 and 2009, time dummies are created due to the financial crisis in the UK.

### 3.6 Methodology for Empirical Study

In this chapter, a system method is used: non-linear three stages least squares (hereafter non-linear 3SLS). System estimating methods estimate all the structural equations that identified in the system. Rather than separately estimating each equation, system estimating procedure estimate equations together. Instead of using single equation method, by using systems method, all the available information is evaluated in estimation procedures and thus, a relatively smaller asymptotic variance - covariance matrix is obtained (Kennedy, 2003). On the other hand, in the availability of misspecification, all the structural parameters estimated in the system are affected. In the single system, only the misspecified parameters are affected, which is less costly.

Two of the system equations are 2SLS and 3SLS. 3SLS is the counterpart of the 2SLS. Each stages of 3SLS is as follows:

**First Stage:** Calculation of 2SLS estimates of the identified equations

**Second Stage:** By using the 2SLS estimates, errors of the structural equations are estimated. These estimates are used to reach contemporaneous variance - covariance matrix of the structural equations’ errors.

**Third Stage:** In the last stage, GLS is applied to the large equation representing all the identified equations of the system.

One of the differences between 2SLS and 3SLS is that 2SLS, generally, is asymptotically less efficient than the 3SLS estimator. In this point, disturbances are the main determinant of this difference. 3SLS makes same estimation if the disturbances
in the different structural equations are uncorrelated. In this case, the contemporaneous variance - covariance matrix of the disturbances of the structural equations is diagonal. In terms of consistency, the 3SLS estimator is a consistent estimator. Because models in this study include non-linear parameters, this study uses a non-linear 3SLS method. The variables and descriptive statistics are obtained by using STATA program but due to using non-linear 3SLS method, the results were obtained by SAS program.

### 3.7 Results

Table 3.2 displays the estimation results by using non-linear 3SLS for six specifications. The first model tests the theoretical foundations by using NONINT1LONG variable. The variable of NONINT1LONG, as the interaction of long-term loan share at time t and non-interest income at time t+1, is tested in the second specification. The third model replaces NONINT1LONG with NONINT2LONG. Effects of non-theoretical variables, LONGDEP, OPEREXP and LABOR, are examined in models four, five and six, respectively.

The coefficient $a_1$ is a critical parameter for the theoretical model because it shows the effect of price differences ($a_1$ must take value within the [-1,0]). Table 3.3 demonstrate that $a_1$ is negative and statistically significant. It takes values higher than -1 by ranging between -0.067 and -0.084, which confirms the validity of results and it is very close to the coefficients of Zhao et al. (2013). When the bank loan price increases compared to the average rival loan price, customers choose to switch to another bank. The negative value of coefficient $a_1$ also implies that banks’ market share and loan price-cost margin are positively associated. The increase in loan share is an indicator of market power. Banks use market power advantage by increasing their prices.

Loan switching cost\(^3\) is tested by the coefficient $b_0$. The positive sign of this

\(^3\)This switching cost is very similar to switching cost suggested by Zhao et al. (2013). However, the current version includes the effect of $H_t$, which is the maturity effect as switching variable
Table 3.2: Determinants of Price-Cost Margin and Loan Market Share - Non-interest income

<table>
<thead>
<tr>
<th>Parameters</th>
<th>DV: pcm_{i,t} and σ_{i,t}</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
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<td>-0.068***</td>
<td>-0.071***</td>
<td>-0.078***</td>
<td>-0.084***</td>
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</table>

pcm_{i,t} = e_0 - b_0 g_{i,t} + \frac{a_1}{n-1} \sigma_{i,t+1} H_t - b_1 v_0 \Pi_{o,t} - a_1 \sigma_{i,t,t} - b_1 \Pi_{o,t} (e_0,i,t - e_0,o,t) - b_2 b_2 \Pi_{o,t} H_t

and

σ_{i,t,t} = e_1 + a_1 (p_{i,t} - P_{i,t}) + b_0 a_1 \left[ \frac{1}{n-1} - \frac{\sigma_{i,t,t-1}}{n-1} \right] + a_1 \beta_0 H_t \left[ \frac{1}{n-1} - \frac{\sigma_{i,t,t-1}}{n-1} \right]

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Standard errors in parentheses.

coefficient implies the benefits of switching cost to the bank from capturing customers in the current period that will be "locked in" for following years. Banks lower enough their price to attract customer at time t and compensate it by enhancing its loan price and charging higher from the locked in customer in the next period. The larger the switching cost, the lower will be the current period price-cost margin in an attempt to capture customers.

The second critical variable for the validity of result is b1. This transition prob-
ability for the non-interest product is expected to be positive, but it must be lower than 1. Values lower than 0 imply the transition of customers due to the higher quality of services that they left, which is implausible. The significant and positive value of $b_1$ states that quality differences and switching cost associated from loanavility contribute to the switching cost and, therefore, customer’s willingness to switch to other banks for non-interest product and service decreases.

Another theoretical coefficient $v_0$ is also statistically significant. $v_0 > 0$ states that time invariant incompatibility cost is positive. Switching is costly for customers due to the compatibility issue, transaction cost related to closing and opening accounts, new brand adaptation costs and uncertainty about the quality (Klemperer, 1995). Brehm (1956) also points out the social psychology in favour of the previously used products. Another theoretical coefficient $\beta_0$ is also statistically significant and positively associated with loan market share as it is expected from theoretical derivation.

$b_2$ theoretically represents switching cost for non-interest products and services stems from having a long-term loan. According to the results, it is positive and statistically significant. This result confirms that increasing the share of the long-term loan in total loan contributes to bank creating a switching cost for non-interest products and services. First, this may be related to improvements in the relationship by the loan. Banks can use personal information of customers to persuade them to purchase non-interest product or services. Banks may also use communication devices properly to reach customer particularly modelling the customer needs. Second, there is an information asymmetry between the inside- and outside bank that changes the likelihood of rejection. A customer who has long-term loan contract with a bank may feel that likelihood of rejection for a non-traditional product is higher for outside banks. Third, during the maturity of the long-term loan, the customer may have inertia to buy non-interest products and services from the same bank thanks to the long-term loan. Fourth, the long-term loans require, by its very nature, many complement products especially during the application period such as
Table 3.3: Determinants of Price-Cost Margin and Loan Market Share - trade income

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
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<td>(0.005)</td>
<td>(0.005)</td>
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</table>

\[ pcm_{l,t} = ee_0 - bb_0 \sigma_{l,t+1} + bb_1 \sigma_{l,t} H_t - bb_2 vv_0 + \sigma_{l,t} - aa_1 (r_{t+1} - r_{t}) - bb_1 bb_2 \sigma_{l,t} H_t \]

and

\[ \sigma_{l,t} = ee_1 + bb_0 (p_{l,t} - p_{l,t+1}) + bb_2 aa_1 \left( \frac{1}{n-1} \sigma_{l,t+1} - \frac{n}{n-1} \sigma_{l,t-1} \right) + aa_1 \beta_0 H_t \left( \frac{1}{n-1} - \frac{n}{n-1} \sigma_{l,t-1} \right) \]

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

Standard errors in parentheses.

non-traditional income activities (e.g. the application of long-term housing credits).

Some of these non-interest income activities are inseparable, and some of them are highly complementary. The necessity for compliments of long-term loan tends to provide the customer of the same bank by good offers (e.g. bundling which creates time and research cost for the customer). A bank reduces the price of the long-term loan and then offset it today or in the future by selling non-interest products and services from higher price to lock the customer in. The significant value of $b_2$ in
models 2, and 3 also imply that an increase in loan’s maturity at time t lowers the price-cost margin conditional on non-interest income at time $t + 1$ and $t + 2$, respectively. Thus, a positive and significant values of $b_2$ confirm the theoretical foundation associated with loanavity.

$d_1$ denotes the effect of the long-term share of the total deposits is also insignificant implying that shifting from short-term to the long-term deposits, surprisingly, has no explanatory power in explaining the price-cost margin. Deposits are assumed to be cheaper than outside funding and hence expected to raise the price-cost margin by lowering the costs of the bank. Moreover, another coefficient of LONGDEP, $d_{11}$, also insignificant to explain banks’ loan market share.

The effect of the OPEREXP is tested by $d_2$ and $d_{22}$. The results state that operational expenses are positively linked with the price-cost margin for the UK banking system. This relationship implies that an increase in operational costs increases the price-cost margin by probably increasing the price. The negative sign of $d_{22}$ states that operational cost reduces the market share of the bank. However, it is statistically insignificant to explain market share. Model 6 in Table 3.2 examines the effect of staff cost. Interestingly, different than $d_2$, $d_3$ is negatively associated with price-cost margin but $d_{33}$ is insignificant, like $d_{22}$. This difference implies that operational cost except labour cost help banks to increase their price-cost margin. Probably these expenditures contribute more to the value added.

Table 3.3 depicts the effect of switching cost of long-term loan conditional on trade income. Testing the effect of long-term loans conditional on trade products and services also proved to be valuable for the analysis. The result shows that long-term loans create a switching cost for trade products and service. The switching cost effect of long-term loan for trade income is statistically significant at time $t$ and $t + 1$ but statistically insignificant at time $t + 2$. 
3.8 Conclusion

This study theoretically extends Kim et al. (2003)’s switching cost model by incorporating the loan maturity as a switching cost factor for non-traditional products. The study empirically examines this theoretical contribution for the UK banking system by using unique banking data compiled by the author. The empirical results show that shifting from short-term to long-term loans increases the switching cost for non-traditional products. Banks lower their long-term loan price to start creating this switching cost. Banks use the personal information of customers to persuade them to purchase non-interest products or services through the improvements in the relationship using long-term loans. A customer who has a long contract with a bank may feel that the likelihood of rejection of a non-traditional product is higher for outside banks, due to information asymmetry. The relationship between the customer and the bank strengthens as a result of the long-term loan and this may create an inertia, which in turn increases along with the maturity of the loan contract, to buy a non-interest products from the same bank. Compared to short-term loans, long-term loans characteristically require many complementary products, particularly during the application period. The necessity for complementary product augments for long-term loan customers, thus the bank provides him good offers (e.g. bundling) which creates time and research costs for the customer.

The empirical results indicate that this situation is valid for trade products, as well. The relationship between trade income and maturity is significant as expected. When loanavity increases, customers switch to trade products. Banks decrease the loan price to a level sufficient enough to attract long-term customer, this locking the customers in. Such act gives them a chance to sell them trade or other non-interest products and services in the subsequent periods.

Similar to prior literature, the study finds that loan price and market share are negatively associated. Customers prefer to switch in response to an increase of loan price, relative to average loan price of rival banks. The price-cost margin is also positively related to loan market share. The increase in market share, as
an increase in market power, increases the price of the loan and hence increases price-cost margin.

This study also introduces the deposit maturity, as a non-theoretical variable, to test its effects on price-cost margin and loan market share. The results state that increase in long-term deposits has no explanation power to explain for neither price-cost margin nor loan market share.

The study also controls for some other non-theoretical variables. The results indicate that operational expenses increase the price-cost margin while staff expenses decrease the price-cost margin. These variables have no explanatory power for loan market share.

Most of the studies in the literature find that cross-selling may create a risk for banks. The increasing covariance between interest and non-interest income sides by cross-selling amplify the bank’s risk in the face of the unexpected income shocks. Regulators should consider the correlation level between these two sides. In particular, they should carefully understand the strategies of banks. This study result helps banks, supervisors and regulators to consider the switching cost effect on shifting from short-term to long-term loans for non-traditional products. Second, long-term loans, are one of the best candidates to compensate loss from lock the customer in through non-interest products. High level of complementarity and time are two key advantages of long-term loans. Banks that are mostly interested in switching cost, should give more importance to the switching cost effect of long-term loans, without ignoring the risk which stems from cross-selling.

This study theoretically implements a linear relationship between transition probability and switching cost. Further studies may contribute to the literature by considering a non-linear relationship. Further studies should also test the effects of long-term deposits as a switching cost factor. Loans require complementary products and it is reasonable to create a switching cost for them. However, as mentioned above, potential inertia can be created by increasing deposit maturity or from banks gathering more information about their customers as the maturity of deposits in-
crease. This information is used to persuade the customer to buy the non-interest products. Potential switching costs created by deposits may impact profitability and risk, too. Lastly, this study considers the loan customers as short and long term customers, due to the barriers associated with lack of detailed data. Further studies may analyse the duration by details, for example, considering at least three terms: short, medium and long term. Finally, the results help banks and regulators to see the evolution of switching costs more clearly.
## 3.9 Appendix B

Table 3.4: Descriptive Statistics - 2

<table>
<thead>
<tr>
<th>Descriptive</th>
<th>PCM</th>
<th>LOANSHARE</th>
<th>SWITCH</th>
<th>NONINT</th>
<th>NONINTLONG</th>
<th>NONINTQUALITY</th>
<th>LOANPRICE</th>
<th>B</th>
<th>BH</th>
<th>OPEREXP</th>
<th>LABOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005 Mean</td>
<td>0.028</td>
<td>0.018</td>
<td>0.050</td>
<td>0.014</td>
<td>0.003</td>
<td>0.015</td>
<td>0.008</td>
<td>0.010</td>
<td>0.001</td>
<td>0.023</td>
<td>0.010</td>
</tr>
<tr>
<td>2005 Std Dev</td>
<td>0.028</td>
<td>0.052</td>
<td>0.150</td>
<td>0.014</td>
<td>0.006</td>
<td>0.229</td>
<td>0.028</td>
<td>0.024</td>
<td>0.011</td>
<td>0.024</td>
<td>0.009</td>
</tr>
<tr>
<td>2006 Mean</td>
<td>0.026</td>
<td>0.016</td>
<td>0.046</td>
<td>0.013</td>
<td>0.003</td>
<td>-0.011</td>
<td>0.005</td>
<td>-0.004</td>
<td>-0.007</td>
<td>0.020</td>
<td>0.009</td>
</tr>
<tr>
<td>2006 Std Dev</td>
<td>0.020</td>
<td>0.043</td>
<td>0.129</td>
<td>0.014</td>
<td>0.005</td>
<td>0.194</td>
<td>0.020</td>
<td>0.067</td>
<td>0.039</td>
<td>0.022</td>
<td>0.009</td>
</tr>
<tr>
<td>2007 Mean</td>
<td>0.025</td>
<td>0.015</td>
<td>0.062</td>
<td>0.017</td>
<td>0.005</td>
<td>-0.084</td>
<td>0.009</td>
<td>-0.002</td>
<td>-0.005</td>
<td>0.023</td>
<td>0.011</td>
</tr>
<tr>
<td>2007 Std Dev</td>
<td>0.019</td>
<td>0.040</td>
<td>0.171</td>
<td>0.040</td>
<td>0.011</td>
<td>0.433</td>
<td>0.019</td>
<td>0.052</td>
<td>0.029</td>
<td>0.039</td>
<td>0.018</td>
</tr>
<tr>
<td>2008 Mean</td>
<td>0.026</td>
<td>0.014</td>
<td>0.051</td>
<td>0.016</td>
<td>0.003</td>
<td>-0.045</td>
<td>0.011</td>
<td>-0.003</td>
<td>-0.006</td>
<td>0.025</td>
<td>0.011</td>
</tr>
<tr>
<td>2008 Std Dev</td>
<td>0.021</td>
<td>0.036</td>
<td>0.157</td>
<td>0.037</td>
<td>0.006</td>
<td>0.244</td>
<td>0.021</td>
<td>0.051</td>
<td>0.030</td>
<td>0.037</td>
<td>0.018</td>
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<tr>
<td>2009 Mean</td>
<td>0.024</td>
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<td>0.009</td>
<td>0.018</td>
<td>0.004</td>
<td>-0.077</td>
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<td>0.000</td>
<td>-0.004</td>
<td>0.027</td>
<td>0.011</td>
</tr>
<tr>
<td>2009 Std Dev</td>
<td>0.021</td>
<td>0.037</td>
<td>0.025</td>
<td>0.028</td>
<td>0.010</td>
<td>0.292</td>
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<td>0.048</td>
<td>0.031</td>
<td>0.037</td>
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<td>2010 Mean</td>
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<td>0.005</td>
<td>0.011</td>
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<td>0.112</td>
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<td>0.000</td>
<td>-0.004</td>
<td>0.035</td>
<td>0.012</td>
</tr>
<tr>
<td>2010 Std Dev</td>
<td>0.023</td>
<td>0.035</td>
<td>0.016</td>
<td>0.037</td>
<td>0.012</td>
<td>1.041</td>
<td>0.023</td>
<td>0.041</td>
<td>0.024</td>
<td>0.089</td>
<td>0.014</td>
</tr>
<tr>
<td>2011 Mean</td>
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<td>0.013</td>
<td>0.006</td>
<td>-0.005</td>
<td>0.004</td>
<td>-0.054</td>
<td>0.006</td>
<td>0.000</td>
<td>-0.003</td>
<td>0.022</td>
<td>0.013</td>
</tr>
<tr>
<td>2011 Std Dev</td>
<td>0.022</td>
<td>0.034</td>
<td>0.018</td>
<td>0.200</td>
<td>0.009</td>
<td>0.314</td>
<td>0.026</td>
<td>0.040</td>
<td>0.024</td>
<td>0.087</td>
<td>0.021</td>
</tr>
<tr>
<td>2012 Mean</td>
<td>0.031</td>
<td>0.014</td>
<td>0.007</td>
<td>0.019</td>
<td>0.005</td>
<td>-0.066</td>
<td>0.013</td>
<td>0.000</td>
<td>-0.004</td>
<td>0.033</td>
<td>0.013</td>
</tr>
<tr>
<td>2012 Std Dev</td>
<td>0.074</td>
<td>0.035</td>
<td>0.020</td>
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<td>0.392</td>
<td>0.074</td>
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Source: UK banks annual reports
Chapter 4

Bank Performance Effect of Deposit and Loan Maturities

Abstract

This study examines the effect of non-interest income, conditional on deposit and loan maturities, on bank performance using unique data on the United Kingdom (UK) banks during the period 2005 - 2012. It is the first study to examine the direct maturity effect of both deposits and loans, as short term and long term, on bank performance for UK banks. The findings suggest that fees and commission income do not directly explain banks’ performance. However, when the fees and commission variable is conditional on longer loan maturities, it reduces the bank performance. Trade income increases the risk-adjusted bank performance, but trade income, conditional on longer deposit and loan maturities, has the opposite effect. The direct diversification results reveal that maturity diversification of loans is associated with higher bank performance, whilst the UK banks do not benefit from deposit diversification. The framework, adopted in this study aims to help banks pay more attention to deposit diversification rather than focusing on both sides. The results also provide significant implications for regulators and supervisors in the UK, as well as other developed countries, to consider the direct and indirect effects of the maturities on bank performance.
4.1 Introduction

Competition, technological advances and regulatory pressure among others are factors that led banks to diversify their operations from traditional lending only to the inclusion of non-interest bearing activities as well. The implication of this shift towards generating non-interest income activities had a significant effect on banks’ performance. Pursuing the maximisation of shareholders wealth, banks initiate new policies and innovate to sell non-interest products to either current or potential customers. The process of selling non-interest products to the present and new customers is known in the literature by cross-selling. However, even persuading current customers (depositor or borrowers) to buy a non-interest product may require time. This time is directly linked to the maturities of interest products in the sense that the longer the maturities of both deposits and loans, the shorter the time to persuade the customer; catalyst role. In this vein, long-term customers are of great importance for banks to be able to sell non-traditional products. Banks continuously improve communication means and learn more about that borrower’s characteristics to reduce information asymmetry (Kane and Malkiel, 1965; Fama, 1985). They introduce new technologies to build closer relationships with customers in order to identify customers’ product preferences; understand their lifestyle and spending patterns; and their demand for other services. Every transaction in the past enriches the information about customers and increases the predictive power of the future. Gathered information may be used in multiple interactions with the same customer and create a chance to benefit from inter-temporal reusability (Greenbaum et al., 2015). This proprietary information creates ex-post monopoly power for banks to sell non-interest products. Moreover, with respect to loan size, one of the distinctive characteristics of long-term maturity is that size of the loan increases in maturities. The increase in loan size may require, by its very nature, more fee and commission transactions. The overall conclusion is that an increase in maturity is expected to pave the way for selling non-traditional products to core customers.

The empirical literature questions the benefit from the cross-selling policy adopted
by banks. A common finding is that the cross-selling policy of banks is one of the
drawbacks that may have detrimental effect on the diversification policies (Boyd
and Graham, 1986; Lown et al., 2004; Stiroh, 2004; Lepetit et al., 2008). Excessive
cross-selling by a bank may lead to the augmentation of customer’s debt which is
positively associated with bank’s risk. Furthermore, the occurrence of an income
shock to the customer will hinder her ability to pay the charges for both traditional
and non-traditional products thus exposing the bank to performance fragility. On
the benefits side, cross-selling assists banks to decrease information asymmetry and
thus acts as a barrier to moral hazard problems. Banks can easily score the perfor-
mance of their customers and can be more selective in their cross-selling policy to
long-term customers.

The preceding discussion shows that cross-selling is directly associated with ma-
turity either in the assets (loans) or liabilities (deposits) sides of banks’ balance
sheets. Therefore the issue of maturity naturally positions itself as a corner stone
in this study. Banks need to diversify their assets and liabilities in terms of their
maturity for various reasons (such as for meeting customers’ demands, managing
liquidity or reducing capital requirements). However, income and product diversi-
fication strategies may conflict with the maturity diversification strategies creating
a maturity mismatch that in turn may affect banks’ performance. The maturity
mismatch between deposits and loans, in some conditions, may cause illiquidity
and insolvency to banks. Therefore, banks are expected to mitigate liquidity risk
by adopting true maturity diversification policy. There is an increasing role of
non-interest income in banks operation given their relatively new experience to the
pricing strategies by banks. In particular, the role it plays for long-term customers.
In this context, a profit maximizer bank may not necessarily know or calculate the
optimal risk and return strategies. The banking sector in the UK has less regional,
state, co-operative or mutual banks that are likely not to have profit maximizing
pricing and cross-selling strategies. During the period 2007 - 2012 the UK banks
were heavily reliant on non-interest income (around 38.0% of total income). There-
fore it is important to examine the cross-selling policies of the UK banks and their effect on performance.

This study addresses an important gap in the literature by investigating the effect of cross-selling strategies on banks’ performance conditional on deposit and loan maturity. The shift towards long-term deposits and loans may increase cross-selling and hence contribute to higher levels of bank revenue. The increase in revenue may be accompanied by higher volatility of income and increased risk. The potential hazard is caused by the longer maturity of deposits and loans critical for banks and regulators that should focus on bank risk factors. The scarcity of detailed data about loans and deposits maturities acted as a fence for researchers to test the direct and indirect impacts of maturity on banks performance.

The study contributes to the literature in two folds. First, it provides important evidence to the existing banking diversification-performance literature by considering the indirect effect of deposit and loan maturities on banks performance. This strand is mainly focused on income and geographical diversification. The study uses a unique data on the United Kingdom(UK) banks from 2005 to 2012. In addition, the study provides valuable insight into the link between cross-selling, conditional on the degree of maturity, and bank risk. The results reveal that fees and commission income do not explain banks’ performance in a direct form. On the other hand, the fees and commission variable conditional on long-term loan maturity reduces the bank performance. The trade income increases the risk-adjusted bank performance, but trade income conditional on longer maturity has the opposite effect. Second, to our knowledge, this is the first study to examine the direct effect of maturity of both deposits and loans on bank performance. The study departs from the traditional approach of direct matching of deposits and loans and separately measures the effect of maturities of deposits and loans. This approach allows detecting the separate maturity effects of deposits and loans on banks performance. The results indicate that the maturity diversification of loan is associated with higher bank performance. However, UK banks do not benefit from deposit diversification. Different explanations
of the power of the deposit and loan diversification implies that compared to loan
diversification, banks should pay deposit diversification more attention, possibly due
to the optimality of loan diversification by alternative funding channels. The study
use System GMM method to count for endogeneity and unobserved heterogeneity in
the sample. For robustness purposes, three alternative indicators were used as prox-
ies for risk namely Z-score, risk-adjusted return on assets and risk-adjusted return
on equity.

The rest of the chapter unfolds as follows: Section 4.2 is comprised of the lit-
erature review on bank performance, diversification and funding to understand the
concepts and their effects. Section 4.3 presents the portfolio theory associated with
diversification and risk. Section 4.4 defines and explains the dependent and inde-
dependent variables used in our analysis. Section 4.5 describes the data and presents
the econometric method employed in the study. Section 4.6 is the discussion of the
results. Section 4.7 concludes.

### 4.2 Literature Review

There is abundant evidence in the literature on the benefits of diversification in
reducing banks’ risks. Some of these studies even suggest that apart from reducing
bank’s risk diversification may help in improving managerial skills. Nonetheless,
the literature on bank diversification recently presents mixed results. The recent
evidence from the literature is contesting the theoretical underpinning of portfolio
theory regarding the benefits of diversifications.

Boyd and Graham (1986) and Boyd et al. (1993) test the riskiness of hypothetical
mergers between bank holding companies and non-bank financial companies. The
findings suggest that mergers between bank holding companies and life insurance
firms reduce the risk of bankruptcy. Saunders and Walter (1994) state that being
open to new activities enables banks to reduce their risk. Cybo-Ottone and Murgia
(2000) analyse the effect of Merger and Acquisitions (M&A) on returns in European
banking for the period 1988 and 1997. They find that M&A create positive abnormal
returns, due to the product diversification. On the other hand, they also find that M&A with securities firms and foreign institutions did not generate any gain. From income diversification perspective, Wall and Eisenbeis (1984) find that diversifying into non-interest activities help banks to reduce their risk. Gallo et al. (1996) test the riskiness of bank holding companies and effects of mutual fund activities on bank risk and profitability. They find that mutual fund activities reduce banks’ exposure to the industry risk. However, these activities are modest to reduce bank unsystematic risk. They also find that bank profitability is positively associated with increased mutual funds activities.

Deng and Elyasiani (2008) imply that geographic diversification contributes to banks’ value maximization and decreases total risk. They show that the distance between bank holding companies and their branches is inversely related to firm value and directly linked to risk. Hughes et al. (1999) find that efficiency improves thanks to geographical diversification while growth in product and geographic diversification reduces the bank risk. Another view argues that global diversification does not affect operating performance negatively, which implies that the idea of misallocation of resources by global diversification is not accurate (Iskandar-Datta and McLaughlin, 2005). According to the authors, leveraging managerial skills and abilities for the products and geographic region are the significant benefits of diversification. In contrast, Morgan and Samolyk (2003) test the geographic diversification and find that diversification does not improve loan performance or returns. Diversification helps banks to increase their lending capacity resulting in a higher loan to asset ratio. However higher loan to asset ratio does not increase profit or reduce risk. Some other studies state that income diversification causes a minor scale economy effect (Lawrence, 1989; Ashton, 1998; Humphrey, 1990). Drucker and Puri (2009) note that banks benefit from economies of scope by selling non-interest income with the same fixed costs in traditional activities. Boot and Schmeits (2000) suggest that diversified financial institutions may reduce the expected costs which stem from financial distress or bankruptcy conditional on spreading operations across different
products. The literature also provides evidence on the adverse effects of diversification. Boyd and Graham (1986) and Lown et al. (2004) find that the increasing trend towards non-bank activities raised the risk of the failure of banks during the seventies. They investigate bank mergers across the financial services industries; their findings show that the combination of bank holding and life insurance companies augments diversification benefit. However, mergers between securities, property insurance, and casualty insurance firms are likely to increase the bank holding companies’ risk albeit to a limited extent. Rosen et al. (1989) examine the diversification benefits for 319 banks involved in real estate activities from 1980 to 1985 and find that diversification towards real estate activities has a modest effect on banks’ risk. However, the positive correlation between returns is overwhelmed by the greater deviations of real estate returns.

Templeton and Severiens (1992) examine the effects of activity diversification for 54 bank holding companies by using market-based data and find that diversification leads to a lower variance of shareholder returns but has no explanation power for systematic risk. Kwast (1989) aims to explain the benefits of existing underwriting and dealing activities to bank returns and risk. His study indicates limited gains from diversification. Kwan (1998) tests the contribution of existing banking and securities activities on bank profitability and risk for the period 1990 - 1997 using micro data of banks’ securities affiliates. He finds that securities trading tends to be riskier but also more profitable, however the proliferation of risk stems from their higher leverage. DeYoung and Roland (2001) analyse data from 472 large and medium sized commercial banks covering the period from 1988 to 1995. Their prime aim is to examine the relationship between earning volatility and fee-based activities. Their result suggests that income diversification generates a new revenue line for banks but equally adds new business risks. The fee-based activities are positively correlated with earning volatility, implying that when banks shift their income activities from interest based activities to fee-based activities, their earnings become more volatile. Thus shifting to fee-based activities increases the risk associated with
income diversification. Authors attributes this situation to costs in shifting from one bank to another. According to the authors, banks bear switching and information costs by shifting banks’ activities from lending relationship to fee-based. These costs are switching and information cost. The volatility of the interest revenue is rather stable compared to the fee-based income. However, the latter requires limited bank-customer relationship and henceforth it is less costly and more volatile.

Acharya et al. (2002a) examine the effects of specialization versus diversification on bank risk and return by using the data of 105 Italian banks for the period 1993 - 1999. The result shows that diversification of bank assets neither improve nor reduce bank risk.

Stiroh (2004) examines the effects of non-interest income components on diversification benefits during the period 1984 - 2001 in the US banking industry. The results indicate that the shifting to non-interest income by diversification increases the bank risk and decreases the risk-adjusted performance indicators. Such relationship is caused by the high correlation between the non-interest income and trade income which led to higher volatility. The study also detects a higher correlation between the growth rates of interest income and non-interest income during the 1990’s, compared to the 1980’s. The study does not test directly bundling strategies or fee policy but because of decreasing risk-adjusted bank performance and increasing the covariance between interest and non-interest income, the author states that cross-selling may have increased in this period thus implying the adverse effect of potential shocks in decreasing bank performance.

Stiroh and Rumble (2006) investigate the impact of non-interest income on the performance of US financial holding companies over the period 1997 - 2002. They find that shifts to the non-interest activities are inversely related with risk-adjusted bank performance. Moreover, the costs associated with the high volatility of non-interest income offsets the benefits from diversification. This result implies that banks cannot attain optimal benefits from their diversification policy. The authors suggest that the problem may be related with misunderstanding of diversification
concept. They elaborate that if the main idea behind diversification is cross-selling to reduce costs and increase profit, then, they may ignore the potential risks associated with potential shocks to the same customer. Another possible factor explained by the author is the priorities of the bank management if they are large equity holders. The bank management may give priority to profit maximization and less attention to the income volatility. The third explanation about the adversity of diversification is the overreaction to the lending problems in earlier periods. In order to avoid lending issues, the financial holding companies may push themselves towards new non-interest income activities. Their final explanation is that the study may have covered the incorrect period to analyse diversification benefits but also suggest that similar results are valid for older periods which in turn reduces the likelihood of the problem in that time.

Mercieca et al. (2007) analyse the effect of income diversification on bank performance for small European banks using in 15 countries from 1997 to 2003. Their sample includes 755 credit institutions with asset size less than 450 million Euros. The study employs the Z-score, the risk-adjusted return on asset and the risk-adjusted return on equity as three alternative proxies for bank insolvency risk. They find that there are no direct diversification benefits for small European banks. The result shows that non-interest income is inversely linked to risk-adjusted performance suggesting that small financial institutions are better at specializing and diversification benefits are not valid for these institutions. Lepetit et al. (2008) examine the association between bank diversification and the European banking industry over the period 1996 and 2002. Their results show that banks which shifts to non-interest income activities from traditional loan activities have poorer performance and have higher insolvency risk. The authors report that the default risk is inversely related to trading activities but positively associated with a larger share of fee-based activities for small banks. However, fee- or trading based activities provide insignificant to risk for large banks.
Berger et al. (2010) examine the benefits of diversification for Chinese banking systems using data for the period 1996 - 2006. Considering loans, deposits, assets and geography diversifications, the authors measure the performance of Chinese banking system, as a developing country banking system. The results indicate that, after controlling for risk, diversification increases the costs and decreases profits for these four dimensions. Zhou (2014) measures the impacts of income diversification on bank risk for 62 Chinese commercial banks over the period 1997 - 2012. The author finds that there is no statistically significant relationship between income diversification and bank risk. While non-interest income increases the risk because of high volatility, traditional interest income activity contributes to the decrease in risk.

Demirguc-Kunt and Huizinga (2010) find that bank’s rate of return and its risk increase with higher proportions of fee income. The study investigates a sample of 1,334 banks in 101 countries, from 1995 to 2007. Their result suggests that fee incomes may produce risk diversification benefits however at very low levels while the wholesale funding lowers the rate of return on assets. They also claim that the reactions of depositors and wholesale funders are different. The wholesale funders quickly react to bank’s risk performance. Huang and Ratnovski (2011) provide a model that investigates banks reliance on wholesale funding. They argue that banks that generate cheap and noisy signals may provide the wholesale financiers with incentives to withdraw their funding. Myers and Rajan (1995) point the differences in asset mix. They claim that banks cannot optimally benefit from income diversification. However, they are likely to diversify their income to obtain more liquidity from non-traditional banking activities. Song and Thakor (2007) suggest that relationship loans which stem from opaqueness are financed by core deposits since liability holders can’t easily evaluate bank solvency. The probability for depositors to withdraw their funds prematurely as a precaution is relatively low.

In consideration of other different diversification policies, Jr and Nash (1993) explain the riskiness and profitability of institutions specialized in credit card loans
over the period 1984 and 1991. The authors find that banks specialized in credit
cards obtain positive abnormal returns compared to those with traditional product
mixes. However, their likelihood of insolvency increases due to the increase in return
on assets volatility. Similarly, Lang and Stulz (1993) find that the value of diversified
firms is less than the specialized firms. Rose (1989) highlights the amplification in
cash flow risk when banks shift towards non-bank product lines. Denis et al. (1997)
also suggest that financial institutions should keep their firms in a single line of
business rather than diversification because of the agency cost. They find that
managerial equity ownership is negatively associated with diversification and reduce
agency cost. Acharya et al. (2002b) argue that expanding into other industries
and sectors creates issues of weakened monitoring quality for risky banks. Another
problem is the quality of the loan portfolio for these risky banks. They also suggest
that industrial loan diversification lessens bank return.

4.3 Portfolio Theory

The trade-off between risk and return is a long-standing predicament for banks.
The microeconomic theory depicts this relationship in the portfolio theory (Sharpe,
1964). The theory assumes that the outcome of any investment is calculated by
probabilistic values. The potential outcome is calculated by the sum of possible
outcomes and their probabilities. If the outcomes involve risk, the investor chooses
among possible outcomes to derive the highest level of utility. In the same spirit,
Stiroh (2004) investigates bank’s income volatility, by considering the proportion of
interest income on the total income as $\alpha$ for the output INT and the percentage of
non-interest income to total income as $(1 - \alpha)$ for the output NONINT. Accordingly
the expected return (ER) is

\[ ER = \alpha INT + (1 - \alpha) NONINT \]  (4.1)
The variance of INT and NONINT combination is

\[ \sigma_t^2 = \alpha^2 \sigma_{t,\text{int}}^2 + (1 - \alpha)^2 \sigma_{t,\text{nonint}}^2 + 2r_t \alpha (1 - \alpha) \]  

(4.2)

where

- \( \sigma_t^2 \) is the volatility of total income at time t.
- \( \sigma_{t,\text{int}}^2 \) and \( \sigma_{t,\text{nonint}}^2 \) are variances of the interest and non-interest income at time t, respectively.
- \( r_t \) is the covariance coefficient at time t.

For the first and second terms, banks can diversify its income by shifting towards non-interest income. The risk-reducing diversification strategy is valid if the return from non-interest income can be used to offset at least partially the changes in the returns from the interest income activities. If non-interest income activity is riskier than the bank’s current portfolio, then increase in non-interest activity may increase the deviation of returns. The equation above also states that risk also depends on \( r_t \), where \( r_t \) is covariance between interest and non-interest income. The positive values indicate a positive relationship between the interest and non-interest income. The interest and non-interest incomes are independent of each other if \( r_t \) is 0. The negative values imply the negative relationship. As the portfolio equation states, negative covariance implies the benefit of income diversification. In this case, any shock negatively affects one side but positively affect the other side, simultaneously. However, positive covariance between interest and non-interest income is expected to increase risk. The main reason behind positive covariance can be the cross-selling policy of the bank. Selling both traditional and non-traditional products to the same customer increases this covariance, \( r_t \). In any income shocks, for a bank, both interest and non-interest income sides are affected. The reason for increasing risk is due to higher \( r_t \) or cross-selling. Thus, a bank needs to have negative, 0 or positive but lower value of \( r_t \) to benefit from diversification\(^1\).

\(^1\)When the ratio of the standard deviations of the incomes is higher than the covariance (if \( \sigma_{t,\text{int}} / \sigma_{t,\text{nonint}} > r_t \)), the risk reduction due to offsetting of income is less than the extra variance by shifting to non-interest income.
Following a similar approach, the variance of income at time $t+1$ is given by

$$
\sigma_{t+1}^2 = \alpha^2 \sigma_{t+1,int}^2 + (1 - \alpha)^2 \sigma_{t+1,\text{nonint}}^2 + 2r_{t+1}\alpha(1 - \alpha)
$$

(4.3)

It is expected that giving long term loan may increase the covariance, not only for time $t$ period, but also time $t+1$. Bank time $t+1$ income still depend on long term loans given at time $t$. The income risk measurement at time $t+1$ is the function of time $t+1$ interest income and therefore, time $t$ long term loan:

$$
\sigma_{t+1}^2 = f(S_{t+1}, L_t, L_{t+1}, N_{t+1})
$$

(4.4)

where

- $S_t$ is the short term loan at time $t+1$
- $L_t$ is the long term loan at time $t$
- $L_{t+1}$ is the long term loan at time $t+1$
- $N_{t+1}$ is the non-interest product sale at time $t+1$

The long-term loans, $L_t$, affect more than one period and thus, it is critical that the change in the share of the long-term loan may affect the volatility of more than one period. Therefore, banks should pay more attention the risk associated with cross-selling due to the continuous effect of the long term loan.

For the non-interest income components, suppose that a portfolio includes interest income and one of the non-interest income components (e.g. fee income). In this portfolio of fee income and interest income, compared to $r_{t+1}$, the value of $r_t$ is expected to be more redundant to long-term loans are given at time $t$. Mostly, a long term loan may require some inseparable or highly complementary fees and commissions during the credit application periods but not following years. Therefore, covariance caused by cross-selling of fee products to the long-term loans can be higher in period $t$. This feature is not valid for trade products. The probability of persuading customer for trade product takes time; it is natural to expect higher covariance value in later periods of long-term loan.
For the overall risk perspective, portfolio theory above shows only one part of the total risk. Rather than insolvency risk, cross-selling also may affect other bank risk factors such as liquidity risk. Potential inability to meet all payment obligations from interest and non-interest income sides when they come due or ability to meet these requirements at excessive costs create liquidity and funding risks. Therefore, problems in payments do not only increase the default risk but some other risks as well. These intended or unintended consequences of cross-selling on other risk also affect bank performance.

4.4 Data

The sample consists of an unbalanced panel with annual observation from 2005 to 2012 for the UK commercial banks. All financial items are inflation adjusted to the base year 2005 by using GDP deflator. Bankscope and other databases do not consist of maturity of deposit and loans, and therefore new data set is compiled from annual reports of each bank. Some macroeconomic data are obtained from the World Bank’s World Development Indicators (WDI). Sample used in this analysis is less than the actual total number of observations but the sample is highly representative, accounting for 83% of total banking assets. Some of the criteria reduce the number of total observations. Criteria implemented in filtering are;

a) Missing years from dependent and independent variables were eliminated

b) Available abnormal or extreme values that distort the nature of the relationships were eliminated as outliers

c) Available bank data less than 3 years in a row were eliminated for potential econometric issues in calculation.
4.5 Variables

4.5.1 Dependent Variables

Three types of measurements of bank performance are used in this study. Bank insolvency risk is measured by Z-score (Z-SCORE), which equals the return on assets plus the equity to asset ratio divided by the standard deviation of asset returns. Z-SCORE presents the number of standard deviations that profits must fall to push a bank into insolvency or more clearly, distance from insolvency. Profitability performance measures are risk adjusted return on asset (ADROA), as ROA over standard deviation of ROA, where ROA is net income to total asset ratio, and risk adjusted return on equity (ADROE), ROE over standard deviation of ROE, where ROE is net income to total equity ratio.

The main reason behind the selection of these three measurements is the evaluating total risk of the bank regarding profitability. Failure of the bank creates transaction and liquidity costs which may trigger the systematic risk by affecting banks and other institutions engaging insurance, mutual fund and other activities. Change in liquidity level of the bank also impacts bank customers in the allocation of resources. As citedeyoung˙product˙2001 suggests, small firms that heavily dependent on the bank credits are negatively affected from the total volatility stem from diversification policies, and thus some profitable projects are not funded in periods of low realised liquidity. Lastly, total risk also affects firm value in the stock market due to the deviation from the mean income citepstiroh˙dark˙2006. Therefore, due to the importance of the total income volatility for stakeholders, this study analysis the effect of selling noninterest products, conditional on deposit and loan maturity, on total income volatility measurements. In this sense, ADROA, ADROE and ZSCORE evaluate the total income volatility from different perspectives but considering the risk/return performance.
4.5.2 Explanatory Variables

Deposit Diversification (HHIDEP) : Maturity diversification for deposit is measured by Herfindahl Hirschman Index. The formula is given by

\[ HHIDEP = \left( \frac{STD}{TD} \right)^2 + \left( \frac{LTD}{TD} \right)^2 \]  

(4.5)

where STD denotes short term deposits by banks and customers with maturity between 0 and 1 year, LTD denotes long term deposits by banks and customers with maturity of more than 1 year. TD is the annual basis total deposits of banks and customers.

Long Term Deposits (LONGDEP) : measured by long term customer and bank deposits divided by total deposit. Long term deposit is the customer deposit with maturity of more than 1 year and total deposit is the sum of short and long term deposits. It shows the effect of shifting maturity of deposits from short term to long term.

Lag of Long Term Deposit Ratio (LAGDEP) : the lag value of LONGDEP. Rather than direct impact, its interactions with non-interest income activities are expected to be significant in explaining bank performance.

Capitalization (CAPITAL) : total equity to total asset ratio is introduced to see the effect of equity. It is priori expected to result in a positive relationship between equity and bank risk.

HHICOM : the effect of market competition on risk, measured by HHI index. HHICOM is the sum of the squares of the bank size shares measured by total assets to total banking sector assets.
INTEREST ASSET : measured by net interest income to total assets ratio. Interest income and non-interest income are not used to calculate HHI index. Because bank interest and non-interest income include many values lower than 0 as components of total income, interest income over total income and non-interest income over total income ratios take values lower than 0 or higher than 1. Thus, measuring the effect with these values is a barrier against true determination of causality. Moreover, this study draws attention to subcategories of total income and their interaction with maturity variables. As such, net interest income over total asset is preferred rather than HHI index.

Fees and Commissions (FEES) : net fees and commissions to total net non-interest income ratio is introduced to measure the effect of fees and commissions as a component of non-interest income.

Trade Income (TRADE) : the effect of trade income on bank risk is measured by trade income to total asset ratio.

Staff Expense (STAFFEXPENSE) : shows the effect of staff expense on performance. Staff expense is measured by staff expense to operating expense ratio.

Asset Size (LNASSET) : measures logarithm of total asset. This variable is included to control for the effect of bank size.

Loan Diversification (HHILOAN) : maturity diversification for loan is also measured by the Herfindahl Hirschman Index. Its formula is given by

\[ HHIDEP = \left( \frac{STL}{TL} \right)^2 + \left( \frac{LTL}{TL} \right)^2 \]  

where STL denotes short term loans and advances to banks and customers with maturity between 0 and 1 year, LTL denotes long term loans and advances to banks...
and customers with maturity of more than 1 year. TL is the annual basis total loans given by banks.

**Long Term Loans (LONGLOAN)**: measured by long term loans and advances to banks and customers divided by total loans. Long term loans are the loans and advances to banks and customers with maturity of more than 1 year. Total loan is the sum of short term and long term loans. It measures the effect of shifting loan maturity from short term to long term on bank performance.

**Lag of Long Term Loan Ratio (LAGLOAN)**: the effect of the lag value of long term loans. It is introduced especially for its indirect effect, conditional on fee and trade incomes.

**Second Lag of Long Term Loan Ratio (LAG2LOAN)**: employed to see the effect of the second lag value of long term loans. Likewise with LAGLOAN, it is employed to see its indirect effect, conditional on fee and trade incomes.

**INTERACTION TERMS**

**LONGDEPFEES**: the effect of net fees and commissions, conditional on current value of long term deposits. It is measured by LONGDEP x FEES.

**LAGDEPFEES**: the effect of lag value of long term deposits conditional on net fees and commissions. It is measured by LAGDEP x FEES.

**LONGLOANFEES**: the effect of current value of long term loans conditional on net fees and commissions, measured by LONGLOAN x FEES.

**LAGLOANFEES**: the effect of lag value of long term loans conditional on net fees and commissions income. It is measured by LAGLOAN x FEES.
LAG2LOANFEES : interaction of second lag of the long term loans and current value of fee income: LAG2LOAN x FEES.

LONGDEPTRADE : the effect of current value of long term deposits, conditional on trade income. It is measured by LONGDEP x TRADE. This variable is introduced to find an evidence for the effect of cross-selling policy of banks. Same period cross-selling and bundling are subject to same type of income shocks and may negatively impact bank performance.

LAGDEPTRADE : the effect of lag value of long term deposits conditional on trade income, measured by LAGDEP x TRADE.

LONGLOANTRADE : the effect of current value of long term loans conditional on trade income. It is measured by LONGLOAN x TRADE. Potential same sign with LONGDEPTRADE provides evidence for increasing risk stemmed from income shock for both traditional and non-traditional income sides.

LAGLOANTRADE : the effect of lag value of long term loans conditional on trade income. It is measured by LAGLOAN x TRADE. Since long term customers stay at the same bank for more than one year, banks may improve their communication by time and hence increases the likelihood of selling non-traditional products in the following years of where loan transaction started.

LAG2LOANTRADE : this variable is the construction of the second lag value of the long term loans and current value of trade income to see the effect of cross-selling of trade product in the second year of long term loan: LAG2LOAN x TRADE

For the years 2007, 2008 and 2009, time dummies are created due to the financial crisis in the UK.
4.6 Methodology for Empirical Study

Coefficients are estimated by two-step system GMM methodology that combines the differenced equations and level equations. Generally, banking data, particularly profit and risk data, includes dynamic association between dependent variable and its lag value. The dynamic approach is captured by the GMM estimator (Baltagi, 2008).

Another reason is the potential endogeneity problem that can be solved by System GMM. Endogeneity is expected between dependent variables and some explanatory variables, such as diversification variables.

Some factors that may explain the bank performance are difficult to measure, such as managerial capability. To avoid problems stem from unobserved heterogeneity, and thus biased results, the system GMM is preferred.

In this study, two specification tests are reported below to the tables. The first test is the auto-correlation test for disturbance term: First order autocorrelation and second order autocorrelation. Estimates are consistent if first order autocorrelation is available in the differenced residuals, but unavailable in the second order autocorrelation. The second test reported in this study is the Hansen test for over-identifying restrictions that examines the validity of instruments. Considering the small sample used in the study, the two-step standard errors are computed in accordance to the Windmeijer (2005) finite-sample correction.

4.7 Results

Table 4.1 presents the descriptive statistics for variables. The numbers indicate the ups and downs for three measurements covering the period 2005 and 2012. Z-SCORE reaches its lowest mean value in 2008, but deviation is highest at 2007. Then, mean value steadily increases up to last observation year 2012. This year is the peak point for sample period. However, ups and downs are clearer for the profitability measurements; ADROA and ADROE. ADROA reaches its minimum
<table>
<thead>
<tr>
<th>Variables</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADROE Mean</td>
<td>1.1096</td>
<td>1.2063</td>
<td>1.0987</td>
<td>1.1608</td>
<td>1.0983</td>
<td>1.1412</td>
<td>1.1263</td>
<td>1.1021</td>
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<tr>
<td>Std Dev</td>
<td>0.8782</td>
<td>0.8729</td>
<td>0.8908</td>
<td>0.9506</td>
<td>0.9478</td>
<td>0.9539</td>
<td>1.0513</td>
<td>0.9245</td>
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<tr>
<td>HHIDEP Mean</td>
<td>0.9229</td>
<td>0.9363</td>
<td>0.9381</td>
<td>0.9409</td>
<td>0.9111</td>
<td>0.9097</td>
<td>0.8825</td>
<td>0.8791</td>
</tr>
<tr>
<td>Std Dev</td>
<td>0.1348</td>
<td>0.1116</td>
<td>0.1036</td>
<td>0.1025</td>
<td>0.1341</td>
<td>0.1335</td>
<td>0.1582</td>
<td>0.1439</td>
</tr>
<tr>
<td>LONGDEP Mean</td>
<td>0.0557</td>
<td>0.0473</td>
<td>0.0451</td>
<td>0.0476</td>
<td>0.0681</td>
<td>0.0801</td>
<td>0.0990</td>
<td>0.0786</td>
</tr>
<tr>
<td>Std Dev</td>
<td>0.1194</td>
<td>0.1160</td>
<td>0.1112</td>
<td>0.1265</td>
<td>0.1389</td>
<td>0.1701</td>
<td>0.1756</td>
<td>0.1101</td>
</tr>
<tr>
<td>HHILOAN Mean</td>
<td>0.7278</td>
<td>0.7170</td>
<td>0.6830</td>
<td>0.6877</td>
<td>0.7013</td>
<td>0.6794</td>
<td>0.6820</td>
<td>0.6703</td>
</tr>
<tr>
<td>Std Dev</td>
<td>0.1814</td>
<td>0.1758</td>
<td>0.1763</td>
<td>0.1691</td>
<td>0.1776</td>
<td>0.1726</td>
<td>0.1741</td>
<td>0.1670</td>
</tr>
<tr>
<td>LONGLOAN Mean</td>
<td>0.2821</td>
<td>0.2884</td>
<td>0.3305</td>
<td>0.3297</td>
<td>0.3189</td>
<td>0.3338</td>
<td>0.3363</td>
<td>0.3620</td>
</tr>
<tr>
<td>Std Dev</td>
<td>0.2601</td>
<td>0.2546</td>
<td>0.2524</td>
<td>0.2565</td>
<td>0.2622</td>
<td>0.2509</td>
<td>0.2552</td>
<td>0.2591</td>
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<tr>
<td>STAFFEXPENSE Mean</td>
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<td>0.4735</td>
<td>0.5035</td>
<td>0.4811</td>
<td>0.4814</td>
<td>0.5192</td>
<td>0.5064</td>
<td>0.5181</td>
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<tr>
<td>Std Dev</td>
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<td>0.1816</td>
<td>0.1664</td>
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<td>0.1962</td>
<td>0.1839</td>
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<tr>
<td>CAPITAL Mean</td>
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<td>0.1284</td>
<td>0.1194</td>
<td>0.1366</td>
<td>0.1344</td>
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<tr>
<td>Std Dev</td>
<td>0.1624</td>
<td>0.1266</td>
<td>0.1248</td>
<td>0.1258</td>
<td>0.1493</td>
<td>0.1357</td>
<td>0.1575</td>
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<tr>
<td>INTERESTLOAN Mean</td>
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<td>0.0247</td>
<td>0.0259</td>
<td>0.0248</td>
<td>0.0255</td>
<td>0.3013</td>
<td>0.0340</td>
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<tr>
<td>Std Dev</td>
<td>0.0279</td>
<td>0.0199</td>
<td>0.0188</td>
<td>0.0210</td>
<td>0.0210</td>
<td>0.0232</td>
<td>2.3449</td>
<td>0.0776</td>
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<tr>
<td>Std Dev</td>
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<td>2.6307</td>
<td>2.7105</td>
<td>2.7929</td>
<td>2.8263</td>
<td>2.8887</td>
<td>3.1680</td>
<td>2.8343</td>
</tr>
<tr>
<td>HHICOM Mean</td>
<td>0.2595</td>
<td>0.1786</td>
<td>0.1617</td>
<td>0.1831</td>
<td>0.1380</td>
<td>0.1338</td>
<td>0.1364</td>
<td>0.1317</td>
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<tr>
<td>Std Dev</td>
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<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
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</tr>
<tr>
<td>FEES Mean</td>
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<td>0.9997</td>
<td>0.5297</td>
<td>0.9364</td>
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<tr>
<td>Std Dev</td>
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<td>1.859</td>
<td>1.4433</td>
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<td>TRADE Mean</td>
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<td>0.0041</td>
<td>0.0028</td>
<td>0.0024</td>
<td>0.0040</td>
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<tr>
<td>Std Dev</td>
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<td>0.0071</td>
<td>0.0068</td>
<td>0.0072</td>
<td>0.0122</td>
<td>0.0122</td>
<td>0.0124</td>
<td>0.0105</td>
</tr>
</tbody>
</table>

Z-SCORE: \((\text{ROA+EA})/\text{stdROA}\) ADROA: \text{ROA}/\text{stdROA}\), ADROE: \text{ROE}/\text{stdROE}\), HHIDEP: deposit diversification by HHI index, LONGDEP: long term deposits by banks and customers divided by total deposits, HHILOAN: loan diversification by HHI index, LONGLOAN: long term loans and advances to banks and customers divided by total loans, STAFFEXP: Staff costs to operating costs, CAPITAL: equity to asset ratio, INTERESTLOAN: interest income over total loan, LNASSET: logarithm of Asset, HHICOM: market competition, FEES: net fees and commissions to net non-interest income, TRADE: trade income to total asset ratio

***, ** and * indicate significance respectively at the 1%, 5% and 10% levels.
value at 2010, while ADROE reaches at 2005.

For deposit diversification, HHIDEP, it is seen that diversification decreases until 2008. Then diversification is in upward trend by falling from 0.94 to 0.87. Deposit diversification decreases during 2005 - 2008 period and then increases steadily for the period 2009 - 2012. On the contrary, loan diversification is an increasing trend for 2005 - 2008 period and followed by ups and downs. The change in mean values of deposit and loan diversification are not correlated. The correlation between deposit and loan diversification is 23%, which is not too high to match supply and demand sides. Another interesting result seen from deposit and loan diversification is that loan diversification is greater than deposit diversification. Moreover, the standard deviation of the loan diversification is relatively higher, too.

The differences in diversification are seen more clearly in the variables LONGDEP and LONGLOAN ratios. The share of the long-term deposits is around 5%, but average for long-term loan share is around 30%. There is no trend for the long-term deposits but Table 4.1 depicts an upward trend for long-term loans from 2005 to 2012. It steadily reaches 36% from 28% between the years 2005 and 2012. This trend shows that share of the long-term loans increased during this period.

The competition level provides interesting trends. The HHICOM values decrease during this period by falling from 0.26 to 0.13. The decrease implies the increase in competition during this period, especially after 2008 financial crisis. Table 4.1 states that as the competition increase, the capital of the banks increases too.

Before the supply and demand side results, it is correct to note that the three measurements are not perfectly correlated. Therefore, different results are expected for some explanatory variables.

### 4.7.1 Supply Side Results

Table 4.2 presents the six estimations for the supply side bank performance using three performance measures. Table 4.2 shows the effects of interaction of deposit maturities with non-interest income components.
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Z-SCORE</th>
<th>ADROA</th>
<th>ADROE</th>
<th>Z-SCORE</th>
<th>ADROA</th>
<th>ADROE</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAFFEXPENSE</td>
<td>4.823</td>
<td>0.305</td>
<td>0.897*</td>
<td>6.697</td>
<td>-0.459</td>
<td>0.854**</td>
</tr>
<tr>
<td></td>
<td>(6.046)</td>
<td>(1.503)</td>
<td>(0.518)</td>
<td>(4.803)</td>
<td>(1.790)</td>
<td>(0.426)</td>
</tr>
<tr>
<td>CAPITALIZATION</td>
<td>19.39**</td>
<td>3.583**</td>
<td>-0.748**</td>
<td>18.17*</td>
<td>4.384**</td>
<td>-1.243***</td>
</tr>
<tr>
<td></td>
<td>(9.029)</td>
<td>(1.736)</td>
<td>(0.339)</td>
<td>(9.792)</td>
<td>(1.822)</td>
<td>(0.452)</td>
</tr>
<tr>
<td>CAPITALIZATION</td>
<td>0.145</td>
<td>0.089</td>
<td>-0.0411**</td>
<td>0.270</td>
<td>0.120</td>
<td>-0.0583***</td>
</tr>
<tr>
<td></td>
<td>(0.231)</td>
<td>(0.0847)</td>
<td>(0.0179)</td>
<td>(0.184)</td>
<td>(0.080)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>CAPITALIZATION</td>
<td>-27.43*</td>
<td>4.585**</td>
<td>0.0608</td>
<td>-32.10**</td>
<td>2.807</td>
<td>-0.590</td>
</tr>
<tr>
<td></td>
<td>(14.07)</td>
<td>(2.111)</td>
<td>(0.890)</td>
<td>(15.95)</td>
<td>(2.277)</td>
<td>(0.929)</td>
</tr>
<tr>
<td>CAPITALIZATION</td>
<td>0.159**</td>
<td>0.064*</td>
<td>-0.008</td>
<td>0.164***</td>
<td>0.101*</td>
<td>-0.0106</td>
</tr>
<tr>
<td></td>
<td>(0.074)</td>
<td>(0.034)</td>
<td>(0.009)</td>
<td>(0.062)</td>
<td>(0.059)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>CAPITALIZATION</td>
<td>-0.105</td>
<td>-2.292</td>
<td>0.457*</td>
<td>2.566</td>
<td>-3.429</td>
<td>1.265**</td>
</tr>
<tr>
<td></td>
<td>(4.917)</td>
<td>(1.739)</td>
<td>(0.281)</td>
<td>(6.117)</td>
<td>(5.080)</td>
<td>(0.607)</td>
</tr>
<tr>
<td>HHI DEP</td>
<td>0.753***</td>
<td>0.889***</td>
<td>(0.120)</td>
<td>(0.106)</td>
<td>(0.076)</td>
<td>(0.122)</td>
</tr>
<tr>
<td>LADROA</td>
<td>0.729**</td>
<td>0.705***</td>
<td>(0.130)</td>
<td>(0.142)</td>
<td>(0.075)</td>
<td>(0.122)</td>
</tr>
<tr>
<td>LADROE</td>
<td>0.694***</td>
<td>0.631***</td>
<td>(0.075)</td>
<td>(0.142)</td>
<td>(0.075)</td>
<td>(0.122)</td>
</tr>
<tr>
<td>FEES</td>
<td>-0.556</td>
<td>0.165</td>
<td>-0.00130</td>
<td>0.133</td>
<td>0.011</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.652)</td>
<td>(0.144)</td>
<td>(0.017)</td>
<td>(0.090)</td>
<td>(0.071)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>TRADE</td>
<td>96.65*</td>
<td>37.56*</td>
<td>6.970*</td>
<td>122.4**</td>
<td>73.50***</td>
<td>7.827**</td>
</tr>
<tr>
<td></td>
<td>(53.08)</td>
<td>(21.68)</td>
<td>(3.873)</td>
<td>(50.74)</td>
<td>(21.83)</td>
<td>(4.064)</td>
</tr>
<tr>
<td>LONG DEP</td>
<td>4.804</td>
<td>-3.002</td>
<td>0.943*</td>
<td>(5.256)</td>
<td>(5.218)</td>
<td>(0.478)</td>
</tr>
<tr>
<td>Constant</td>
<td>1.141</td>
<td>0.0971</td>
<td>0.140</td>
<td>-6.580</td>
<td>1.486</td>
<td>-0.141</td>
</tr>
<tr>
<td></td>
<td>(7.560)</td>
<td>(2.502)</td>
<td>(0.583)</td>
<td>(7.689)</td>
<td>(5.324)</td>
<td>(0.836)</td>
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</table>

**Time Dummies**: Y Y Y Y Y Y

**Observations**: 528 528 528 528 528 528

**No of id**: 77 77 77 77 77 77

**No of instruments**: 47 52 60 51 57 59

**Hansen Test P**: 0.490 0.231 0.744 0.539 0.188 0.681

**AR(1)**: 0.013 0.000 0.001 0.015 0.000 0.002

**AR(2)**: 0.710 0.463 0.597 0.663 0.123 0.621

Z-SCORE: (ROA+EA)/stdROA ADROA: ROA/stdROA ADROE: ROE/stdROE, STAFFEXPENSE: staff costs to operating costs, CAPITALIZATION: Equity to asset ratio LNASSET: logarithm of asset, HHICOM: market competition (HHI index) INTERESTLOAN: net interest income over total loan, HVIDEP: deposit diversification (HHI index), LZSCORE/LADROA/LADROE: lag values of dependent variables, FEES: net fees and commissions to net non-interest income, TRADE: trade income to total asset ratio, LONGDEP: long term deposits by banks and customers divided by total deposits

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

The results show that the coefficient of HVIDEP is significant and positively associated only with adjusted return on equity ADROE, but for the ZSCORE and ADROA, it is statistically insignificant. The result implies that when deposits are diversified, risk-adjusted return on equity decreases, as diversification increases with lower HHI value. The problem in deposit diversification performance ought to the
lack of power of banks to shift the directions of maturities. Depositors may be inelastic against to change maturity of their deposits. Banks may be politically insufficient to diversify their deposits corresponding to their loan plan, and therefore, deposits are relatively out of control. To elaborate further, the deposits are short-term in most cases which implies that deposit customers are also short-term customers.

Second, deposits are just one instrument to supply sources for loans. Banks can provide other sources, and henceforth diversification of deposits may not significantly contribute to the performance if other sources are not costly enough. Having different sources instead of deposits may allow banks to draw less attention to the deposit diversification. As clarified by Altunbas et al. (2011), deregulation and innovations help the bank to alleviate the need for financial markets for their funding. The advantage of the financial markets, such as interbank markets, certificate of deposits and short-term bonds, is that banks can borrow more easily from these markets. Moreover, the deposits are relatively less than the potential in financial market so that they can borrow with large amounts (Altunbas et al., 2011). Easily borrowing from markets by a large amount is used to fund, probably, long term loans. Shares of the long-term deposits and loans are far away from matching. The sum of total long-term deposits is around half of the long-term loans. Calomiris and Kahn (1991) point out that financial market investors are relatively more sophisticated than depositors who create a market discipline. Demirgüç-Kunt and Huizinga (2010) find that use of non-deposit funding is more common in developed countries. For these reasons, banks possibly give more consideration to the alternative sources and thereby deposit diversification is insignificant in explaining market risk.

Similar to HHIDEP, STAFFEXPENSE is positively associated with the risk-adjusted return on equity. This variable is insignificant for both ZSCORE and ADROA. The effect of the CAPITALIZATION variable is interesting: it affects the different dependent variable with the opposite sign. CAPITALIZATION increases the bank performance for ZSCORE and ADROA. However, it is inversely related with ADROE. These opposite results confirm the findings by
Table 4.3: Deposit Interaction Variables

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>ZSCORE (7)</th>
<th>ADROA (8)</th>
<th>ADROE (9)</th>
<th>ZSCORE (10)</th>
<th>ADROA (11)</th>
<th>ADROE (12)</th>
</tr>
</thead>
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<tr>
<td>STAFFEXPENSE</td>
<td>0.933</td>
<td>1.991</td>
<td>0.444*</td>
<td>-4.967</td>
<td>0.110</td>
<td>0.906*</td>
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<td></td>
<td>(2.809)</td>
<td>(1.738)</td>
<td>(0.237)</td>
<td>(5.542)</td>
<td>(1.343)</td>
<td>(0.510)</td>
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<tr>
<td>CAPITALIZATION</td>
<td>18.89*</td>
<td>3.117***</td>
<td>-1.057***</td>
<td>26.06**</td>
<td>3.737*</td>
<td>-0.756*</td>
</tr>
<tr>
<td></td>
<td>(10.00)</td>
<td>(1.790)</td>
<td>(0.336)</td>
<td>(10.04)</td>
<td>(2.171)</td>
<td>(0.403)</td>
</tr>
<tr>
<td>LNASSET</td>
<td>0.147</td>
<td>0.138</td>
<td>-0.0447**</td>
<td>-0.0326</td>
<td>0.0798</td>
<td>-0.042**</td>
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<tr>
<td></td>
<td>(0.241)</td>
<td>(0.0920)</td>
<td>(0.0156)</td>
<td>(0.194)</td>
<td>(0.108)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>HHICOM</td>
<td>-39.16***</td>
<td>4.770***</td>
<td>0.543</td>
<td>-19.82**</td>
<td>4.517**</td>
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<tr>
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<td>(14.57)</td>
<td>(1.792)</td>
<td>(0.872)</td>
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<td>(0.815)</td>
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<tr>
<td>INTERESTLOAN</td>
<td>0.0629</td>
<td>0.0583*</td>
<td>-0.016</td>
<td>0.178*</td>
<td>0.0387**</td>
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<tr>
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<td>(0.201)</td>
<td>(0.031)</td>
<td>(0.014)</td>
<td>(0.100)</td>
<td>(0.019)</td>
<td>(0.003)</td>
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<tr>
<td>HHIDEP</td>
<td>1.917</td>
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<td>0.700**</td>
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<td>(7.629)</td>
<td>(1.644)</td>
<td>(0.580)</td>
<td>(5.489)</td>
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<td>(0.346)</td>
</tr>
<tr>
<td>FEES</td>
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<td>(0.015)</td>
<td>(0.194)</td>
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<td>(0.024)</td>
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<tr>
<td>TRADE</td>
<td>212.6***</td>
<td>73.68***</td>
<td>6.711*</td>
<td>123.9**</td>
<td>89.54***</td>
<td>7.810*</td>
</tr>
<tr>
<td></td>
<td>(73.38)</td>
<td>(26.49)</td>
<td>(3.456)</td>
<td>(52.78)</td>
<td>(32.41)</td>
<td>(4.454)</td>
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<tr>
<td>LZSCORE</td>
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<td>0.733***</td>
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<td>(0.103)</td>
<td>(0.124)</td>
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<tr>
<td>LADROA</td>
<td>0.554***</td>
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<td>0.557***</td>
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<tr>
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<td>(0.0939)</td>
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<tr>
<td>LADROE</td>
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<td>(0.0776)</td>
<td></td>
<td>(0.0839)</td>
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<tr>
<td>LONGDEP</td>
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</tr>
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<td>(7.395)</td>
<td>(1.072)</td>
<td>(0.425)</td>
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</tr>
<tr>
<td>LONGDEPTRADE</td>
<td>-636.5**</td>
<td>-205.5*</td>
<td>-37.63*</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(266.5)</td>
<td>(115.3)</td>
<td>(21.49)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>LONGDEPFEES</td>
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<td>0.523</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>(1.309)</td>
<td>(0.482)</td>
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</tr>
<tr>
<td>LAGDEP</td>
<td></td>
<td></td>
<td></td>
<td>-2.013</td>
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<td>0.179</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(4.520)</td>
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<td>(0.306)</td>
</tr>
<tr>
<td>LAGDEPTRADE</td>
<td></td>
<td></td>
<td></td>
<td>-289.9*</td>
<td></td>
<td>-36.23**</td>
</tr>
<tr>
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<td></td>
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<td>(152.3)</td>
<td></td>
<td>(17.96)</td>
</tr>
<tr>
<td>LAGDEPFEES</td>
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<td></td>
<td>1.265</td>
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<td>0.310</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(4.894)</td>
<td></td>
<td>(0.408)</td>
</tr>
<tr>
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<td>8.082</td>
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<td>-0.071</td>
</tr>
<tr>
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<td>(8.586)</td>
<td>(2.061)</td>
<td>(0.592)</td>
<td>(8.367)</td>
<td>(2.843)</td>
<td>(0.740)</td>
</tr>
</tbody>
</table>

Time Dummies: Y Y Y Y Y Y
Observations: 528 528 528 526 526 526
No of id: 77 77 77 77 77 77
No of instruments: 57 56 67 66 67 65
Hansen Test P: 0.250 0.547 0.348 0.614 0.328 0.864
AR(1): 0.020 0.010 0.000 0.020 0.000 0.001
AR(2): 0.855 0.148 0.570 0.575 0.198 0.724

Z-SCORE: (ROA+EA)/stdROA ADROA: ROA/stdROA ADROE: ROE/stdROE, STAFFEXPENSE: staff costs to operating costs, CAPITALIZATION: equity to asset ratio LNASSET: log of asset HHICOM: market competition INTERESTLOAN: net interest income over total loan, HHIDEP: Deposit Diversification FEES: net fees and commissions to net non-interest income TRADE: trade income to total asset ratio, LZSCORE/LADROA/LADROE: lag values of dependent variables LONGDEP: long term deposits by customers and banks divided by total deposits, LONGDEPTRADE: LONGDEP*TRADE, LONGDEPFEES: LONGDEP*FEES, LAGDEP:lag of LONGDEP, LAGDEPTRADE: LAGDEP*TRADE, LAGDEPFEES: LAGDEP*FEES ***., ** and * indicate significance respectively at the 1%, 5% and 10% levels.

Stiroh and Rumble (2006) and Mercieca et al. (2007).

The effect of the LNASSET is negative and significant only for ADROE. The
negative coefficient implies that deviation increases over bank size. For others, it is statistically insignificant. Similar to LNASSET, HHICOM is statistically significant for only one dependent variable; ZSCORE. When the competition increases, bank’s income becomes more stable.

Table 4.2 also reports lag values of the dependent variables. Results indicate that they are statistically highly significant, and their signs are positive for all three types of measurements. Hence, current adjusted bank performance is positively linked with past realization of bank performance which implies a dynamic relationship.

Non-interest income includes different products that are characteristically different than each other or from another view; non-interest products are priced differently and used for different policies. Testing non-interest products by disaggregating them as fee and trade products allows us to understand causalities of each line of income separately. Table 4.2 reports the effects of non-interest income components and share of the long-term deposits. Now, non-interest income is decomposed as FEES and TRADE. Results state that higher dependence on FEES is statistically insignificant to explain risk-adjusted bank performance. However, different than the literature, greater reliance on TRADE is positive and significant for all three types of measurements of bank performance. This result implies that despite the results that finding a negative association between TRADE and bank performance in the literature, TRADE no longer has an adverse effect on risk-adjusted bank performance. In the literature, it is seen that most of the studies present the 1990’s whilst this study grasps the more recent period. Banks may adjust their trade product strategies through the increasing trend in sales of trade product. Also, transformation of its structure, new non-interest products and advances in technology are the other factors that may contribute to less deviation in trade income. In addition, banks gain knowledge about trading, especially small banks were not familiar with the trading activities in 1990’s. Banks possibly now more experienced than the 1990’s. Alternatively, the period examined in this study includes the crisis and post-crisis periods. Compared to interest and fee income channels, trade income may be less
dependent on overall business conditions.

Another income component, INTERESTLOAN, is statistically significant, and its effect is positive to the performance. As DeYoung and Roland (2001) suggest, shifting banks for lending activity is costly for the customer. Information, search and other switching costs are the barriers changing banks for lending activity hence, making interest income more stable. The only problem with income components is the fees and commissions, during the period 2005 and 2012. The fee income is significantly affected by loan market, as well as the fee market, and is open to different pricing strategies as a complement product. Using fee products for multiple pricing may prevent diversification benefits from the shifting loan side to the fee income side.

Table 4.3 presents the interaction variables which show the indirect effect of deposit maturity. Similar to the FEES variable, LONGDEPFEES and LAGDEPFEES are also insignificant in explaining bank performance. Since fees and commissions policy consists of many pricing strategies, its effects may not reflect these policies. The lack of the data for fees and commissions charged from different pricing strategies is a barrier to differentiating fee policies. However, for all three measurements, LONGDEPTRADE is statistically significant. As models 10 to 12 depict, LAGDEPTRADE is also statistically significant for all three measures. Improvements in communication between the bank and long-term depositors increase the probability of cross-selling to these long-term customers. In other words, if banks assume that long-term depositors are more creditworthy, then, they may have an incentive to sell non-interest products. However, at this point, any income shock to the depositor may affect both deposits and non-interest income side by lowering the deposits and creating a payment problem in non-interest income side. Hence, cross-selling to the core depositor negatively affects bank performance.
4.7.2 Demand Side Results

Table 4.4 presents the six estimations regarding the implication of the demand side on bank performance. According to the results in Table 4.4, loan diversification is positively associated with Z-SCORE and ADROA. Banks have more instruments and choices to diversify their loans by adjusting the interest rates for short- and long-terms loans. Compared to depositors, banks possibly find short- and long-term loan customers for intermediation activity easier. Therefore, they can benefit from loan diversification utilising interest rate policies.

Table 4.5 presents the interaction of long-term loan share with fee income (LONGGLOANFEE) and trade income (LONGGLOANTRADE). The results indicate that the effect of fees income conditional on the long-term loans is statistically significant, but its effect is negative. The trade income positively affects bank performance, but the interaction of trade income with long term loan negatively impacts bank performance. This result implies that the positive effect of the trade income becomes negative, conditional on long-term loan. The main reason behind these opposite signs is likely related to banks’ selling trade products to the long-term customer using bundling and cross-selling policies. Since the long-term customer and bank relationship includes improvements in communications, such as arm length relationship, similar to long-term depositors, it is expected to provide an incentive for banks to engage in non-interest product sale to the long-term loan customers. The power and ability of persuasion of banks increases over time and banks would like to use this condition to its advantage by cross-selling. However, this is an increase of the transaction volume or a similar case to increase in loan size and as such, increase in the risk of the bank. From the portfolio perspective, it increases the correlation coefficient between interest and non-interest income, which implies an increase in risk for the bank.

Banks may struggle to sell diversified products not only in the current period but also following years of the relationship with long-term loan customers (i.e. more than one year). Thus, they may be persuaded to perform a cross-selling transaction
Table 4.4: Non-interest Income Components - 2

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>ZSCORE</th>
<th>ADROA</th>
<th>ADROE</th>
<th>ZSCORE</th>
<th>ADROA</th>
<th>ADROE</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAFFEXPENSE</td>
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Time Dummies Y Y Y Y Y Y
Observations 528 528 528 528 528 528
No of id 77 77 77 77 77 77
No of instruments 51 59 57 51 62 60
Hansen Test P 0.552 0.416 0.344 0.581 0.389 0.786
AR(1) 0.018 0.000 0.000 0.016 0.000 0.002
AR(2) 0.639 0.399 0.619 0.624 0.377 0.590

Z-SCORE: (ROA+EA)/stdROA ADROA: ROA/stdROA ADROE: ROE/stdROE, STAFFEXPENSE: staff costs to operating costs, CAPITALIZATION: equity to asset ratio LNASSET: logarithm of asset, HHICOM: market competition, INTERESTLOAN: net interest income over total loan, HHILOAN: loan diversification, FEES: net fees and commissions to net non-interest income, TRADE: trade income to total asset ratio, LONPGOAN: long term loans and advances to customers and banks divided by total loans, LZSCORE/LADROA/LADROE: lag values of dependent variables.

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

different time. In this respect, risks stem from cross-selling as can be deducted from the coefficient of variables LAGLOANFEE and LAGLOANTRADE. The results
state that the LAGLOANFEE is statistically insignificant revealing the adverse effect of the fees income conditional on long-term loan on bank performance. The logic behind this relationship may be associated with the fees and commissions charged during the loan application process. Banks are inclined to charge fees and commissions to compensate losses from lower loan prices, and generally, customers are unable to escape such a set-up as fees are an inseparable part of the lending activity. Secondly, the complement fee products may be sold in the application period by bundling strategy. In this structure, any income shocks to customers affect both parts of the income statement and negatively affects bank performance. Most of the long-term loans require fee transactions associated with the aim of using that loan. Furthermore, they may be higher in volume. For example, long-term housing credits require a broad range of fee activities during the application period, the size of both fees and loans are very high. The insignificance in later periods as the result shows imply the flexibility effect of customers.

Similar to LONGLOANTRADE, LAGLOANTRADE is also statistically significant, and its effect is negative for all three measures. Moreover, LAG2LOANTRADE is also statistically significant for the three measures. As such, long-term relationships with loan customer conditional on trade income contributes to low bank performance. The significance of LONGLOANTRADE, LAGLOANTRADE and LAG2LOANTRADE provides substantial evidence for the probability of bundling (for LONGLOANTRADE) and other cross-selling policies, conditional on loan maturity.

These empirical results also imply that the effect of efficient monitoring is not a dominant factor in increasing bank performance in cross-selling. Sometimes, banks fail to monitor their customers or score them improperly. The reason behind the issue may be related to the ability and motivation of the sales forces (Jarrar and Neely, 2002). Banks use technology and some mathematical modelling and provide information. This information is analysed by employees and requires appropriate
Table 4.5: Loan Interaction Variables

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Z-SCORE: (ROA+EA)/stdROA; ADROA: ROA/stdROA; ADROE: ROE/stdROE; STAFFEXPENSE: staff costs to operating costs; CAPITALIZATION: equity to asset ratio; LNASSET: logarithm of asset HHICOM: market competition; HHILOAN: loan diversification FEES: net fees and commissions to net non-interest income; TRADE: trade income to total asset ratio; INTERESTLOAN: net interest income over total loan; LONGLOAN: long term loans and advances to customers and banks divided by total loans; LONGLOANFEE: LONGLOAN*FEES; LONGLOANTRADE: LONGLOAN*TRADE; LAGLOAN: lag of LONGLOAN; LAG2LOAN: 2nd lag of LONGLOAN; LAG2LOANFEE: LAG2LOAN* FEES; LAG2LOANTRADE: LAG2LOAN*TRADE; LZSCORE/LADROA/LADROE: lag values of dependent variables

***, ** and * indicate significance respectively at the 1%, 5% and 10% levels.
staff training at the end. Alternatively, even though banks correctly choose the customers which they offer cross-selling, unexpected shocks may remove the success in their selection. As it is seen from results, private information obtained by the bank through longer maturity of loan does not help the bank to reduce risk in cross-selling activities.

The reasons why banks shift to the non-interest income activities can be explained by the approach of Stiroh and Rumble (2006). Firstly, the expected and actual returns can be different than each other, due to the unexpected shocks. Ignoring unexpected shocks may be accompanied by higher covariance coefficient. Compared to expected return, the actual return may become lower due to these shocks such as shocks associated with macroeconomic conditions or some particular sectors. Secondly, the managerial perception of diversification benefit may be higher than the actual gain. The lack of information about the covariance between interest and non-interest income may lead banks to diversify their income aggressively through cross-selling. Moreover, earnings of the management may depend on higher profits but any losses may be independent of the managerial earnings. Higher earning managers without any risk bearing creates an incentive to take more risk. Thirdly, a bank’s aim may not necessarily be profit maximization, such as conserving firm-specific human capitals or corporate control problems. Another explanation suggested by Denis et al. (1997) and Rajan et al. (2000) is the agency problem between managers and owners, and power struggles between different segments within a bank may lead to lower performance by cross-selling.

4.8 Conclusion

The aim of this study is to analyse the risk implications on the UK banking sector which has shifted away from traditional activities towards non-interest income activities. To achieve its objective, the study investigates the impact of shifting banks maturity diversification policies between short - and long-term loans and deposits. One of the main advantages of this study is that the UK deposit and loan
maturities are compiled from bank annual reports, and it is a very new and unique data that has been used to analyse short and long-term deposit and loan maturities. Therefore, it is the first study to investigate the direct and indirect effects of both deposit and loan maturities on bank performance. The results show that cross-selling policies create risk through shifting deposits and loans from short- to long-term. The fees and commissions variable in its own is insignificant to explain banks’ performance, but fees and commission income associated with long-term loan negatively affects bank performance. This negative relationship is valid only for the same period. However, the interaction of fees with deposit maturity is insignificant. It is reasonable to think that risk is associated with some complementary fees and commissions for loans as well as the inseparable ones charged in the application period of the long-term loan. The structure of the long-term loans allows the bank to charge more fees and commission from transactions.

The trade income positively impacts risk-adjusted bank performance for all three risk measures. In contrast, all the interaction variables of long-term maturity including trade income are negatively associated with bank performance. The negative coefficient of the interaction effect strengthens the presence of potential problems such as bundling and other cross-selling policies for the bank. Cross selling and bundling strategies to the core customer are exposed to shocks, and it negatively affects both the interest and trade income sides of the banks.

The findings reveal that deposit diversification neither improves nor reduces the bank Z-score and risk-adjusted return on asset, but reduces the risk-adjusted return on equity. The result implies that banks do not benefit from deposit diversification. However, loan diversification improves banks’ performance measured by Z-score and risk-adjusted return on asset. Studying the maturities of deposits and loans separately allows us to address the side that creates a barrier against diversification benefit. The result postulates that for the British banking system, this side is the deposit side which requires more attention from policy makers.

The policy implications of this study are threefold. First the diversification of
deposits appears unsatisfactory for the UK banking sector and banks should pay deposit diversification policies more attention. Second, the income diversification may alleviate bank risk. However, the excessive cross-selling pattern, conditional on maturity, creates more risk for the bank. This study shows that increasing maturity and cross-selling associated with longer maturity reduces the bank performance. Bank should limit their cross-selling strategies. Also, banks need to improve their monitoring capacity for cross-selling. Third banks should adopt robust techniques to determine a cross-selling customer more appropriately and rigorously. Their risk seems to stem from cross-selling increases by the maturity, and therefore, banks should consider the risk of cross-selling on the maturities of deposits and loans.

Greater use of bundling and cross-selling by banks, and addressing it to the same customer has risk implications whether or not the sale is made over one or two periods. Thus selling traditional and non-traditional products and services sold in different periods should also be considered in risk diversification models.

Concerning the overall risk associated with income components, banks should be motivated, primarily to augment the fees and commission revenue side. However, the positive effect of both interest and trade income variables warns us that banks in the UK should focus on the fee and commission revenue sides to be more stable. Reducing income volatility by improving the income diversification also helps banks to reduce capital requirements in order to buffer risk. Therefore, the cross-selling policy is also crucial for banks with respect to capital requirements.

For the regulators, it is seen that bank risk increases with maturity conditional on cross-selling. This cross-selling strategy of bank increases the risk possibly due to the higher covariance. As the covariance increases, the risk exposure from loan size increases. There are no significant differences between risk with higher loan size without cross-selling and risk with loan size but cross-selling of non-interest products if the customer faces with income shock. In both cases, banks may have exposure to liquidity risk or even bankruptcy risk subject to the total debt size. They should increase the level of concentration to cross-selling without ignoring the importance
of total debt size.

The nature of the data does not allow differentiating bundling from other cross-selling strategies. Periodical differences of cross-selling affect the debt size of the customer. Bundling is implemented when loan debt size of the customer is in the maximum amount. However, cross-selling excluding bundling may arise following periods of the loan transaction. Compared to bundling, this implies the lower debt size. Any income shock to the second case is expected to be less risky for banks. Further researches should be devoted to the analysis of differences in these strategies beyond the risk stem from general cross-selling. Also, further researches should focus on the comparisons between relationship banking and transactional banking. Relationship banking is subject to borrower-specific information by screening (Allen, 1990; Ramakrishnan and Thakor, 1984) and/or by monitoring (Diamond, 1984). On the contrary, transactional banking motivates on a single transaction with a customer. This main difference between the two approaches can have a different risk on maturities. Any study about indirect maturity effect for these approaches can shed important lights on bank performance.
Chapter 5

Conclusion

This chapter summarizes the main findings, policy implications, limitations of the study and recommendations for further research. The chapter is organised as follows. The first part provides an overview of the three chapters, including the main findings and policy implications. The second section discusses the shortcomings of the study and outlines avenues for further work.

5.1 Main Findings and Policy Implications of the Research

The fundamental research questions in this thesis deal with bank performance by analysing the relationship between interest and non-interest income. The thesis focused on three issues:

- Theoretical incorporation of fees and commissions, and trade incomes into Ho and Saunders (1981)’s dealership model and the role of the pricing strategies in shaping their relationship with interest margin. The theoretical study particularly highlights the role of bundling policies in the association between the interest margin and the non-interest income components in the presence of well-informed and less-informed customers. In addition, the thesis focuses on the empirical test of theoretical findings for the European banking system.
• Attempts to evaluate the switching cost effect of long term loans for non-interest products by theoretically modelling and testing it for the UK banking system during the period between 2005 and 2012.

• The direct and indirect role (by paving the way for cross-selling) of the deposit and loan maturities, on bank performance.

The empirical and theoretical models were formulated to examine the above issues, employing recent panel data and panel data techniques.

In focusing on the main three issues, this study uses different profitability/performance measures in the empirical part of each chapter. In the second chapter, this study uses net interest income over the total asset. This profitability ratio measures the banks’ profitability from intermediation activity. Since the second chapter analyses the relationship between interest margin and non-interest margin in the theoretical part, study empirically uses net interest income to total asset ratio to measure profitability. In the third chapter, study theoretically derives the price-cost margin. The price-cost margin is computed as net interest income over the total loan. Because banks’ loan price is determined by loan market share and the average rival price is weighted by banks’ market share in the loan market, the total loan is used as the denominator to normalise price cost margin. For the fourth chapter, this study analyses the effect of cross-selling on bank performance. Since this chapter analysis the effect of cross-selling on bank performance regarding risk/return relationship, this study analyses the return of the banks for each standard deviation. Different than the second and third chapter, fourth chapter measures the profitability for total income rather than interest income because main aim is the investigating the role of cross-selling to the total income volatility. Failure of the bank due to the higher volatility in total income generates transaction and liquidity costs which may create the systematic risk by affecting banks and other institutions. Change in the liquidity level of the bank also impacts customers in obtaining bank credit, particularly in the periods that volatility reduces bank liquidity. Finally, total risk also affects firm value in the stock market due to the income volatility (Stiroh and Rumble, 2006).
Therefore, the importance of the total income volatility for stakeholders motivates this study to focus on the total income volatility measurements and uses ADROA, ADROE and ZSCORE.

The second chapter investigates the role of non-interest income components on interest margin. Theoretically, fees and commissions income and trade income are incorporated into the Ho and Saunders (1981)’s pioneering dealership model by considering the pricing strategies of banks. The pricing strategies considered in this study are the bundling and loss-leader strategies. The theoretical contributions consist of the propositions that derive the negative relationship between interest margin and trade income, as well as fees and commissions income. The result is distinguishing fees and commissions, and trade income from each other due to their different characteristics. The theoretical study also analyses the loan price information of customers.

There are four propositions in the theoretical part. The first proposition presents the conditions for a negative effect of fees and commissions income on interest margin, in pure bundling of loan and, fees and commissions, in the presence of well-informed customers. The second proposition highlights the importance of price information level of customers in bank pricing decisions. The proposition states that in the presence of less-informed customers, banks can get higher gross margins by pure bundling of loan and fee-based activity. The third and fourth propositions provide the conditions under which trade income negatively affects interest margin, in the assumption of all customers’ being well-informed about total loan price. The third theoretical contribution proposes the conditions for a negative relationship between trade income and interest margin in the implementation of loss-leader strategy. The fourth proposition derives the conditions for negative relationship in the presence of price bundling strategy.

For the empirical part of the second chapter, the effects of the fees and commissions income and trade income on net interest margin are tested for the European banking system during the period 2004 - 2011 by using System GMM method. The
results obtained state that conditions for a negative relationship between interest income and trade income, as well as fees and commissions income are satisfied for the European banking system. However, both fees and commissions and trade incomes are significant for the current period only but not next period. This finding increases the likelihood of price bundling being a relevant pricing strategy to create a current period negative relationship.

The empirical results also suggest that the previous period value of interest margin, bank market power, equity and inflation are the other factors that provide the conditions for higher interest margins. On the contrary, economic growth, liquidity and loan size reduce the interest margin. Empirical estimations also imply that operational or personnel expenses are insignificant in explaining interest margin.

Individual banks which heavily concentrate on interest income, due to their profit-maximizing objectives, should also consider the non-interest income side by mainly implementing bundling strategy if they believe that customer considers core product price rather than the total price of the transaction. However, cross-selling activities may also increase bank risk. Therefore, cross-selling strategies are open to evaluation of risk/return trade-off. The availability of this negative relationship should lead banks to examine their riskiness due to the pricing strategies created by this relationship. Lastly, these results may be beneficial for particular economic policies. For example, results suggest that banks with market power can increase their interest margin. Regulators may consider this situation in their analysis concerning competition structure of the sector.

The third chapter theoretically extends the Kim et al. (2003)’s switching cost model by considering the switching cost effect of long term loans on non-interest products. The switching cost is assumed to be a long term phenomenon created by banks. However, none of the studies in the literature examine the switching cost effect of long-term loans, especially for non-interest products. Since this thesis analyses the relationship between interest and non-interest income created by banking strategies, switching cost strategies of banks for non-interest products would be
one of the motivations for this study. The third chapter theoretically derives the
equation that shows the relationship between price, cost-margin and switching cost
effect of long-term loan on non-interest income, as well as other factors, like general
switching cost, inertia and market share. Factors determining banks’ loan market
share are also derived in the theoretical part. In the second part of the third chapter,
the theoretical findings are empirically tested by employing data for a panel of UK
banks from 2005 to 2012 and using the non-linear 3SLS econometric method. The
empirical results imply that shifting loans from short term to long term increases
the switching cost for non-traditional products. The first stage in creating this
switching cost is lowering the price of the long-term loan. The banks may interpret
customers’ personal information in persuading them to purchase non-interest prod-
uct and services thus improving the relationship through long-term loans. Or, from
the customers’ perspective, a customer, who has long term contract with a bank,
may feel that other banks may reject the application of non-interest product due to
information asymmetry. Third, it is also expected that relationship improves in the
long-term, and long-term loans enable this improvement. The improvement in the
relationship over time by long term loan may create inertia to buy a non-interest
product from the same bank. Lastly, long term loans characteristically require many
complementary products. In particular during the application period, most of the
long-term loans are sold conditionally on non-interest income activities. The magni-
tude of the non-interest income activities for loan transaction changes on customer’s
aim of using that loan. For example, some of the loans, like housing credit, require
many complementary non-interest income activities. Requirements of long term
loan complements tend long term loan customer to apply the same bank. In this
point, attractive offers by banks, such as price bundling, create time and research
cost for the customer and lead them to stay at the same bank. This study also tests
the switching cost effect of the long-term loan, particularly for trade products. The
results indicate that this situation is valid for trade products either.

The negative relationship between loan price and loan market share, as a the-
oretical finding, is also empirically tested, and the results provide evidence for the UK banking system. The banks which decrease their price compared to their rivals attract customers and thus increase their market share. The loan market share also has a non-linear explanatory factor in the coefficient that enhances the price-cost-margin.

The shifting from short-term to long-term deposits has no power to explain the price-cost margin and loan market share. The operational cost increases the price-cost margin, but the labour cost of the banks reduces the price-cost margin implying that the efficiency of banks stems mainly from the operational factors but not the labour. On the other hand, labour cost does not contribute to the increase in market share. Banks may no longer hire staff to improve communication to support their customer or to find a new customer to improve their market share. This result is intuitive for the UK banking sector as it is currently common knowledge that banks in the UK tend to rely heavily on technology to create platforms to attract customers.

Unlike the usual practice in the literature, the study examines the switching cost for non-interest products but set up by interest products. Thus, tested switching cost in this study paves the way for cross-selling. The increasing correlation between interest and non-interest income sides by cross-selling may enhance the bank risk against unexpected income shocks. Banks, regulators and supervisors should consider the correlation level between the two sides. The result implies that policy makers need to further understand the strategies of banks for cross-selling. This provides policy-makers with evidence to consider switching cost effect of shifting from short-term to long-term loans for non-traditional products. Also, long term loans, by its very nature, are one of the best candidates to compensate loss from locking the customer in through non-interest products. Having the feature of requiring high-level complementarity and time are two key advantages of a long-term loan. Banks that pay attention to switching cost should afford more importance to the switching cost effect of long-term loans.
The fourth chapter investigates the role of deposit and loan maturities, conditional on non-interest income components, on bank performance for the UK banking system over the period 2005 - 2012. Getting information about characteristics and consumption pattern of customers, as discussed earlier, mostly require time. Having information gathered in the long run makes selling non-interest products easier. In this respect, long-term loans and deposits are suitable instruments to achieve this goal because it is a longer period phenomenon. Having information about the customer and spreading the fixed costs are two advantages of selling non-interest products to dedicated customers. However, increasing the likelihood of cross-selling by long-term maturity may negatively affect bank performance. These adverse conditions help explain how deposit and loan maturities, conditional on non-interest income components, empirically impact on bank performance. The advantage of the study is distinguishing the non-interest income components as fees and commissions income and trade income. This provides further understanding on how each of the non-interest income components, conditional on deposit and loan maturities impacts on bank performance. Moreover, this is the first study that directly but separately examines the effect of both deposit and loan maturities. The empirical study finds that fees and commissions income do not directly explain banks' performance. However, when the fees and commission variable is conditional on longer loan maturity, it decreases the bank performance. Trade income increases the bank performance, but trade income, contingent on long-term deposit and loan maturities, has the opposite effect. These negative associations between non-interest income and bank performance conditional on maturities imply the failure of the bank from one perspective, as discussed above, such that they cannot benefit from the information gathered from a long period relationship. As long as the duration of relationships with customers increase through deposits and loans, banks' ability to evaluate the customer for cross-selling is expected to increase. Moreover, it is also assumed that banks spread their fixed cost by cross-selling and thus improve their performance. The results are indicating a negative relationship between non-interest income com-
ponents and bank performance conditional on maturity thus contradict with these expectations and imply the dominancy of the negative effect of cross-selling. In this context, banks should more concentrate on determining the true long-term loan and deposit customers in selling non-interest products. Even this study does not measure the direct weights of cross-selling and information asymmetry between bank and customer in affecting bank performance, being more rigorous in cross-selling to long term customer seems to need more attention. Moreover, banks may fail in spreading the fixed costs when they sell non-interest products to long-term customers. This aspect may also require more attention.

Moreover, this study is the first study that directly examines the effects of deposit and loan maturities on bank performance. The results contribute to bank performance literature by diagnosing which maturity diversification variable creates a problem regarding bank performance rather than analysing whether maturity mismatches exist or how their match influence bank performance. Direct diversification results imply that maturity diversification of loan is associated with the higher bank performance in the UK. The banks in the UK do not benefit from deposit diversification to improve their performance. The first policy implication of fourth chapter study is that diversification performance of bank deposits is unsatisfactory for the UK banking system, and banks should pay deposit diversification policy more attention. Second, the study reveals that cross-selling stem from longer maturity reduces the bank performance. Bank may need to improve their monitoring capacity for cross-selling. Another possibility is determining cross-selling customers more appropriately and rigorously. It is reasonable to suggest using models considering income diversification risk models. Risk models of banks should include the effect of pricing policies implemented by that bank. Moreover, as the results suggest, both traditional and non-traditional products and services sold in different periods should also be considered in risk diversification models. Third, in consideration of overall risk associated with income components, banks should be motivated, especially to the fees and commissions income side. The unconditional effect of fees and commissions
income is not the reason of increasing risk, the insignificance of fee income variables but the positive contribution of both interest and trade income variables give the signal that bank should be more concentrated on the fees and commissions income side to be less volatile.

Fourth, lower performance caused by cross-selling to long term customers and higher volatility of fees and commissions income may lead to higher capital requirements. Lowering these risks permits banks to keep less equity to buffer risk.

Finally, the cross-selling strategy of banks towards long-term loan customers increases the risk possibly due to the higher covariance. The risk effect of higher loan size without cross-selling to the same customer and lower loan size but compensated with cross-selling of non-interest products have similar effects on bank performance. In both cases, banks may face liquidity or bankruptcy risk depending on size. Therefore bank managers, supervisors and regulators pay similar attention to these problems. Total debt created by cross-selling should be considered rather than separately analysing the traditional and non-traditional side. By means of these implications, this study does not only provide practical implications for UK bank managers, supervisors and regulators but also lends some perspectives to other developed economies.

5.2 Limitations of the Study and Recommendations for Further Research

This thesis employed bank level data for the purpose of empirical analysis. However, some firm-level data are missing to analyse more appropriately or to be beneficial in achieving the understanding of the nature of the relationship established between interest and non-interest income sides.

For the second chapter, this study tests the relationship between interest income and non-interest income components: fees and commissions, and trade income. The theoretical structure presents the conditions of a negative correlation between in-
terest income and, fees and commissions. The bank-level data provides all fees and commissions income without distinguishing the fees and commissions income charged from loan transaction or complementary of loan transaction and, fees and commissions independent from loan transactions. Similarly, the bank-level data is insufficient to determine a direct relationship between loan activity and trading activity. The common point in these two issues is the data’s being insufficient with respect to cross-selling. Having cross-selling information enriches the test of theoretical findings. Despite the lack of data about cross-selling to loan customer through fees and commissions, and trade activities, significance and sign of the relationships gives valuable information in explaining the reasons of causality. Alternatively, another drawback for bank level data is studying with annually data for the first chapter and absence of the exact time of the cross-selling activities of the banks. Having exact dates of the transactions gives worthy information about the pricing strategies that affect the relationship between interest and non-interest income sides. By this information, it is easy to conclude the main pricing strategies of the banks and their weights in these significant relationships.

Lastly, for the second chapter, despite the theoretical model showing the significance of the average size of loans, as a determinant of the interest margin, Bankscope does not allow this variable to be directly introduced. In the absence of transaction volume, as suggested by Maudos and Guevara (2004) and implemented by Maudos and Solis (2009), loan size is proxied by the logarithm of loan size.

Further studies should analyse the weights of pricing strategies that create significant relationships between traditional and non-traditional sides by reaching the individual lending data. Analysing the pricing strategies behind these relationships more clearly also helps regulators to investigate the magnitude of banking risks from cross-selling strategies. Regulations on some pricing strategies may protect the system against potential hazards. Second, further studies should also consider the size effects in transactions in any case of bundling or loss leader strategy. The size of the total customer debt in cross-selling may change on bundling and loss leader
strategies, due to the periodical differences, when transactions are carried out successfully. The total size of the debt may be lower in loss leader strategy, compared to the simultaneous sale of traditional and non-traditional products by bundling. In this sense, the timing of income shocks to the customer is critical. Besides, bundling and loss leader strategies may affect switching cost in a different way by changing the market power of the firm. Change in market power also affects the profitability and risk of the bank. Third, this and other extensions of Ho and Saunders (1981) model theoretically assume a linear demand function. Further studies may examine the non-linear demand and supply functions.

For the third chapter, this study uses unique data compiled from bank annual reports. The problem in the collection of data is the different structure of each bank. Some banks categorize deposit and loan maturities by details; some others generalize the maturities. For example, especially big banks classify maturities as less than one year and more than one year. However, some banks categorize the maturities as 0-3 months, 3-6 months, 6-12 months, 1-5 year. In this sense, it is impossible to create at least three maturity categories as short term, middle term and long term without losing most of the observations. From another perspective, this changing structure of bank reports and obligation of this study to classify maturities as short term and long term force this study to determine a period as the break-even point in order to distinguish between short term and long term. Fortunately, one year, as a break-even point, is assumed a critical time length for the maturity and this study defines this length as critical to distinguishing between short and long term. Having significant empirical findings that prove theoretical results show that this shortcoming of data is very limited. However, an empirical test that analyses the switching effect of the medium term would be better. Further studies may analyse the duration by details, for example, considering at least three terms: short, medium and long term. This helps banks and regulators to see the evolution of switching cost more clearly. In addition, chapter 3 analyses the switching cost for linear probabilities. Further studies may also contribute to the literature by considering non-linear relationship
for probabilities and factors that affect probabilities. Further studies should also
test the effects of long term deposits as a switching cost factor. Loans are generally
requiring complementary products and it is reasonable to create a switching cost for
them. However, as discussed earlier, potential inertia can be created by increasing
deposit maturity or banks gathering more information about their customers as the
maturity of deposits increases. This information is used to persuade customer to
buy non-interest product. Then, potential switching cost created by deposits may
impact profitability and risk, too. Lastly, this study uses aggregate data but it
would prefer the disaggregated data associated to bank products.

With respect to the fourth chapter, the limitation of the study is a combination
of the limitations of the second and third chapter. Lack of data about individual
data is a barrier to understanding the reasons for the relationships and magnitude
of pricing policies that satisfy cross-selling. The periodical differences of cross-
selling affect the debt size of the customer. Bundling is implemented when the
loan debt size of the customer is in the maximum amount. However, cross-selling
excluding bundling may arise following periods of the loan transaction. Compared
to bundling, this implies the lower debt size. Any income shock to the second case
is expected to be less risky for banks. Further researches may be devoted to the
analysis of the differences in these strategies beyond the risk stem from general
cross-selling. The inability to categorize the maturities further than short and long
term is another barrier to understanding the adverse effects of non-interest income
components conditional on maturity. The focusing on comparisons of relationship
banking and transactional banking may offer some interesting results. Relationship
banking is subject to borrower specific information through screening (Allen, 1990;
Ramakrishnan and Thakor, 1984) and/or by monitoring (Diamond, 1984). However,
transactional banking focuses on a single transaction with customers. This difference
between the two approaches may involve different risks depending on maturities.
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