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Non-Interest Income and Bank Lending

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Abstract. This paper examines the influence of non-interest activities on bank lending in terms of loan quality and interest spread. We also investigate the possible existence of profit complementarities between non-interest activities and lending. Using quarterly data on 6,921 U.S. commercial banks between 2007:Q3 to 2016:Q3 we find that non-interest activities have no adverse influence on bank credit risk. This is the case for banks of different asset size (including systemically important banks) as well as for distressed banks. There is evidence that banks with assets between $100 million and $1 billion that have a greater share of fiduciary income have lower credit risk. They also have lower interest rates on loans secured by real estate, and higher franchise values, particularly post-crisis. Moreover, banks in the aforementioned size range benefit from synergies in joint production of non-interest income and lending, whereas other banks, in particular smaller banks (below $100 million in assets) suffer from diseconomies of joint production. Larger banks exhibit cross-subsidization between several non-interest activities and lending business.

JEL Classifications: G21

Keywords: Non-interest Income, Fiduciary, Credit Risk, Spread, Profit Complementarities

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1. Introduction

Existing theories have conflicting predictions on the necessity of restricting bank activities. Engaging in different activities may exacerbate conflicts of interest (John, John and Saunders, 1994, and Saunders, 1994) and moral hazard problems (Boyd, Chang and Smith, 1998). Moreover it may make banks too complex to be monitored and too big to discipline (Barth, Caprio and Levine, 2004). Alternatively, fewer regulatory restrictions permit banks to realize economies of scope (Claessens and Klingebiel, 2001).

Many works have looked into the risk implications of functional diversification in banking following deregulation in the U.S. and Europe in the 1980's (DeYoung and Rice, 2004; Stiroh 2004 & 2006; Stiroh and Rumble, 2006; Lepetit et al, 2008) and also after the global financial crisis of 2007-2008 (De Jonghe, 2010; Demirguc-Kunt and Huizinga, 2010; Brunnermeier, Dong and Palia, 2012; DeYoung and Torna, 2013; Engle et al., 2014; De Jonghe, Diepstraten and Schepens, 2015; Williams, 2016 among others). Such studies show that, combined with traditional intermediation, non-interest activities generally contribute to higher standalone risk and systemic risk of financial institutions. As a result, post-crisis regulatory reforms in the U.S. and Europe (Dodd Frank Act, 2010; Liikanen Report, 2012 and the Independent Commission on Banking – Vickers Report, 2011) recommend restrictions on various banks' non-interest activities (International Monetary Fund, 2011).

While previous work has focused on the broad diversification gains or on internal agency problems of mixing traditional intermediation and non-interest business lines, this paper is the first (as far as we know) to examine how such non-traditional activities affect bank lending quality and pricing. Given that the empirical literature tends to find that diversification into non-interest areas (and particularly in more volatile businesses like investment banking) generally increases risk it is interesting to study whether recent diversification activity has the same influence on bank lending behavior in terms of credit risk

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and interest spread. It is also of interest to examine whether behaviors have changed post-global financial crisis, as banks have been moving out of the riskier areas of non-interest activities to meet tougher capital requirements dictated by Basel III and Dodd Frank. An analysis of these issues may identify whether any noticeable risk shifting has been taking place between non-interest activities and lending business as predicted by the model proposed by John et al. (1994). Boot and Ratnovski (2016) also present a model showing that combining long-term relationship banking and short-term transaction banking can undermine the former. We also investigate whether evidence of profit complementarity between lending and non-interest activities is prevalent in the post-crisis environment again highlighting potential merits or demerits of diversification. This is an area, which surprisingly has attracted little academic attention.

Bank lending can benefit from informational and synergy advantages associated with diverse activities. Moreover, fewer regulatory restrictions may increase banks' charter value and thereby encourage managers to behave more prudently (Barth, et al., 2004). Alternatively, getting into different activities may lead to agency problems and loss of focus. Bank loan pricing might also be affected by subsidization across interest-based and fee-based businesses.

Theories of financial intermediation stress that banks can obtain inside information by developing close relationships with clients and thereby mitigate asymmetric information problems (Berger, 1999; Boot, 2000). Petersen and Rajan (1994) and Berger and Udell (1995) show that borrowers with longer relationships enjoy lower collateral requirements and more available credit. The building of such relationships can mitigate risk, as illustrated by Puri, Rochell and Steffen (2011) who find that borrowers with prior credit relationships (with German savings banks) default less. By examining 18,000 bank loans to small Belgian firms, Degryse and Van Cayseele (2000) also show that interest rates tend to fall as the scope of the relationship expands. Hellmann, Lindsey and Puri (2008) find that prior relationships with

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early stage venture capital firms increase the chances of bank loan origination. Firms may also benefit from established bank relationships by signaling their quality resulting in lower loan rates. Bharath et al. (2007) document the benefits of bank-borrower relationships from the perspective of the bank. They claim that strong previous lending relationships increase the chances of attracting new loan and investment banking business.

Boot (2000) emphasizes that private customer-specific information is obtained through multiple interactions with the same client over time, often in the form of providing various financial services. The way information is collected and its nature changes when banks engage in more business lines. Banks can obtain information through more channels and have the opportunity to use this information with greater customer interaction. For very large banks, however, the reusability of proprietary information is likely to be limited, because they rely more on hard-information technologies, and provide different financial services through segregated subsidiary corporate structures. The interplay between lending and non-interest activities, therefore, is more likely to be pronounced for smaller banks.

On the basis of extant theories and empirical literature we postulate that engaging in different non-interest activities can affect lending behavior for smaller banks and articulate three arguments in support of the hypothesis that broadening bank businesses can improve loan quality. First, through activity diversification, banks can gather more private information on client quality as well as access a wider array of potential borrowers. Second, information, relationship and reputational factors that can be acquired through various businesses can enhance banks' franchise value and hence increase the potential indirect costs of financial distress, leading to more prudent lending behavior (Marcus, 1984; Keeley, 1990; Demsetz et al., 1996 and Gonzalez, 2005 show the negative relationship between banks' charter value and risk-taking). Finally, revenue from other business areas may also enhance lending as it enables banks to lower interest margins by facilitating information collection from clients.

Carbo and Rodriguez (2007) show that income from non-traditional activities influence net interest margins through possible cross-subsidization effects. However, the empirical evidence is not conclusive. For instance, Nguyen (2012) finds no clear evidence of a negative link between non-interest income and bank interest margins, whereas Lin et al. (2012) claim that non-interest income mitigates the sensitivity of interest margins to shocks.

Non-interest activities also have various drawbacks. First, most fee-based activities are short-term in nature, and have lower switching costs than traditional banking (DeYoung and Roland, 2001); hence, in order to establish longer-term client relationships, banks may grant loans to cement non-interest income client relationships. Such a policy could, therefore, undermine the delegate-monitoring role of banks. Banks are expected to produce and convey information on the quality of borrowers, which could be biased if non-interest activities provide incentives for weaker loan screening and monitoring. Lepetit et al. (2008b) find that banks may underprice credit risk if they expect to obtain additional fees from borrowers. Second, greater reliance on non-interest activities may increase agency problems. Several studies show that agency costs stemming from exacerbated information asymmetries outweigh the benefits of activity diversification (Laeven and Levine, 2007; Elyasiani and Wang, 2009; Akhigbe and Stevenson 2010; Berger, Hasan and Zhou, 2010)[1]. Third, expanding into non-interest activities could be to the detriment of lending. Boot and Ratnovski (2016) show that engaging in too much market-based activities damages relationship-banking. They highlight diseconomies of scope in combining traditional commercial banking and market-based activities, in particular when financial markets are deeper. Lastly, lower credit exposure may encourage managers to be less conservative in their loan-granting activities.

[1] Elsas, Hackethal and Holzhauser (2010) find that diversification improves bank value, and provide some evidence against the "*conglomerate discount*" proposed by Laeven and Levine (2007) and Elyasiani and Wang (2009).

In contrast to the afore-mentioned cross-country studies, in this paper we focus on the U.S - because of access to more information on the breakdowns of bank non-interest activities - and investigate the relationship between bank lending and diversification in eight major non-interest business lines[2]. These range from activities such as fiduciary where clients entrust funds for asset management by the bank, to loan servicing which is directly attached to lending. We examine the influence of these activities on banks' lending in terms of loan quality and interest spread. We also investigate the possible existence of profit complementarity ((dis)economies of joint production) between non-interest activities and lending.

We use quarterly data on 6,921 U.S. commercial banks between 2007:Q3 to 2016:Q3. Since the U.S. banking system is dominated by small banks and business models vary with size, we classify banks into three categories: those with less than $100 million in total assets (*'Small' Banks*), with total assets between $100 million and $1 billion ('*Medium*' *Banks*) and with more than $1 billion in total assets (*'Large' Banks*). This is particularly important for our profit complementarity analysis because scope economies may depend on scale of operation, and it may not be achieved for too small banks. De Jonghe, Diepstraten and Schepens (2015) show that the impact of non-interest activities on banks' performance depends on size. However, they attribute the positive impact of non-interest activities on the risk of smaller banks to the opacity of such banks, whereas in this paper, using the three sub-samples, we examine the role of size in the economies of joint production.

Overall, we do not find any significant evidence in favor of an adverse effect of non-interest activities on credit risk for banks with different sizes including systemically important banks (assets more than $50bn) and even distressed banks. Our credit risk analysis for *medium-size* commercial banks with total assets between $100 million and $1 billion indicates

[2] Fiduciary, annuity sales, insurance services, loan servicing, loan sale, investment banking, securities brokerage and service charges on deposit accounts.

that banks that manage client investments (asset management) have lower credit risk. The relationship is stronger during the post-crisis period. These findings are robust across different specifications, credit risk proxies and estimation techniques. The results help explain the positive relationship between fiduciary and risk-adjusted returns shown by Stiroh (2004). Further investigation for this group of banks shows a positive association between fiduciary income and franchise value. Banks with a higher share of fiduciary income earn lower interest income on loans secured by real estate so it could be that preferential mortgage rates are being charged in 'exchange' for managing clients' assets.

We also find evidence of cross-subsidization for several non-interest activities and traditional lending-borrowing business, in particular for *Large Banks.* For instance, the interest rate on loans secured on real estate is negatively correlated to revenue generated from loan servicing and sales. Moreover, banks with higher income from investment banking have, on average, lower interest rates on C&I loans. This is particularly important, because previous studies (Carbo and Rodriguez, 2007 and Lepetit et al., 2008b) typically find more widespread evidence of cross-subsidization effects. In fact, we find that higher deposit services charges are associated with larger interest spreads, which suggests that banks do not use higher deposit fees to subsidize lending rates. Our analysis of *Small Banks* (those with assets under $100 million) show little evidence of any significant link between non-interest activities, credit risk and price cross-subsidization[3]. Finally, we also investigate pair-wise profit complementarity and (dis)economies of joint production between lending and non-interest activities. We find evidence in support of scope economies for *medium-size* commercial banks, whereas other banks in particular *small* commercial banks suffer from diseconomies of joint production. This finding contributes to the literature and provides further evidence on the role of size and scope economies in U.S. banking.

[3] Non-interest income have too small weight in total operating income of these banks to affect their lending.

The remainder of the paper is organized as follows: Section 2 outlines our methodology and econometric specifications. Section 3 describes the data and summary statistics. Section 4 discusses the results and finally section 5 concludes.

2. Econometric Specification and Methodology

Our objective is to investigate the impact of non-interest activities on credit risk and interest spreads to seek any evidence on the existence of cross-subsidization between interest and non-interest businesses. For this purpose, we estimate the following *dynamic* panel models based on Berger and DeYoung (1997) and Carbo and Rodriguez (2007) and Delis and Kouretas (2011)[4]. The variables we consider are the determinants of credit risk and lending-deposit spreads as highlighted in the literature (McShane and Sharpe, 1985; Clair, 1992; Angbazo, 1997; Kwan and Eisenbeis, 1997; Maudos and De Guevara, 2004; Dell'Ariccia and Marquez, 2006; Ogura, 2006; Lepetit et al., 2008b; Foos, et al., 2010):

$$\begin{aligned}\text{Credit\_Risk}_{i,t} = {} & \alpha_0 + \alpha_1\times\text{Credit\_Risk}_{i,t-1} + \sum_{k=1}^{8}\alpha_{2,k}\times\text{Non-interest\_Income\_Activities}_{k,i,t} + \\ & \alpha_3\times\text{Capital}_{i,t} + \alpha_4\times\text{Risk\_Weighted\_Assets}_{i,t} + \alpha_5\times\text{Size}_{i,t} + \\ & \alpha_6\times\text{Loan\_Growth}_{i,t} + \alpha_7\times\text{Yield\_on\_Total\_Loans}_{i,t} + \alpha_8\times\text{C\&I\_Loans}_{i,t} + \\ & \alpha_9\times\text{Agricultural\_Loans}_{i,t} + \alpha_{10}\times\text{Consumer\_Loans}_{i,t} + \alpha_{11}\times\text{All\_Other\_Loans}_{i,t} + \\ & \alpha_{12}\times\text{Short\_Term\_Loans}_{i,t} + \alpha_{13}\times\text{Loan\_Commitment}_{i,t} + \\ & \sum_{y=2007}^{2015}\alpha_{14,y}\times\text{Year\_Dummy}_{y,t} + \sum_{q=1}^{3}\alpha_{15,q}\times\text{Quarter\_Dummy}_{q,t} + \varepsilon_{i,t} \qquad (1)\end{aligned}$$

$$\begin{aligned}\text{Spread}_{i,t} = {} & \beta_0 + \beta_1\times\text{Spread}_{i,t-1} + \sum_{k=1}^{8}\beta_{2,k}\times\text{Non-interest\_Income\_Activities}_{k,i,t} + \\ & \beta_3\times\text{Capital}_{i,t} + \beta_4\times\text{Infficiency}_{i,t} + \beta_5\times\text{Liquidity}_{i,t} + \beta_6\times\text{Interest\_Rate\_Risk}_{i,t} + \\ & \beta_7\times\text{Core\_Deposit}_{i,t} + \beta_8\times\text{Wage}_{i,t} + \beta_9\times\text{Size}_{i,t} + \\ & \beta_{10}\times\text{C\&I\_Loans}_{i,t} + \beta_{11}\times\text{Agricultural\_Loans}_{i,t} + \beta_{12}\times\text{Consumer\_Loans}_{i,t} + \\ & \beta_{13}\times\text{All\_Other\_Loans}_{i,t} + \beta_{14}\times\text{Loan\_Commitment}_{i,t} + \\ & \sum_{y=2007}^{2015}\beta_{15,y}\times\text{Year\_Dummy}_{y,t} + \sum_{q=1}^{3}\beta_{16,q}\times\text{Quarter\_Dummy}_{q,t} + \eta_{i,t} \qquad (2)\end{aligned}$$

where individual banks and time dimension are represented by i and t subscripts, respectively. Variation in credit risk (*Credit Risk*) and lending-borrowing spread (*Spread*) are modelled in Equations (1) and (2) as a function of our variables of interest, namely, income shares from various non-interest activities including fiduciary activities, insurance, annuities,

[4] We need to address several econometric concerns in our study. We deal with the omitted-variable bias by introducing a lagged dependent variable on the right-hand-side of the equation (following Wooldridge 2016 p. 283) and by applying panel estimation techniques. We also address this concern in sub-section 4.4.3. by using Heckman's self-selection model following Campa and Kedia (2002), and Laeven and Levine (2007).

loan servicing, investment banking and securities brokerage. These activities are expected to increase the scope of banking operations and extend relationships with borrowers. Moreover, we also take into account non-interest income from loan sales and service charges on deposit accounts. The latter represents how actively clients do banking (the scale of relationship) and/or banks' market power and pricing strategy with regard to servicing account holders. Both models include a range of bank-level control variables, and time fixed effects.

We use a dynamic panel setting for our study as suggested by Carbo and Rodriguez (2007) and Delis and Kouretas (2011). This allows us to address the persistence in bank risk-taking. We estimate the models using fixed effects, similar to Loutskina (2011)[5].

2.1. DEPENDENT VARIABLES

In model (1) we use the ratio of loan-loss provisions to average gross loans (*Loan Loss Provision*) as a proxy for *Credit Risk*. Loan loss provisions are a flow proxy for loan quality and reflect the adjustment of loan-loss reserves and write-offs. As a robustness check, we consider the ratio of non-performing loans to gross loans (*Non-performing Loans)*. This consists of non-accrual loans and loans which are past due for 90 days or more and still accruing. These proxies are widely used in the literature as accounting-based credit risk indicators (for instance Kwan and Eisenbeis, 1997; Gonzalez, 2005; Carbo and Rodriguez, 2007; Delis and Kouretas, 2011; Fiordelisi, Marques-Ibanez and Molyneux, 2011).

For the *Spread* model (Equation (2)) we follow the literature (Carbo and Rodriguez, 2007; Lepetit et al., 2008b) and use the net interest spread, which is defined as $\frac{total\ interest\ income}{average\ total\ earning\ assets} - \frac{total\ interest\ expense}{average\ total\ interest-bearing\ liabilities}$ (*Spread*).

2.2. VARIABLES OF INTEREST

[5] In the dynamic panel specification the lagged dependent variable becomes endogenous when the sample has a small time dimension (the literature considers this problematic for a sample with less than 15 time periods, whereas in this study we use 32 time periods). Roodman (2009) also suggests applying difference and system GMM techniques to panels with small T and large N. He points out that with large T, a dynamic panel bias becomes insignificant and the straightforward fixed effect technique can be used. In fact, the number of instruments in difference and system GMM tends to explode with T.

On the basis of the breakdown provided in the Federal Financial Institutions Examination Council (FFIEC) 031 Reports of Income and Condition (Call Reports), and data availability, we consider eight major non-interest business lines that are expected to influence customer credit relationships and banks' lending[6].

1) Income from fiduciary activities (*Fiduciary*).

   Clients using fiduciary services entrust their assets to banks for management or safekeeping against payment of a fee. Attracting such clients requires reputational capital and expertise in asset management. Hence, we expect successful banks to have a better chance of selling fiduciary services. Provision of fiduciary services can also improve loan quality, because a) banks can grant wealthy and relatively low-risk clients loans in order to strengthen wealth management ties. These clients may use their assets as collateral to borrow to fund traditional purchases (property etc). Such lending is collateralized and hence is less risky. b) Banks' asset management can benefit from synergies and scale economies associated with managing entrusted funds (Boot, 2003).

2) Fees and commissions from annuity sales (*Annuities*).

   As pointed out by Boot (2003), annuity sales are similar to savings products that banks produce jointly to make more use of their expertise in asset management. By using these products, clients establish a long-run relationship and provide banks with stable funding. This financial resource is also likely to enhance bank's position in lending.

3) Underwriting income from insurance and reinsurance activities and income from other insurance activities (*Insurance*).

   Insurance income provides banks with financial resources (a pool of premiums) under management that may be used partly in lending. Nevertheless, the nature of risk in this

[6] Due to a lack of sufficient data, we are unable to take into account income from other activities such as venture capital and securitization activities. Because we focus primarily on lending we do not analyze other items of non-interest income which are not expected to expand the scope of clients' relationships, such as other asset sales.

business requires specific asset management skills that likely limits synergies with credit products. Banks that have more general insurance business are likely to be aware of the items insured – autos, residential and commercial property, other high value goods – that may require re-financing in the future and therefore can suggest lending opportunities. However, offering both lending and insurance services to the same clients may lead to weakening lending standards. This is particularly important for smaller banks where the interplay between lending and other businesses is more pronounced.

4) Investment banking, advisory, and underwriting fees and commissions (*Investment Banking*)

   Existing studies (Bharath et al. 2007) show that previous lending relationships facilitate investment banking activity. Investment banking can further improve banks' position in lending by providing access to proprietary information. Nevertheless, this potential positive impact might be cancelled out by the associated agency problem and/or loss of focus caused by activity diversification.

5) Net servicing fees (*Loan Servicing*)[7].

   In undertaking loan-servicing activities banks may underprice mortgage loans and/or target borrowers less likely to make timely instalments so as to boost fees (Wagner, 2009). Servicers can also collect soft information and identify borrowers who regularly fulfil their repayment obligations and this information can be used by banks for 'improved' future loan origination. Given these two conflicting views, the relationship between *Loan Servicing* and lending quality is undetermined prior to estimation.

6) Net gains (losses) on sales of loans and leases (*Loan Sale*).

[7] Servicing companies typically receive a percentage of the outstanding amount of the loans they service. Normally, they do not own the loans. Services include statements, impounds, collections, tax reporting, and other requirements. Any person with a mortgage loan pays her scheduled instalments to a loan-servicing firm. Most mortgages (known as conforming mortgages) are backed by Federal housing programs such as Fannie Mae and Freddie Mac.

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Access to market funding through the sale of loans may depend on reputation in loan monitoring and screening. Therefore, banks have to build a record in lending (a sort of certification effect) before entering into these areas. However, a strong presence in the market and ability to sell the loans easily may encourage banks to invest less in loan monitoring (Parlour and Plantin, 2008) that could lead to a deterioration in loan quality (Purnannandam 2010).

7) Service charges include charges on deposit accounts in domestic offices, income and fees from the printing and sale of checks, income and fees from automated teller machines and bank card and credit card interchange fees (*Service Charge*).

Service Charge can represent the volume of transactions with clients and how much income can be obtained from such transactions. Banks with greater income from these services might have clients that are more financially active, or they could be exerting market power charging higher fees. Lower service charges, again, may be a consequence of limited account activity or may reflect cross-subsidization where lower fees are charged to attract loans at higher spreads.

We also include income from 8) securities brokerage in our models. The aim is to analyze the implications for credit risk and spread resulting from variation in the aforementioned non-interest activities.

2.3. CONTROL VARIABLES

The ratio of equity capital to total assets (*Capital*) is controlled for in both models. On the one hand, higher *Capital* is associated with lower moral hazard problems and better capitalized banks have greater monitoring incentives (Berger et al., 1995, and Keeley and Furlong, 1990). On the other hand, an increase in equity capital encourages risk-taking behavior (Koehn and Santomero, 1980; Kim and Santomero, 1988 and Blum, 1999 among others). *Capital* represents equity-holders' risk preferences (McShane and Sharpe, 1985 and

Maudos and De Guevara, 2004) and banks with a higher capital ratio may require a greater spread to compensate for the higher cost of equity compared to debt finance.

We include the ratio of the face value of unused credit lines and loan commitments to total assets (*Loan Commitment*) in our analysis. Borrowers of banks with higher *Loan Commitment* face, on average, lower liquidity shocks and have the capacity to be more leveraged. As such, we expect a negative relationship between *Loan Commitment* and *Credit Risk*. Berg, Saunders and Steffen (2016) show that credit lines act as insurance for borrowers against liquidity shocks and the related fees (including commitment fees) smooth borrowing costs across different scenarios (namely, the presence and absence of liquidity shocks). Therefore, higher *Loan Commitment* may represent greater borrowing cost smoothing and lower *Spread*.

We also capture heterogeneity in the credit portfolio by classifying loans into five groups and calculate their share in total loans: Loans secured on real estate (*Real Estate Loans*), commercial and industrial loans (*C&I Loans*), consumer loans (*Consumer Loans*), loans to finance agricultural production (*Agricultural Loans*) and other types of loans (*All Other Loans*). We consider *Real Estate Loans* as the benchmark and introduce the other four types of loans into our model[8].

We also control for bank size by including the logarithm of total assets (*Size*) in both models. *Size* can have several impacts on *Credit Risk* and *Spread*: Large and small banks have different business models, the former relying more heavily on non-interest activities given their greater capacity to benefit from diversification and scale economies (Hughes et al., 2001). Larger banks may also hold riskier loan portfolios to benefit from safety net subsidies (Kane, 2010). Moreover, bigger banks mainly deal with larger and more transparent borrowers, while small banks are more likely to lend to small and opaque firms. Alternatively,

[8] Thanks to an anonymous referee for this suggestion, we control for characteristics of banks loan portfolio in our analysis.

large borrowers generally have easier access to financial markets as a substitute for bank lending. Hence, large banks could face higher competition, resulting in greater risk-taking and lower spreads.

In our *Credit Risk* model (1) we control for *Risk Weighted Assets*, as it captures a number of risk factors such as borrowers' type and the existence of collateral (Berger and DeYoung, 1997). We add the quarterly growth rate of gross loans (*Loan Growth*) to the *Credit Risk* model, since the literature shows a negative relationship between credit expansion and loan quality (Clair, 1992; Dell'Ariccia and Marquez, 2006; Ogura, 2006; Foos, et al., 2010). We also include the implicit interest rate on loans (*Yield on Total Loans*). Setting a higher interest rate may increase *Credit Risk*. Alternatively, cheap credit may represent a weak marketing strategy, lax lending standards and higher *Credit Risk*. *Credit Risk* may also depend on the duration; hence, we consider the share of loans with maturity less than one year (*Short-Term Loans*) in the *Credit Risk* equation.

In the *Spread* model (model 2), we control for cost inefficiency (*Inefficiency*), because less efficient banks are expected to have a higher spread to cover higher costs (Altunbas, Evans and Molyneux, 2001). We also introduce the ratio of liquid assets to total liabilities (*Liquidity*) into our model to capture liquidity risk and the difference between loans and securities with maturity over one year and liabilities with maturity more than one year divided by total assets as a measure of interest rate risk (*Interest Rate Risk*). We expect higher liquidity or interest rate risk to translate into higher *Spread* (Angbazo, 1997; Carbo and Rodriguez, 2007 and Saunders and Schumacher, 2000 among others). The share of core deposits in total liabilities (*Core Deposit*) is also included in Equation (2), as *Spread* depends on the structure of debt financing. We also consider salaries and employee benefits divided by the number of full-time equivalent employees (*Wage*) as a proxy for employees' expertise.

Banks with greater expertise are expected to have a higher *Spread*, since they are expected to offer more specialized and higher valued services.

In both models, we attempt to capture time fixed effects by introducing nine year-dummy variables for the years 2007 to 2015. Year 2016 is considered the benchmark. We also control for seasonal effects by including three quarter dummies, where the last quarter is set as the benchmark. Table A1 in the appendix outlines the variables used in our models.

3. Data and Descriptive Statistics

Our empirical investigation is based on a sample of 6,921 commercial banks domiciled in the U.S. The sample is constructed on a quarterly basis between 2007:Q3 and 2016:Q3, providing a total of 165,924 bank-quarter observations. Banks' financial data is collected from SNL, and failed banks are identified from the website of the FDIC. We exclude banks that have been in operation for less than three years and banks with no loans and core deposits. Outliers are removed from the sample by dropping up to 1% of observations on each tail that lie outside three standard deviation of the mean. The dropping is made in an iterative process, because after cutting outliers in each round, the standard deviation and therefore the domain of observations become smaller. The dropping is stopped when there is no observation beyond three standard deviations of the mean or cumulative droppings reach 1% on each tail. Moreover, we double-check all variables and their distributions manually to make sure that observations are in an acceptable range[9].

The U.S. banking system is dominated by small banks with a relatively different business model. As banks become larger their funding strategy, loan composition and income structure tend to change. Therefore, we split our sample into three groups: small banks with less than $100 million in total assets (*Small Banks*), medium banks with total assets between

[9] Thanks to an anonymous referee for detailed comments on the descriptive statistics, which we have taken into account in the paper.

ACCEPTED MANUSCRIPT

$100 million and $1 billion (*Medium Banks*), and large commercial banks with more than $1 billion in total assets (*Large Banks*).

Table I presents the descriptive statistics for *Small, Medium and Large Banks*. The mean equality tests show a significant difference between the three groups of banks. The figures show that *Loan Loss Provision* of *Medium Banks* equals 0.12% which is significantly higher than that of *Small Banks* (0.08%), but lower than *Large Banks* (0.18%); *Large Banks* also hold on average more *Non-performing Loans* (2.13%) than *Small and Medium Banks* (1.57% and 1.86%, respectively).

Spread and Cost of Fund are the highest for Small Banks (3.58% and 1.26%, respectively). They decrease for larger groups of banks. *Small Banks* also have the lowest *Risk Weighted Assets* (63.49%) and the highest *Capital* (11.3%). They are less exposed to the risk of interest rate rises. *Large Banks* have on average the lowest *Core Deposits* and *Liquidity*. They are the most efficient banks, while they pay on average the highest *Wage*.

The second part of the table illustrates the characteristics of loan portfolios of banks in our sample. *Growth Loans* and *Loan Commitment* are the lowest for *Small Banks*. Loan composition varies across banks with different size. *Medium Banks* have the highest proportion of loans secured on real estate (*Real Estate Loans*). Among the three groups, *Large Banks* allocate the greatest proportion of loans to *C&I Loans*, whereas *Agricultural Loans* have the highest share in loan portfolio of *Small Banks*. *Short-term Lending* decreases by size of banks from 30.54% for *Small Banks* to 26.12% and 23.46% for *Medium* and *Large Banks*. The figures also show that smaller banks charge a higher interest rate on their loans. The average interest rates of loans granted by *Small, Medium* and *Large Banks* are 6.49%, 5.95% and 5.34%, respectively. For all groups of banks, *Consumer Loans* are the most expensive and *Real Estate Loans* are the cheapest.

[TABLE I]

ACCEPTED MANUSCRIPT

The third part of the table depicts the income shares of non-interest activities in total operating income and our variables of interest, namely, *Fiduciary*, *Annuities, Insurance, Investment Banking, Loan Servicing, Securities Brokerage, Loan Sale* and *Service Charge*. The descriptive statistics show that the share of non-interest activities in total operating income of *Large Banks* is 20.90%, whereas the share is 14.84% and 12.32% for *Medium* and *Small Banks*, respectively[10]. Other than *Service Charge*, which is the highest for *Small Banks*, the income share of other non-interest activities follow almost a similar pattern and increase by banks' size. The income share for *Fiduciary* is 2.36% for *Large Banks*, while it is 0.61% and 0.04% for *Medium and Small Banks*. *Other Non-interest Income* accounts for 4.23%, 5.15% and 7.60% of total operating income for *Small*, *Medium* and *Large Banks*, respectively.

4. Empirical Results

4.1. CREDIT RISK

We estimate the *Credit Risk* model (Equation (1)) using our quarterly panel data to investigate whether non-interest activities have any impact on banks' loan quality. We apply the fixed effects technique with standard errors clustered at the bank level. Table II presents the estimation results for *Small*, *Medium* and *Large Banks* during the period under study.

Column (1) illustrates the estimation of the model for *Small Banks*, where we find no significant relationship between non-interest activities and *Credit Risk*. Columns (2) to (7) present the results for *Medium Banks*. In column (2), we regress *Loan Loss Provision* as the *Credit Risk* proxy on its own lagged value and non-interest activities, namely *Fiduciary, Annuities, Insurance, Investment Banking, Loan Servicing, Securities Brokerage, Loan Sale* and *Service Charge.* We also control for year and quarter fixed effects. In the third column, we add *Capital, Risk Weighted Assets and Size*. In column (4), we aim to capture

[10] Stiroh (2006) quotes 23.9% as the *Noninterest Income* of traded BHCs operating between 1997 and 2004. Elyasiani and Wang (2009) report 24% as the *Noninterest Income* of listed BHCs operating between 2001-2005 period. The average bank considered in their studies is larger and more diversified than the average bank studied in our paper.

heterogeneities caused by loan portfolio characteristics by adding *Loan Growth, Yield on Total Loans, C&I Loans, Agricultural Loans, Consumer Loans, All Other Loans, Short-Term Loans* and *Loan Commitment* to our model. In all specifications the results show significant and negative coefficients for *Fiduciary* implying that income from this business appears to lower *Credit Risk*. The result is also economically meaningful. A one percent increase, evaluated at the mean, in the income share of *Fiduciary* in total net operating income lowers *Loan Loss Provision* on average by 0.004%. The average *Loan Loss Provision* is 0.12%, so the effects are economically significant and equal to a 3.33 percent ($=\frac{0.004\%}{0.12\%}$) fall on average *Loan Loss Provision.*

We carry out a set of robustness checks. In column (5), we use a panel data setting and estimate our model using lagged values of all right-hand-side variables and find a similar result for *Fiduciary*. Moreover, we scale the non-interest income items by total assets in lieu of total net operating income and re-estimate our model. The results are reported in column (6) and in-line with our previous findings: *Fiduciary* negatively affects *Credit Risk.* Column (7) shows the result when we use *Non-performing Loan* as the alternative proxy for *Credit Risk* in lieu of *Loan Loss Provision*. The result supports our finding for *Fiduciary.* As a further robustness check and following Thompson (2011)[11], we cluster the standard errors by quarter and find similar results[12]. We also consider *Loan Growth* as an endogenous variable, because it can be influenced by the riskiness of existing loans[13]. We address this endogeneity problem using the two stage least squares technique and employing the second, third, fourth and fifth lags of *Loan Growth* as instruments. The result in the first step shows that the

[11] Petersen (2009) and Thompson (2011) both claim that when the dimensions of panel are extremely unbalanced, there is no need to double cluster at all; however, the former believes that single-clustering on the more frequent dimension (bank in our case) is almost identical to clustering by both dimensions, whereas the latter argues that in this case, single-clustering on the less frequent dimension (time in our case) removes the bias.

[12] The results are not reported here, but are available from the authors upon request.

[13] We would like to thank an anonymous referee for underscoring this important point.

instruments are strong and relevant (the null hypothesis that they are jointly zero is strongly rejected) and hence the model does not suffer from the weak instrument problem. In the second stage, we find that the negative link between *Fiduciary* and *Credit Risk* persists[14]. Overall, the outcome implies that income from *Fiduciary* appears to lower *Credit Risk* for *Medium Banks*.

Among the control variables, we find that *Credit Risk* is positively linked to increases in *Risk-Weighted Assets* (unsurprisingly), *Size* and *Short-Term Loans*. *Loan Growth, Yield on Total Loans, Consumer Loans and Loan Commitment* are associated with lower *Credit Risk*. We also estimate our model for *Large Banks*. The result is presented in column (8) and shows no significant relationship between *Credit Risk* and our variables of interest.

[TABLE II]

We also study the relationship between non-interest activities and *Credit Risk* for two important groups of banks, - systemically important banks which we define as commercial banks with total assets more than $50 billion as (*Systemically Important Banks*)[15] and distressed banks. We define the latter as banks that failed during their last 12 quarters of operation. The results show no relationship between non-interest activities and *Credit Risk*[16].

4.2. SPREAD

In this sub-section, we investigate the relationship between non-interest activities (*Fiduciary, Annuities, Insurance, Investment Banking, Loan Servicing, Securities Brokerage, Loan Sale* and *Service Charge*) and *Spread*, in particular, we are interested in studying possible cross-subsidization between the two sources of income. We use the fixed effects technique with standard errors clustered at the bank level. Moreover, we scale revenue from

[14] The results are not reported here, but are available from the authors upon request.

[15] For simplicity, we merely consider size to define *Systemically Important Banks*. The $50 billion threshold is based on the Federal Reserve Boards proposed rules to define "*significant*" firms issued on February 11, 2011: http://www.federalreserve.gov/newsevents/press/bcreg/20110208a.htm.

[16] The results are not reported here, but are available from the authors upon request.

ACCEPTED MANUSCRIPT

non-interest activities by total assets instead of total operating income, because the latter includes net interest income, which is affected by *Spread* and thereby may display a spurious relationship between *Spread* and non-interest income items[17]. Table III presents the estimation results of Equation (2) using quarterly data of *Small, Medium* and *Large Banks*.

The first column reports the result for the *Small Banks* sub-sample. We find no evidence of cross-subsidization between non-interest activities and the lending-borrowing spread. Indeed, we observe that *Spread* is positively associated with *Insurance* and *Service Charge*. Banks with higher service charges have higher spreads – so this shows that there is no cross-subsidization in pricing – such a finding reflects pricing power emanating from brand strength (higher quality services earn higher spreads and fees) or market power (or a combination of both). The results also show that better capitalized banks have a higher *Spread*. This is in-line with our expectations and the existing literature (Carbo and Rodriguez 2007). The higher cost of equity compared to debt requires a premium for capital over the interest spread. Smaller banks have on average a higher *Spread*, which is consistent with scale economies and recent literature (Hughes and Mester 2013).

Core deposits depicts a positive relationship with *Spread*. Core deposits represent banks' charter value, which justifies a premium on *Spread*. The findings support the results of Carbo and Rodriguez (2007). As expected *Inefficiency* necessitates a higher *Spread*. We also find that *Spread* has a positive association with *Liquidity Risk* and *Interest Rate Risk* (as also found by Angbazo 1997; Saunders and Schumacher 2000; Carbo and Rodriguez 2007).

Columns (2) & (3) illustrate the regression results for *Medium Banks*. In column (2), we estimate the *Spread* model. We find a positive coefficient for *Annuities*, *Insurance* and *Service Charge*. The result also shows a negative association between *Loan Sale* and *Spread*. Since mortgage loans are more easily saleable in the market, banks that are more active in

[17] In the *Spread* model, we also define *Inefficiency* as the ratio of non-interest expense divided by total assets in lieu of total operating income.

loan sales may charge lower interest on *Real Estate Loans*. Therefore, in column (3), we use *Yield on Real Estate Loans* as the dependent variable[18]. We find no significant relationship between *Yield on Real Estate Loans* and *Loan Sale*. However, we do find some evidence to support cross-subsidization between fiduciary and loans secured on real estate.

In columns (4) to (9), we study *Large Banks*. In column (4), similar to *Small* and *Medium Banks*, we observe a positive association between *Service Charge* and *Spread*. We also find that *Spread* is negatively correlated with *Fiduciary* and *Loan Sale*. In order to examine whether a lower *Spread* of banks with a higher *Fiduciary* is driven by a higher funding cost or a lower loan interest rates, in columns (5) & (6), we use *Cost of Fund* and *Yield on Total Loans*, respectively, as the dependent variable. We find a significantly negative relationship between *Fiduciary* and *Yield on Total Loans*. The results also show that *Securities Brokerage* and *Loan Sale* are negatively correlated with both *Cost of Fund and Yield on Total Loans*. The link is stronger for *Loan Sale*. In columns (7) to (9), we use *Yield on Real Estate, Yield on C&I Loans* and *Yield on Consumer Loans*, respectively, as the dependent variable to further explore the cross-subsidization between non-interest activities and lending. We do not find a significant relationship between *Fiduciary* and our dependent variables despite our finding on the *Yield on Total Loans* model. However, we find that banks with a higher income on *Loan Sale* charge a lower rate on *Real Estate Loans*. Moreover, banks with a higher income share from *Investment Banking* or *Securities Brokerage* tend to charge a lower interest rate on *C&I Loans* and *Consumer Loans*. The results also display a negative correlation between *Loan Servicing* and *Real Estate Loans.*

Overall, we find some evidence to support the cross-subsidization conjecture driven mainly by *Medium and Large Banks'* lending secured on real estate and various non-interest activities such as *Fiduciary, Loan Sale, Loan Servicing* and *Investment Banking*. We also find

[18] In this specification, we exclude the variables representing composition of loan portfolio and *Loan Commitment*.

ACCEPTED MANUSCRIPT

that an increase in *Service Charge* is associated with an increase in *Spread,* which suggest that banks do not follow a loss-leader strategy in servicing depositors.

[TABLE III]

4.3. PROFIT COMPLEMENTARITIES[19]

The linkage between non-interest activities and lending may be due to informational or profit synergies. In this section we investigate whether pair-wise profit complementarity exists between lending and non-interest activities that might contribute to joint production[20]. As such, we examine whether the marginal profit of producing loans increases when they are generated jointly with non-interest activities[21].

In a multi-product firm pair-wise profit complementarity (PPC) between two products exists when an increase in product A increases the marginal profit of producing product B[22].

[19] Thanks to an anonymous referee for this suggestion, we examine profit synergies.

[20] Informational synergy analysis requires detailed data on clients' relationship which are not available.

[21] We follow Berger and Mester (1997) and set-up the following multi-product alternative profit function with a trans-logarithmic functional form (Berndt and Christensen, 1973):

$$LnTP = C_0 + \sum_{i=1}^{5} \alpha_i LnY_i + \sum_{j=1}^{3} \beta_j LnW_j + \gamma_1 LnZ + \tau_1 Trend + \frac{1}{2}\left[\sum_{i=1}^{5}\sum_{k=1}^{5} \delta_{i,k} LnY_i LnY_k + \sum_{j=1}^{3}\sum_{l=1}^{3} \theta_{j,l} LnW_j LnW_l + \gamma_2 (LnZ)^2 + \tau_2 Trend^2\right] + \sum_{i=1}^{5}\sum_{j=1}^{3} \mu_{i,j} LnY_i LnW_j + \sum_{i=1}^{5} \vartheta_i LnY_i\, LnZ + \sum_{i=1}^{5} \pi_i LnY_i\, Trend + \sum_{j=1}^{3} \varphi_j LnW_j\, LnZ + \sum_{j=1}^{3} \sigma_j LnW_j\, Trend + \varepsilon \quad \text{(F-1)}$$

Wherein: TP = the total profit defined as net income before income taxes and discontinued operations. Y is the output vector consisting of: Y1 = Net loans and leases; Y2 = securities plus federal funds sold, securities purchased under agreements to resell and other investments; Y3 = total nominal value of off-balance sheet items; Y4 = the income from the non-interest activities (*Fiduciary*, *Annuities*, *Insurance*, *Investment Banking*, *Loan Servicing* and *Securities Brokerage*); Y5 = the income from service charges on deposit accounts.

W is the input price vector comprising: W1 = salary expenses divided by the number of full-time equivalent employees; W2 = expenses of premises and fixed assets divided by total fixed assets; W3 = total interest expense divided by interest-bearing liabilities.

Z = the total capital equity. Z is added to the model to control for unmeasured cost of equity capital. Banks with higher equity capital have higher profit as they have less debt financing and hence interest expense, assuming all other factors equal (Hughes and Mester, 2013).

We also impose input price homogeneity restrictions and symmetry assumptions. Since it is not possible to take logarithms of negative numbers, we replace negative total profit (loss) with one and include a variable in the right-hand-side of the equation that takes the value one when total profit is positive and equals the absolute value of the loss, when total profit is negative.

[22] This is similar to cost complementarity discussed in Clark (1988). In this paper we study profit complementarity, because several studies highlight the importance of profit maximization vis-a-vis cost minimization (Berger et al. 2004 among others), as profit is a broader indicator of corporate's performance and is more aligned with managerial objectives.

We can then write the measure of pair-wise profit complementarity (PPC) between products A and B as follows:

$$PPC(Y_A, Y_B) = \frac{\partial^2 TP}{\partial Y_A \partial Y_B} = \left(\frac{TP}{Y_A Y_B}\right) \times \left[\frac{\partial^2 LnTP}{\partial LnY_A \partial LnY_B} + \left(\frac{\partial LnTP}{\partial LnY_A}\right) \times \left(\frac{\partial LnTP}{\partial LnY_B}\right)\right] \quad (3)$$

PPC > 0 implies the existence of profit complementarity between products A and B.

PPC = 0 implies non-jointness or an absence of profit complementarities.

PPC < 0 implies diseconomies of joint production. The necessary condition (NC) for diseconomies of joint production (PPC<0) is: $NC = \frac{\partial^2 LnTP}{\partial LnY_A \partial LnY_B} < 0$ (4)

Table IV illustrates the empirical results on profit complementarity between non-interest activities and lending (Y1 & Y4) for *Small, Medium and Large Banks*. In this analysis, non-interest income consists of income from *Fiduciary, Annuities, Insurance, Loan Servicing, Securities Brokerage and Investment Banking*. Service charges on deposits accounts are classified as a separate output (Y5). Income from loan sales is excluded from the model. Moreover, we exclude the crisis period in this analysis. *Small, Medium and Large Banks* are studied in panels (A), (B) & (C), respectively.

In the first column, we define the profit function based on the intermediation approach (Berger and Mester, 1997 among others) and estimate it using the fixed effects technique[23]. In panel (A), the first two rows display marginal profit of Y1 & Y4 for *Small Banks*. The marginal profit of loans and non-interest income are about 0.12% and 36.79%, respectively. The substantial difference between the marginal profits of loans and non-interest activities is due to the fact that lending is measured in the model by the volume of loans, whereas non-interest activities are represented by the net income of such businesses. In the third row, the result shows the necessary condition for diseconomies of joint production is fulfilled. The

[23] We do not use the stochastic frontier approach, because in most cases we encounter estimation convergence problems.

fourth row depicts the result on pair-wise profit complementarity suggesting diseconomies of joint production. The impact is economically small. A one percent increase from the mean in non-interest income equals a 0.292% (0.292%=1%×14.28×$\frac{-0.0000245}{0.0012}$) fall in the marginal profit of loans.

[TABLE IV]

As a robustness check, we follow the production approach (Berger and DeYoung, 1997 among others) and include transaction deposits in our model as a further output. The results are presented in the second column. The marginal profit of both loans and non-interest income decreases, because in the production approach total profit is shared among more products. The result on the third row shows that the necessary condition for diseconomies of joint production of non-interest activities and loans is realized, which is in-line with our findings under the intermediation approach. In the fourth row, we observe that the sufficiency condition is also fulfilled and the measure of profit complementarity suggests diseconomies of joint production. The economic magnitude is small and slightly higher than that of the intermediation approach. A one percent increase from the mean in non-interest income equals a 0.356% decrease in the marginal profit of loans.

Panel (B) reports our results for *Medium Banks*. The results on the first column using the intermediation approach show that the marginal profit of loans and non-interest activities are on average lower compared to *Small Banks*. We find that the necessary condition for diseconomies of joint production is achieved, whereas the sufficient condition is not fulfilled, because the measure of profit complementarity, displayed in the fourth row, predicts economies of joint production. The economic magnitude is tiny. A one percent increase from the mean in non-interest income equals a 0.028% (0.292%=1%×101×$\frac{0.000000303}{0.00109}$) increase in the marginal profit of loans. The second column illustrates the results for the production approach. In row (3), we find that contrary to the intermediation approach, the necessary

ACCEPTED MANUSCRIPT

condition for diseconomies of joint production is not realized. Row (4) reports the measure of profit complementarity which suggests scope economies between non-interest income and lending. The economic magnitude is larger compared to the intermediation approach; yet it is tiny. A one percent increase from the mean in non-interest income equals a 0.041% increase in the marginal profit of loans.

Panel (C) displays our results for *Large Banks*. The first column exhibits our results when we follow the intermediation approach. Column (2) reports the outcome using the production approach. In both columns, we find that the marginal profit of loans is higher, but the marginal profit of non-interest activities is lower on average compared to *Small* and *Medium Banks*. The results show that the necessary and sufficient conditions for diseconomies of joint production are realized, because both NC and PPC are negative. The economic magnitude is tiny and smaller than that of *Small Banks*. A one percent increase from the mean in non-interest income equals a 0.029% decrease in the marginal profit of loans under both the intermediation and production approaches.

As further analysis, we limit the sample of *Large Banks* to banks with $1 to $10 billion total assets[24]. The results predict diseconomy of joint production. The economic magnitude becomes smaller, namely 0.008%, under the intermediation approach; however, it is almost unchanged under the production approach[25].

Overall, our findings suggest profit complementarity of joint production of loans and non-interest activities for *Medium Banks*. We find evidence for diseconomies of joint production for both Small and Large Banks. The joint production is less harmful for *Large Banks*, whereas *Small* can suffer the most from diseconomies of joint production.

[24] The results are not reported here, but are available from the authors upon request.

[25] We also study banks with $10 to $50 billion total assets and those with total assets more than $50 billion. The results on these two groups are not statistically reliable, for instance for the former group, we find a negative marginal profit for loans and for the latter group, the results substantially vary between the intermediation and the production approaches.

ACCEPTED MANUSCRIPT

4.4. FURTHER INVESTIGATION

4.4.1. Crisis and Post-Crisis Periods

In sections 4.1 & 4.2 we find a robust negative relationship between fiduciary activities and *Medium Banks*' credit risk and *Large Banks'* lending-borrowing spread. As a further analysis, in this sub-section, we explore the relationship between *Fiduciary, Credit Risk* and *Spread* during the global financial crisis and afterwards. Table V presents the results of our analysis using quarterly data of *Medium* and *Large Banks*. In all specifications, instead of year dummies, we include *Crisis*, a dummy that takes the value one for the crisis period, namely 2007-Q3:2009:Q2[26], and zero otherwise. We also add the interaction term of *Fiduciary* and *Crisis* to our models.

Columns (1) & (2) illustrate the estimation of the *Credit Risk* Model (Equation (1)). In the first column, *Fiduciary* shows a negative relationship with *Credit Risk* in the post-crisis period, (when *Crisis* takes the value zero), whereas the coefficient of the interaction term takes a positive sign. The F-test for the significance of the summation of the two coefficients shows that the relationship between *Fiduciary* and *Credit Risk* - even though it is weaker - remains significant during the crisis. In the second column, we study *Large Banks* and find no significant relationship between *Fiduciary* and *Credit Risk* during both crisis and post-crisis periods.

[TABLE V]

Columns (3) and (4) display the results for the *Spread* Model (Equation (2)) for *Medium* and *Large Banks*, respectively. In column (3), we find a significantly negative relationship between *Fiduciary* and *Spread* in the post-crisis period. However, the interaction term has a positive coefficient, and the result of the F-test of significance of the summation shows that its magnitude is substantial enough to wipe out the negative link between

[26] According to the National Bureau of Economic Research, the US recession ended in June 2009 (http://www.nber.org/cycles.html).

Fiduciary and *Spread*, and predicts no significant relationship during the crisis period. In column (4), contrary to our findings for *Medium Banks*, we observe that the negative relationship between *Fiduciary* and *Spread* for *Large Banks* persists during the crisis period.

Overall, the results show that *Fiduciary* lost its predictive power during the crisis period. This is in-line with empirical banking literature which shows that relationships that hold in normal times tend to change during crisis periods (e.g. Beltratti and Stulz 2012; De Jonghe and Öztekin 2015; Berger et al. 2016).

4.4.2. Franchise Value Model[27]

So far we find that fiduciary activities lower banks' credit risk. One plausible channel for explaining this finding is via banks' franchise value. In commercial banking, relationships with customers form a core part of intangible assets known as franchise or charter value (Boot, 2017). Non-interest activities can widen and stimulate such relationships by attracting new clients and increasing the scope of interactions with existing customers. Therefore, in this sub-section, we explore the relationship between non-interest activities and franchise value. We adopt the following model based on De Jonghe and Vennet (2008):

$$\begin{aligned}\text{Franchise\_Value}_{i,t} = {} & \lambda_0 + \sum_{k=1}^{8} \lambda_{1,k} \times \text{Non-interest\_Income\_Activities}_{k,i,t} + \lambda_2 \times \text{Credit\_Risk}_{i,t} + \\ & \lambda_3 \times \text{Inefficiency}_{i,t} + \lambda_4 \times \text{Core\_Deposit}_{i,t} + \lambda_5 \times \text{Capital}_{i,t} + \lambda_6 \times \text{Size}_{i,t} + \\ & \sum_{y=2007}^{2015} \lambda_{7,y} \times \text{Year\_Dummy}_{y,t} + \sum_{q=1}^{3} \lambda_{8,q} \times \text{Quarter\_Dummy}_{q,t} + \mu_{i,t} \qquad (5)\end{aligned}$$

Where individual banks and the time dimension are represented by i and t subscripts, respectively. We use market to book value of equity capital (*Market to Book Value*) as a proxy for franchise value (*Franchise Value*). Variations in *Franchise Value* are modelled in Equation (5) as a function of non-interest activities and a set of controls. We control for *Credit Risk, Inefficiency, Core Deposit, Capital* and *Size.* Banks with a higher credit risk and inefficiency are expected to have lower franchise value. Core deposits are a stable source of funding representing clients' relationships and are expected to increase franchise value. We

[27] Thanks to an anonymous referee for this suggestion, we estimate a *Franchise Value Model*.

ACCEPTED MANUSCRIPT

also control for capital strength using the equity capital to assets ratio, because banks with less capital are likely to be more risky and hence are expected to have a lower franchise value. We also control for size of banks in our model and predict a positive relationship between size and franchise value. Finally, we include year and quarter dummy variables to capture year and quarter fixed effects.

We estimate the *Franchise Value* model (Equation (5)) using 1,840 quarterly panel data on listed *Medium Banks*. Table VI presents the estimation results. In the first column, we estimate our model using fixed effects techniques. The result shows that *Franchise Value* is positively correlated with *Fiduciary* and *Loan Servicing*. We also find that banks with a higher *Credit Risk* or *Inefficiency* have on average lower *Franchise Value*.

In columns (2) – (5), we examine the robustness of our results. In the second column, we follow Petersen (2009) and Thompson (2011) and cluster standard errors at both bank and quarter levels, because the dimensions of our panel data are not extremely unbalanced toward either of the two dimensions. In column (3), we use the lagged value of right-hand-side variables to address potential endogeneity of explanatory variables. In both specifications, the results on *Fiduciary* and *Loan Servicing* remain unchanged. In column (4), we adopt a dynamic panel setting for our model to deal with omitted-variable bias following Wooldridge (2016 p. 283) and find that the positive and significant relationship of *Franchise Value* and *Fiduciary* persists, while the significant coefficient of *Loan Servicing* and *Franchise Value* disappears. In column (5), we scale non-interest income items by total assets to control for possible impacts caused by variation in total operating income. The result is in-line with previous findings. There is a robust and significantly positive relationship between *Fiduciary* and *Franchise Value*.

[TABLE VI]

4.4.3. Self-selection Model

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We find a negative relationship between income share of fiduciary activities and credit risk; however, it could be argued that factors behind fiduciary income might also explain the lower level of credit risk. To control for this endogeneity issue in identifying the impact of fiduciary activities on credit risk, we follow Campa and Kedia (2002) and Laeven and Levine (2007) and use Heckman's (1979) two-step procedure for estimation of self-selection models.

We define a dummy variable that takes the value one for banks with fiduciary income, and zero otherwise (*Fiduciary Dummy*) and model banks' decision for providing fiduciary services as a function of a set of bank characteristics and estimate the relationships using a probit model:

$$\begin{aligned}\text{Fiduciary\_Dummy}_{i,t} &= f(\theta X_{it}) = f(\theta_0 + \theta_1 \times \text{Risk\_Weighted\_Assets}_{i,t} + \theta_2 \times \text{Inefficiency}_{i,t} + \\ &\theta_3 \times \text{Core\_Deposits}_{i,t} + \theta_4 \times \text{Capital}_{i,t} + \theta_5 \times \text{Size}_{i,t} + \\ &\sum_{y=2007}^{2015} \theta_{6,y} \times \text{Year\_Dummy}_{y,t} + \sum_{q=1}^{3} \theta_{7,q} \times \text{Quarter\_Dummy}_{q,t}) \qquad (6)\end{aligned}$$

We also define *Credit Risk* as a function of the *Fiduciary Dummy* and the control variables described in Equation (1) ("*Controls"*).

$$\text{Credit\_Risk}_{i,t} = \delta_0 + \delta_1 \times \text{Credit\_Risk}_{i,t-1} + \delta_2 \times \text{Fiduciary\_Dummy}_{,i,t} + \sum_{k=1}^{15} \delta_{3,k} \times \text{Controls}_{k,i,t} + \upsilon_{i,t} \qquad (7)$$

The expected *Credit Risk* conditional on having fiduciary income is estimated as follows:

$$\begin{aligned}E(\text{Credit\_Risk}_{i,t} \mid \text{Fiduciary\_Dummy}_{i,t} = 1) &= \delta_0 + \delta_1 \times \text{Credit\_Risk}_{i,t-1} + \delta_2 + \sum_{k=1}^{15} \delta_{3,k} \times \text{Controls}_{k,i,t} + \\ &E(\upsilon_{i,t} \mid \text{Fiduciary\_Dummy}_{i,t} = 1) \qquad (8)\end{aligned}$$

Under the assumption that the error terms in Equations (6) and (7) have bivariate normal distributions with means equals zero, standard deviations of 1 and σ_υ, and correlation ρ, we can write $E(\upsilon_{i,t} \mid \text{Fiduciary\_Dummy}_{i,t} = 1) = \rho\sigma_\upsilon\lambda_1(\theta X_{it})$, where $\lambda_1(\theta X_{it}) = \frac{\phi(\theta X_{it})}{\Phi(\theta X_{it})}$, $\phi(.)$ and $\Phi(.)$ are respectively the probability density and the cumulative distribution functions of the standard normal. The expected *Credit Risk* conditional on having no fiduciary income is estimated as follows:

$$\begin{aligned}E(\text{Credit\_Risk}_{i,t} \mid \text{Fiduciary\_Dummy}_{i,t} = 0) &= \delta_0 + \delta_1 \times \text{Credit\_Risk}_{i,t-1} + \sum_{k=1}^{15} \delta_{3,k} \times \text{Controls}_{k,i,t} + \\ &E(\upsilon_{i,t} \mid \text{Fiduciary\_Dummy}_{i,t} = 0) \qquad (9)\end{aligned}$$

Based on the previous assumptions, we have $E(\upsilon_{i,t} \mid Fiduciary\_Dummy_{i,t} = 0) = \rho\sigma_{\upsilon}\lambda_2(\theta X_{it})$, where $\lambda_2(\theta X_{it}) = \frac{-\phi(\theta X_{it})}{1-\Phi(\theta X_{it})}$. To control for factors that lead to choosing fiduciary business, in the first step we estimate Equation (6) using a probit model and calculate λ_1 and λ_2. In the second step, we estimate Equation (7), after adding the corrections for the self-selection issue.

$$\begin{aligned} Credit\_Risk_{i,t} &= \delta_0 + \delta_1 \times Credit\_Risk_{i,t-1} + \delta_2 \times Fiduciary\_Dummy_{i,t} + \delta_{\lambda}[\lambda_1(\hat{\beta}X_{it}) \times Fiduciary\_Dummy_{it} \\ &\quad + \lambda_2(\hat{\beta}X_{it}) \times (1 - Fiduciary\_Dummy_{it})] + \sum_{k=1}^{15} \delta_{3,k} \times Controls_{k,i,t} + \upsilon_{i,t} \\ &= \delta_0 + \delta_1 \times Credit\_Risk_{i,t-1} + \delta_2 \times Fiduciary\_Dummy_{i,t} + \delta_{\lambda}\lambda + \\ &\quad \sum_{k=1}^{15} \delta_{3,k} \times Controls_{k,i,t} + \upsilon_{i,t} \end{aligned} \quad (10)$$

The sign of δ_{λ} is the same as the sign of correlation of the error terms in Equations (6) and (7). For instance, a negative coefficient indicates that factors that encourage banks to provide fiduciary services are negatively correlated with credit risk.

We estimate our sample selection model[28]; overall, the analysis shows that even after controlling for self-selection issues, fiduciary activities do lead to a fall in *Credit Risk*[29].

The result of estimation of Equation (6) - not reported here - show that banks with lower *Inefficiency* and higher *Core Deposits* are more likely to have fiduciary income. It can be argued that the negative relationship between *Fiduciary* and *Credit Risk* is due to omission of these two variables from the *Credit Risk* model (Equation (1)), because higher efficiency or more core deposits funding can both lower *Credit Risk* and attract more fiduciary services. In order to address this concern, we include *Inefficiency* and *Core Deposits* into the *Credit Risk* model and re-estimate it. Similar to our previous findings, the results show that an increase in income share of *Fiduciary* is associated with a decline in *Credit Risk*[30].

4.4.4. Sub-sampling Based on Fiduciary Income

[28] The results are not reported here, but are available from the authors upon request.

[29] Using a similar approach, we examine the relationship between fiduciary and overall risk, proxied by the standard deviation of return on assets, and how it might be affected when we control for possible sample selection bias. The results show that the negative correlation between *Fiduciary Dummy* and overall risk of *Medium Banks* persists even after adding *Lambda* to the model.

[30] The results are not reported here, but are available from the authors upon request.

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It could be argued that banks offering fiduciary services may be different from those without such income and the negative relationship between *Fiduciary* and *Credit Risk* is driven by such differences in bank type. We address this concern, by restricting the sample to *Medium Banks* with fiduciary income and re-estimate our *Credit Risk* model (Equation (1)). The results are in-line with our previous findings and show a robust and significantly negative relationship between *Fiduciary* and *Credit Risk*[31].

5. Summary and Conclusion

This paper analyses the impact of non-interest activities on banks' lending in terms of credit quality and spread. Agency problems and a potential loss of focus associated with diversification into non-interest businesses may cause deterioration in loan quality. Alternatively, expanding client relationships can improve the quality of banks' credit by providing relatively stable financial resources, more soft information, greater cross-selling opportunities and (ultimately) improved franchise value. Banks with a wider scope of relationships are able to reach more potential borrowers. Moreover, non-interest earnings may also influence banks' interest spread through possible cross-subsidization effects. Post-crisis banks have had to strengthen their capital positions by de-risking their operations – by both choice and legal mandate (Dodd-Frank). This has particularly occurred in non-traditional banking areas – such as investment banking and securities business. It is interesting to see how loan pricing and risk has responded to these developments and in particular to see if (as previous literature has found for broader bank risks) if diversification in non-traditional areas typically results in a heightened risk appetite for commercial banks, or if there has been any risk-shifting from non-traditional to traditional banking business areas.

Using quarterly data on 6,921 U.S. commercial banks between 2007:Q3 and 2016:Q3 we show that an increase in the income share from fiduciary activities in total operating

[31] The results are not reported here, but are available from the authors upon request.

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income lowers credit risk for banks with total assets ranging between $100 million and $1 billion. The impact is more pronounced during the post-crisis period. We find for all bank sizes no evidence that other non-interest activities adversely affect loan quality. We also find no link between non-interest activities and credit risk for systemically important banks (greater than $50bn in assets), or even distressed banks.

In addition, we find some evidence in support of cross-subsidization in particular for *Large Banks* (more than $1bn total assets). Their loan servicing and loan sales income is negatively associated with interest rates on secured loans. Moreover, *Large Banks* with a higher investment banking income tend to charge lower rates on C&I and consumer loans. Contrary to the aforementioned non-interest activities, income from service charges appears to be positively linked to spread suggestive of pricing market power on loans and other services.

We investigate whether pair-wise profit complementarity or alternatively (dis)economies of joint production exist between lending and non-interest activities. Our analysis provides evidence to support the existence of profit complementarity and scope economies for banks with assets ranging between $100 million and $1 billion, whereas other banks in particular *small* banks (with assets less than $100 million) actually suffer from diseconomies of joint production.

One can surmise that the very smallest banks – under $100mn, that suffer from diseconomies of scope, are in no position to take on more non-interest activities as this reduces profits. Larger banks (greater than $1bn) appear to cross-subsidize lending from their non-interest activities – for instance C&I and other loan rates are lower for banks that earn more investment banking income. It seems likely that types of credit and lending technologies of banks in the $100mn to $1bn range produce more synergies with non-interest activities in particular fiduciary services and differ from those of bigger banks. Smaller banks have less

opportunity or are unwilling to cross subsidize non-interest activities due to size, operational constraints or less competitive pressure in pricing relationship loans.

From a policy and commercial perspective there appears to be diversification benefits derived from combining lending and non-interest activities in particular fiduciary business (at least for banks in the $100mn to $1bn asset size range) so regulators should seek to introduce rules / incentives that encourage this business combination as it can potentially mitigate credit risk problems. Also perhaps antitrust regulators may be further interested in investigating why banks with high spreads also have high service charges.

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Table I. Descriptive Statistics

This table illustrates general descriptive statistics of U.S. commercial banks for the period of 2007:Q3-2016:Q3. *Small Banks* are defined as commercial banks with total assets below $100 million. *Medium Banks* are commercial banks with total assets between $100 million and $1 billion. *Large Banks* are defined as commercial banks with total assets above $1 billion.

		Small Banks					Medium Banks						Large Banks					
	Variable	Obs	Mean	Std. Dev	Min	Max	Obs	Mean	Std. Dev	Min	Max	T-Stat.†	Obs	Mean	Std. Dev	Min	Max	T-Stat.§
General Descriptive Statistics	Total Assets (mil. $)	54,508	58	24	5	100	96,822	294	199	100	1,000	-364***	14,594	8,223	24,975	1,000	291,824	-38.4***
	Loan Loss Provision (%)	54,508	0.08	0.18	-0.55	1.79	96,822	0.12	0.21	-0.62	2	-39.0***	14,594	0.18	0.3	-0.85	2.69	-23.3***
	Non-performing Loans (%)	54,508	1.57	1.91	0	12.63	96,822	1.86	2.08	0	15.34	-27.5***	14,594	2.13	2.28	0	16.98	-13.5***
	Spread (%)	54,508	3.58	0.71	1.29	5.94	96,822	3.55	0.61	1.55	5.69	8.3***	14,594	3.4	0.65	0.7	8.34	26.2***
	Cost of Fund (%)	54,508	1.26	0.94	0.07	4.23	96,822	1.17	0.91	0.07	4.17	18.1***	14,594	1.01	0.92	0.06	4.28	19.6***
	Risk Weighted Assets (%)	54,508	63.48	13.2	22.35	105.03	96,822	69.31	11.82	32.7	106.45	-85.6***	14,594	73.57	11.42	35.07	110.19	-41.8***
	Capital (%)	54,508	11.3	3.19	1.26	25.87	96,822	10.4	2.28	3.1	20.54	58.0***	14,594	10.71	2.53	2.79	22.91	-14.0***
	Core Deposits (%)	54,508	90.44	9.32	51.25	100	96,822	87.67	10.77	39.43	100	52.4***	14,594	85.89	12.62	4.92	100.00	16.2***
	Liquidity (%)	54,508	33.18	17.62	1.02	88.3	96,822	23.88	13.29	1.01	70.16	107***	14,594	17.77	10.62	1.17	67.53	62.5***
	Inefficiency (%)	54,508	74.77	18.29	16.85	197.97	96,822	69.53	15.45	17.96	171.03	56.5***	14,594	64.45	13.3	18.33	147.61	42.1***
	Interest Rate Risk (%)	54,508	46.28	14.4	0.13	90.99	96,822	48.44	13.73	2.87	90.23	-28.5***	14,594	48.22	14.41	0.07	85.66	1.7***
	Wage (thou. $)	54,508	58.32	15	14	126	96,822	64.5	17	12	142	-73.3***	14,594	76.35	24.7	3	221.00	-56.0***
	Market to Book Value (%)	314	79.88	33.59	21.71	201.04	1,840	87.15	30.69	25.16	201.67	-3.6***	395	111.99	41.28	41.43	259.36	-11.3***
Loan Portfolio Characteristics	Loan Growth (%)	54,508	0.87	4.89	-15.34	22.17	96,822	1.05	3.65	-10.84	18.69	-7.5***	14,594	1.62	4.4	-13.45	40.98	-14.9***
	Loan Commitment (%)	54,508	6.96	5.2	0	28.17	96,822	9.95	5.42	0	32.02	-106***	14,594	16.71	8.55	0.03	79.47	-92.7***
	Real Estate Loans (%)	54,508	62.48	18.04	3.51	99.8	96,822	74.84	13.25	24.44	99.93	-140***	14,594	72.56	14.56	0.04	99.93	17.8***
	C&I Loans (%)	54,508	13.53	8	0	46.39	96,822	13.61	7.96	0	46.9	-1.9*	14,594	17.51	10.88	0.03	67.66	-41.7***
	Agricultural Loans (%)	54,508	14.07	14.98	0	63.57	96,822	5.12	8.63	0	44.93	128***	14,594	1.3	2.85	0	19.89	105***
	Consumer Loans (%)	54,508	8.72	6.74	0	40.86	96,822	5.01	4.82	0	32.51	113***	14,594	5.16	7.25	0	58.17	-2.4***
	All Other Loans (%)	54,508	1.2	2.08	0	15.27	96,822	1.42	2.1	0	17.23	-19.7***	14,594	3.47	4.53	0	42.59	-53.8***
	Short-Term Loans (%)	54,508	30.54	13.9	0	78.1	96,822	26.12	12.71	0	70.14	61.2***	14,594	23.46	12.97	0	94.99	23.2***
	Yield on Total Loans (%)	54,508	6.49	1.03	3.44	9.97	96,822	5.95	0.93	3.05	9.31	101***	14,594	5.34	1	2.11	10.71	69.3***
	Yield on Real Estate Loans (%)	54,508	6.31	1.03	3.09	9.93	96,822	5.87	0.92	2.98	9.07	82.8***	14,594	5.33	0.98	2.44	9.55	62.5***
	Yield on C&I Loans (%)	54,508	6.71	1.77	1.21	16.22	96,822	6.15	1.48	1.52	13.23	62.6***	14,594	5.41	1.51	0.48	14.15	55.3***
	Yield on Consumer Loans (%)	54,508	8.11	2.11	1.41	18.93	96,822	7.67	2.24	0.61	19.21	38.1***	14,594	6.85	2.58	0.67	21.62	36.4***
Non-interest Activities	Non-interest Income (%)	54,508	12.32	6.35	-11.83	50.46	96,822	14.84	7.76	-18.02	58.32	-68.3***	14,594	20.9	10.35	-19.03	71.89	-67.9***
	Fiduciary (%)	54,508	0.04	0.3	0	4.62	96,822	0.61	1.85	0	16.03	-93.7***	14,594	2.36	3.94	0	39.65	-52.8***
	Annuities (%)	54,508	0	0.02	0	0.42	96,822	0.07	0.25	0	2.04	-86.6***	14,594	0.21	0.37	0	1.8	-44.2***
	Insurance (%)	54,508	0.34	1.22	-3.08	13.71	96,822	0.28	0.93	-2.6	9.39	10.0***	14,594	0.5	1.45	-2.43	11.71	-17.8***
	Investment Banking (%)	54,508	0	0.02	0	0.44	96,822	0.04	0.22	0	2.32	-56.2***	14,594	0.19	0.58	0	4.87	-30.9***
	Loans Servicing (%)	54,508	0.15	0.65	-1.82	6.22	96,822	0.41	1.05	-2.77	7.99	-59.4***	14,594	0.49	1.29	-3.84	12.6	-7.1***
	Securities Brokerage (%)	54,508	0.02	0.12	0	1.75	96,822	0.21	0.56	0	4.32	-102***	14,594	0.44	0.68	0	5.15	-38.9***
	Loan Sales (%)	54,508	0.41	1.89	-5.88	23.6	96,822	1.64	3.98	-11.15	35.39	-81.3***	14,594	2.5	4.72	-12.24	42.86	-20.9***
	Service Charges (%)	54,508	7.12	4.14	0	22.26	96,822	6.4	3.82	0	21.21	33.4***	14,594	6.55	3.8	0	21.29	-4.4***
	Other Non-interest Income (%)	54,508	4.23	4.47	-21.89	33.33	96,822	5.15	5	-27.44	32.44	-36.8***	14,594	7.6	6.81	-23	62.09	-41.8***

† T-Stat. of mean equality test between *Small* and *Medium Commercial Banks*. § T-Stat. of mean equality test between *Medium* and *Large Commercial Banks*. ***, ** and * indicate significance at 1%, 5% and 10% respectively. See Table A1 for variable definitions.

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Table II. Credit Risk Model

This table reports estimations of the *Credit Risk* model (Equation (1)) using quarterly data of 6,921 commercial banks during 2007:Q3-2016:Q3. *Small Banks* are defined as commercial banks with total assets below $100 million. *Medium Banks* are commercial banks with total assets between $100 million and $1 billion. *Large Banks* are defined as commercial banks with total assets above $1 billion. We use *Loan Loss Provision* as the primary proxy for *Credit Risk* and regress it on our variables of interest and a set of control variables, using the fixed effects technique with standard errors clustered at the bank level.

In the first column, we estimate our model for *Small Banks*. Columns (2) to (7) illustrate the results for *Medium Bank*. In column (2) we regress *Loan Loss Provision* on its own lagged value and our variables of interest, i.e. *Fiduciary, Annuities, Insurance, Investment Banking, Loan Servicing, Securities Brokerage, Loan Sale,* and *Service Charge*. We also include year and quarter dummies in our estimation. In the third column, we control for *Capital*, *Risk Weighted Assets* and *Size*. In column (4), we try to capture loan portfolio heterogeneities by adding *Loan Growth, Yield on Total Loans, C&I Loans, Agricultural Loans, Consumer Loans, All Other Loans, Short-Term Loans* and *Loan Commitment*. In column (5), we use a panel data setting in lieu of dynamic panel. In this specification we use the lagged value of explanatory variables. Column (6) displays the estimation of our model, wherein non-interest income items are scaled by total assets. We use *Non-performing Loans* instead of *Loan Loss Provision* as the *Credit Risk* proxy in column (7). Finally, in column (8), we estimate the *Credit Risk* model for *Large Banks* sub-sample. Year and quarter dummies are included in the model, but not reported in the table.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Small Banks	Medium Banks						Large Banks
L. Dependent Variable (α_1)	0.083***	0.212***	0.195***	0.173***		0.173***	0.786***	0.329***
	(0.010)	(0.008)	(0.008)	(0.008)		(0.008)	(0.004)	(0.025)
Fiduciary (α_{21})	-0.003	-0.004**	-0.003*	-0.004***	-0.004***	-0.345***	-1.162*	0.008
	(0.004)	(0.002)	(0.002)	(0.001)	(0.002)	(0.133)	(0.603)	(0.006)
Annuities (α_{22})	-0.012	-0.002	-0.002	-0.004	-0.005	-0.165	-0.861	-0.015
	(0.057)	(0.005)	(0.005)	(0.005)	(0.005)	(0.467)	(1.661)	(0.014)
Insurance (α_{23})	-0.000	-0.001	-0.001	0.000	-0.001	0.060	0.182	-0.000
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.141)	(0.519)	(0.004)
Investment Banking (α_{24})	-0.062	0.013*	0.010	0.008	0.004	0.955	1.637	-0.011
	(0.058)	(0.007)	(0.007)	(0.007)	(0.008)	(0.646)	(2.221)	(0.009)
Loan Servicing (α_{25})	0.000	-0.002	-0.002	-0.002	-0.002	-0.147	-0.575	-0.004
	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.132)	(0.534)	(0.003)
Securities Brokerage (α_{26})	-0.005	-0.000	0.000	-0.001	-0.004	-0.005	-0.677	-0.015
	(0.016)	(0.003)	(0.003)	(0.003)	(0.003)	(0.301)	(1.105)	(0.009)
Loan Sale (α_{27})	0.000	-0.000	-0.000	-0.000	-0.002***	-0.012	-0.050	-0.001
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.029)	(0.110)	(0.001)
Service Charge (α_{28})	-0.001	-0.000	0.001	-0.001	-0.001	-0.055	-0.150	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.064)	(0.243)	(0.003)
Capital (α_3)	-0.006***	-0.009***	-0.009***	0.000	-0.009***	0.006	-0.010***	
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.003)	
Risk Weighted Assets (α_4)	0.002***	0.002***	0.003***	0.003***	0.003***	0.004***	0.003***	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	
Size (α_5)	0.081***	0.123***	0.111***	0.176***	0.110***	0.352***	0.095***	
	(0.013)	(0.009)	(0.008)	(0.010)	(0.008)	(0.033)	(0.023)	
Loan Growth (α_6)	-0.003***		-0.005***	-0.003***	-0.005***	-0.015***	-0.005***	
	(0.000)		(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	
Yield on Total Loans (α_7)	-0.034***		-0.056***	-0.054***	-0.055***	-0.510***	-0.054***	
	(0.003)		(0.004)	(0.004)	(0.004)	(0.018)	(0.011)	
C&I Loans (α_8)	0.001***		0.001**	0.001**	0.001**	-0.002	-0.001	
	(0.000)		(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	
Agricultural Loans (α_9)	0.001***		0.000	-0.001	0.000	-0.008***	-0.003	
	(0.000)		(0.000)	(0.001)	(0.000)	(0.002)	(0.003)	
Consumer Loans (α_{10})	0.002***		-0.002**	-0.002**	-0.002**	-0.011***	-0.002	
	(0.001)		(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	
All Other Loans (α_{11})	-0.000		-0.001	-0.001	-0.001	-0.012***	-0.003**	
	(0.001)		(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	
Short-Term Loans (α_{12})	0.001***		0.001***	0.002***	0.001***	0.001*	0.002***	
	(0.000)		(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	
Loan Commitment (α_{13})	-0.001***		-0.003***	-0.004***	-0.003***	-0.013***	-0.004***	
	(0.000)		(0.000)	(0.000)	(0.000)	(0.002)	(0.001)	
Constant (α_0)	-0.708***	0.090***	-1.524***	-1.098***	-2.047***	-1.096***	-1.758***	-1.163***
	(0.149)	(0.005)	(0.114)	(0.110)	(0.132)	(0.109)	(0.454)	(0.354)
Observations	45,999	84,342	84,342	84,342	84,342	84,342	84,342	12,842
Number of Banks	2,582	4,284	4,284	4,284	4,284	4,284	4,284	718
R-squared	0.078	0.163	0.177	0.195	0.163	0.195	0.713	0.370
F-Statistics	41.89	223.2	224.1	185.1	134.8	184.9	1754	63.01

See Table A1 for variable definitions. Standard errors are adjusted for clusters in banks. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

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Table III. Spread Model

This table reports estimations of the *Spread* model (Equation (2)) using quarterly data of 6,921 commercial banks between 2007:Q3-2016:Q3 *Small Banks* are defined as commercial banks with total assets below $100 million. *Medium Banks* are commercial banks with total assets between $100 million and $1 billion. *Large Banks* are defined as commercial banks with total assets above $1 billion. We estimate our model using a dynamic panel setting and the fixed effects technique with standard errors clustered at the bank level.

The first column presents our analysis for *Small Banks.* We regress *Spread* on its own lagged value and our variables of interest, namely, *Fiduciary*, *Annuities*, *Insurance*, *Investment Banking*, *Loan Servicing*, *Securities Brokerage*, *Loan Sale*, and *Service Charge*, and control variables. Columns (2) & (3) illustrate our results for *Medium Banks*. In column (2), we estimate the *Spread* model and in column (3), we use *Yield on Real Estate Loans* as the dependent variable. Columns (4) to (9) display the estimations for *Large Banks*, where *Spread*, *Cost of Fund*, *Yield on Total Loans*, *Yield on Real Estate Loans*, *Yield on C&I Loans* and *Yield on Consumer Loans* are used as the dependent variables, respectively. Loan portfolio characteristics, namely, *C&I Loans*, *Agricultural Loan*, *Consumer Loans*, *All Other Loans* and *Loan Commitment* are not included when we use yield on a particular loan's type as the dependent variable. Non-interest income items, i.e. *Fiduciary*, *Annuities*, *Insurance*, *Investment Banking*, *Loan Servicing*, *Securities Brokerage*, *Loan Sale*, *Service Charge*, and *Inefficiency* are scaled by total assets in lieu of total operating income. Year and quarter dummies are included in the model, but not reported in the table.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Small Banks	Medium Banks		Large Banks					
	Spread	Spread	Yield on Real Estate Loans	Spread	Cost of Fund	Yield on Total Loans	Yield on Real Estate Loans	Yield on C&I Loans	Yield on Consumer Loans
L. Dependent Variable (β_1)	0.576***	0.650***	0.529***	0.695***	0.762***	0.663***	0.601***	0.540***	0.598***
	(0.007)	(0.005)	(0.008)	(0.012)	(0.009)	(0.016)	(0.019)	(0.026)	(0.024)
Fiduciary (β_{21})	0.504	-0.176	-0.419*	-0.584**	-0.172	-0.807***	-0.369	-1.246	-0.735
	(0.953)	(0.160)	(0.225)	(0.230)	(0.160)	(0.253)	(0.394)	(0.895)	(1.356)
Annuities (β_{22})	2.733	1.124**	-0.333	0.633	-0.964*	0.484	1.572	-3.330	0.629
	(5.880)	(0.566)	(0.686)	(1.070)	(0.531)	(1.117)	(1.600)	(3.808)	(6.665)
Insurance (β_{23})	0.509**	0.375**	0.216	-0.230	0.097	0.264	0.221	1.099	2.013
	(0.231)	(0.186)	(0.286)	(0.390)	(0.134)	(0.460)	(0.510)	(1.019)	(2.339)
Investment Banking (β_{24})	-3.620	-0.122	0.538	-1.179	-0.416	-1.605	-0.931	-5.934**	-7.596*
	(9.437)	(0.638)	(1.094)	(1.016)	(0.395)	(1.207)	(1.607)	(2.386)	(4.411)
Loan Servicing (β_{25})	0.301	-0.021	-0.103	-0.521	0.086	-0.447	-0.807*	-0.708	1.232
	(0.480)	(0.148)	(0.248)	(0.334)	(0.088)	(0.368)	(0.463)	(0.850)	(1.188)
Securities Brokerage (β_{26})	3.069	0.258	-0.513	0.562	-1.057**	-1.414*	-1.314	-6.604**	-7.185*
	(2.612)	(0.334)	(0.555)	(0.683)	(0.413)	(0.789)	(1.243)	(2.756)	(4.308)
Loan Sale (β_{27})	-0.036	-0.072**	-0.080	-0.242***	-0.117***	-0.442***	-0.326**	-0.387	-0.441
	(0.119)	(0.034)	(0.052)	(0.065)	(0.033)	(0.075)	(0.127)	(0.246)	(0.330)
Service Charge (β_{28})	0.664***	0.727***	0.026	0.856***	-0.082	0.373	0.364	0.340	0.987
	(0.113)	(0.080)	(0.114)	(0.221)	(0.097)	(0.237)	(0.309)	(0.720)	(1.120)
Capital (β_3)	0.023***	0.017***	0.002	0.017***	-0.005***	0.007**	0.011***	0.019**	-0.010
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.003)	(0.004)	(0.009)	(0.015)
Inefficiency (β_4)	0.272***	0.272***	0.194***	0.376***	0.013	0.489***	0.549***	0.168	0.327
	(0.023)	(0.016)	(0.023)	(0.047)	(0.018)	(0.060)	(0.071)	(0.133)	(0.247)
Liquidity (β_5)	-0.012***	-0.010***	0.004***	-0.007***	0.000	0.004***	0.004***	0.003	0.005
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.003)
Interest Rate Risk (β_6)	0.002***	0.003***	0.001**	0.003***	-0.001***	0.000	-0.000	-0.001	-0.000

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	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)	(0.003)
Core Deposits (β_7)	0.006***	0.006***	0.002***	0.005***	-0.003***	0.002***	0.002**	-0.001	0.003
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.003)
Wage (β_8)	-0.000	0.000	0.000	0.001**	0.001***	0.002***	0.002***	0.003***	0.008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)
Size (β_9)	-0.056**	-0.033***	-0.031*	0.031*	0.030***	0.099***	0.146***	0.121*	0.096
	(0.023)	(0.011)	(0.017)	(0.017)	(0.008)	(0.022)	(0.029)	(0.071)	(0.094)
C&I Loans (β_{10})	0.001	0.001**		0.000	-0.000	-0.001			
	(0.001)	(0.000)		(0.001)	(0.000)	(0.001)			
Agricultural Loans (β_{11})	0.005***	0.005***		0.006	-0.001	-0.004			
	(0.001)	(0.001)		(0.004)	(0.002)	(0.005)			
Consumer Loans (β_{12})	0.002*	0.004***		0.002	-0.002***	0.000			
	(0.001)	(0.001)		(0.002)	(0.001)	(0.003)			
All Other Loans (β_{13})	-0.005***	-0.004***		-0.004***	0.001**	-0.003**			
	(0.002)	(0.001)		(0.001)	(0.001)	(0.002)			
Loan Commitment (β_{14})	0.001	0.002***		-0.000	-0.001	-0.002**			
	(0.001)	(0.000)		(0.001)	(0.000)	(0.001)			
Constant (β_0)	1.285***	0.713***	2.240***	-0.480*	-0.058	-0.756**	-1.355***	-0.170	-0.359
	(0.275)	(0.149)	(0.229)	(0.288)	(0.120)	(0.352)	(0.492)	(1.197)	(1.500)
Observations	45,999	84,342	84,342	12,842	12,842	12,842	12,842	12,842	12,842
Number of Banks	2,582	4,284	4,284	718	718	718	718	718	718
R-squared	0.563	0.651	0.814	0.709	0.984	0.906	0.834	0.549	0.475
F-Statistics	708.0	1658	5635	411.5	6510	2099	1167	239.5	120.2

See Table A1 for variable definitions. Standard errors are adjusted for clusters in banks. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

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Table IV. Profit Complementarities Analysis

This table reports profit complementarities analysis (Equation (3)) for joint production of the non-interest activities and loans for *Small, Medium* and *Large Banks*. *Small Banks* are defined as commercial banks with total assets below $100 million. *Medium Banks* are commercial banks with total assets between $100 million and $1 billion. *Large Banks* are defined as commercial banks with total assets above $1 billion. The study covers the post-crisis period 2009:Q3-2016:Q3.

The first column present the results for the profit complementarity analysis under the intermediation approach following Berger and Mester (1997). In the second column, the multi-product profit function is defined based on the production approach following Berger and DeYoung (1997).

The results for *Small, Medium* and *Large Banks* are presented in panels (A), (B) and (C), respectively. MP_Y1 = Marginal profit of loans. MP_Y4 = Marginal profit of the non-interest activities. NC = Necessary condition for realizing pair-wise profit complementarities. PPC = Pair-wise profit complementarity.

		Intermediation Approach	Production Approach
(A)		(1)	(2)
Small Banks	(1) MP_Y1	0.12%	0.08%
	(2) MP_Y4	36.79%	35.47%
	(3) NC	-10.25%	-8.62%
	(4) PPC	-0.000024500	-0.000021100
	(5) Economic Magnitude	-0.292%	-0.356%
(B)			
Medium Banks	(1) MP_Y1	0.11%	0.09%
	(2) MP_Y4	25.28%	24.49%
	(3) NC	-0.16%	0.18%
	(4) PPC	0.000000303	0.000000383
	(5) Economic Magnitude	0.028%	0.041%
(C)			
Large Banks	(1) MP_Y1	0.23%	0.22%
	(2) MP_Y4	15.58%	14.74%
	(3) NC	-3.68%	-3.56%
	(4) PPC	-0.000000010	-0.000000010
	(5) Economic Magnitude	-0.029%	-0.029%

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Table V. Crisis and Post-Crisis Periods

This table reports estimations of the *Credit Risk* and *Spread* models (Equations (1) & (2)) using quarterly data for *Medium* and *Large Banks* during 2007:Q3-2016:Q3. *Medium Banks* are commercial banks with total assets between $100 million and $1 billion. *Large Banks* are defined as commercial banks with total assets above $1 billion. We use *Loan Loss Provision* as the primary proxy for *Credit Risk.* We estimate our model using a dynamic panel setting and the fixed effects technique.

The first two columns report the estimations of the *Credit Risk* model for *Medium* and *Large Banks*, respectively. Columns (3) and (4) present the results for the *Spread* model. In all four specifications, year dummies are replaced by *Crisis*, which is a dummy variable that takes the value of one for the crisis period, 2007:Q3-2009:Q2, and zero otherwise. We add the interaction term between *Fiduciary* and *Crisis* in all specifications. The control variables described in Equations (1) and (2) are included, but not reported in the table.

	(1)	(2)	(3)	(4)
Variables	Credit Risk		Spread	
	Medium Banks	Large Banks	Medium Banks	Large Banks
L. Dependent Variable (α_1)	0.223***	0.420***	0.658***	0.711***
	(0.008)	(0.023)	(0.005)	(0.012)
Fiduciary (α_{21})	-0.007***	0.001	-0.414**	-0.883***
	(0.002)	(0.006)	(0.167)	(0.219)
Fid×Crisis (α_{21Cr})	0.002*	-0.002	0.550***	0.259*
	(0.001)	(0.003)	(0.125)	(0.140)
Crisis (α_{Cr})	-0.043***	0.028*	-0.087***	-0.073***
	(0.004)	(0.015)	(0.004)	(0.011)
Controls	Yes	Yes	Yes	Yes
Constant (α_0)	-0.472***	-0.170	1.386***	0.732***
	(0.113)	(0.317)	(0.127)	(0.251)
Observations	84,342	12,842	84,342	12,842
Number of Banks	4,284	718	4,284	718
R-squared	0.158	0.326	0.648	0.705
F-Statistics	195.4	66.18	2013	498.8
H_0: $\alpha_{21} = \alpha_{21Cr} = 0$ (F-stat.)	11.07***	0.251	11.18***	9.811***
H_0: $\alpha_{21} + \alpha_{21Cr} = 0$ (F-stat.)	4.800**	0.007	0.505	5.812**

See Table A1 for variable definitions. Standard errors are adjusted for clusters in banks. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

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Table VI. Franchise Value Model

This table illustrates the results of the *Franchise Value* model (Equation (5)) using 1,840 quarterly data observations on *Medium Banks* between 2007:Q3-2016:Q3. *Medium Banks* are commercial banks with total assets between $100 million and $1 billion. We use the ratio of market to book value of equity capital (*Market to Book Value*) as a proxy for *Franchise Value*. We estimate our model using the fixed effects technique.

In the first column, we regress *Market to Book Value* on our variables of interest, namely, *Fiduciary*, *Annuities*, *Insurance*, *Investment Banking*, *Loan Servicing*, *Securities Brokerage*, *Loan Sale*, and *Service Charge*, and control variables. In column (2) we follow Petersen (2009) and Thompson (2011) and cluster the standard errors at both the bank and time levels. Column (3) displays the result when we use the lagged value of our explanatory variables. In column (4), we use a dynamic panel setting by introducing the lagged value of the dependent variable in the right-hand-side of the equation. In column (5), we scale non-interest income items by total assets instead of total operating income. Year and quarter dummies are included in the model, but not reported in the table.

Variables	(1)	(2)	(3)	(4)	(5)
L. Dependent Variable				0.758***	0.754***
				(0.021)	(0.021)
Fiduciary (λ_{11})	6.440**	6.440**	10.797***	3.028***	316.362***
	(2.822)	(3.006)	(2.751)	(1.084)	(109.825)
Annuities (λ_{12})	-12.642	-12.642*	-6.869	-1.014	-111.203
	(7.997)	(7.183)	(7.718)	(1.544)	(139.598)
Insurance (λ_{13})	-1.483	-1.483	-1.613	-0.750	-33.052
	(1.186)	(1.420)	(1.123)	(0.924)	(54.435)
Investment Banking (λ_{14})	-13.589	-13.589	-21.818***	-2.300	-242.113
	(10.489)	(10.773)	(8.231)	(6.170)	(439.399)
Loan Servicing (λ_{15})	5.164*	5.164*	5.686**	0.939	169.847***
	(2.729)	(2.704)	(2.344)	(0.884)	(63.926)
Securities Brokerage (λ_{16})	-3.927	-3.927	-4.369	-0.998	-119.585
	(4.493)	(4.438)	(4.109)	(1.083)	(104.636)
Loan Sale (λ_{17})	0.364	0.364	0.589	0.290	17.695
	(0.470)	(0.489)	(0.592)	(0.257)	(17.793)
Service Charge (λ_{18})	1.625	1.625	1.868	0.514	77.817**
	(1.044)	(1.053)	(1.129)	(0.401)	(37.296)
Credit Risk (λ_{2})	-6.738*	-6.738*	-13.879***	-0.636	-0.613
	(3.456)	(3.610)	(3.784)	(2.778)	(2.880)
Inefficiency (λ_{3})	-0.321***	-0.321***	-0.379***	-0.108**	-0.101*
	(0.106)	(0.106)	(0.126)	(0.051)	(0.052)
Core Deposits (λ_{4})	0.085	0.085	0.103	0.071	0.035
	(0.209)	(0.216)	(0.177)	(0.083)	(0.084)
Capital (λ_{5})	0.572	0.572	1.140	0.205	0.152
	(1.037)	(1.006)	(1.178)	(0.460)	(0.456)
Size (λ_{6})	7.140	7.140	8.610	-0.948	-1.176
	(7.693)	(7.474)	(8.879)	(3.029)	(3.088)
Constant (λ_{0})	1.395	62.817	-21.876	30.560	36.255
	(108.138)	(109.851)	(121.650)	(41.878)	(42.795)
Observations	1,840	1,840	1,585	1,585	1,585
Number of Banks	93	93	86	86	86
R-squared	0.326	0.688	0.320	0.724	0.725
F-statistics	7.781	.	11.39	162.2	168.1

See Table A1 for variable definitions. Standard errors are adjusted for clusters in banks. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

Appendix - *Table A1.* Variable Description

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This table presents description of variables used in this study.

Dependent Variables	**Description**
Loan Loss Provision	The ratio of loan loss provisions to average gross loans. Loan loss provision is the expense that banks incur to increase loan loss reserves or to write-off a loan.
Non-performing Loans	The ratio of non-performing loans to gross loans. Non-performing loans consist of non-accrual loans and loans which are past due for 90 days or more and still accruing.
Spread	Equals (Interest income / average earning assets) – (interest expense / average interest-bearing liabilities).
Cost of Fund	Total interest expense as a percent of, sum of average interest bearing liabilities and average noninterest bearing deposits.
Yield on Total Loans	Interest income on total loans & leases divided by average total loans & leases.
Yield on Real Estate Loans	Interest income on real estate loans divided by average real estate loans.
Yield on C&I Loans	Interest income on commercial & industrial loans / average commercial & industrial loans.
Yield on Consumer Loans	Interest and fee income on consumer loans other than credit card plans as a percent of average consumer loans other than credit card plans.
Fiduciary Dummy	Takes the value one for banks with fiduciary income, and zero otherwise.
Market to Book Value	The market value of equity capital divided by total book value of equity capital.
Variable of Interest[32]	
Fiduciary	Income from fiduciary activities.
Annuities	Fees and commissions from annuity sales.
Insurance	Underwriting income from insurance and reinsurance activities and income from other insurance activities.
Loan Servicing	Net servicing fees.
Loan Sale	Net gains (losses) on sales of loans and leases.
Investment Banking	Investment banking, advisory, and underwriting fees and commissions
Securities Brokerage	Fees and commissions from securities brokerage
Service Charge	Service charges on deposit accounts in domestic offices, income and fees from the printing and sale of checks, income and fees from automated teller machines and bank card and credit card interchange fees.
Control Variables	
Capital	Equity capital to asset ratio.
Inefficiency	Total non-interest expense divided by total operating revenue[33].
Risk Weighted Assets	The ratio of risk weighted assets to total assets. Risk weighted assets are defined by the Basel Accord to measure the riskiness of banks' assets, including off balance sheet items.
Core Deposit	The share of core deposits in total liabilities.
Liquidity	The ratio of liquid assets to total liabilities.
Interest Rate Risk	Difference between loans and securities with maturity over one year and liabilities with maturity more than one year divided by total assets.
Loan Commitment	The ratio of face value of unused credit lines and loans commitment to total assets.
Loan Growth	Quarterly growth rate of gross loans.
Real Estate Loans	The ratio of loans secured by real estate to total loans.
C&I Loans	The ratio of commercial and industrial loans to total loans.
Agricultural Loans	The ratio of loans for the purpose of financing agricultural production to total loans.
Consumer Loans	The ratio of consumer loans to total loans.
All Other Loans	The ratio of all other loans to total loans.
Short-Term Loans	The ratio of loans and leases with a remaining maturity of one year or less to total loans.
Wage	The salaries and employee benefits divided by number of full time equivalent employees.
Size	Logarithm of total assets.
Crisis	Takes the value one for the 2007:Q3 – 2009:Q2 period, and zero otherwise.

[32] The income from non-interest activities is measured as a percentage of total net operating income following the existing literature (Stiroh 2004). For Equation (2) we scale non-interest income items by total assets to avoid a mechanical inverse relationship between the share of non-interest income in total operating income and *Spread*.

[33] In *Spread* model, i.e. Equation (2), *Inefficiency* is defined as total non-interest expense divided by total assets.