Non-Interest Income Activities and Bank Lending

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Abstract. This paper investigates the impact of non-interest income businesses on bank lending. Using quarterly data on 7,578 U.S. commercial banks between 2003 and 2010 we find that, for banks with total assets above $100 million, non-interest income activities influence credit risk and loan portfolio compositions. Banks which emphasize fiduciary and life insurance businesses appear to have a lower credit risk. Moreover, we find that a greater reliance on loan servicing is associated with lower lending-deposit spreads. Finally, we find little evidence to suggest that cost complementarity explains the joint production of lending and relationship expanding non-interest income businesses.

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1. Introduction

A substantial empirical literature finds that bank diversification into non-interest income areas leads to banking sector instability (DeYoung and Roland, 2001; DeYoung and Rice, 2004; Stiroh, 2004; Stiroh and Rumble, 2006; Stiroh, 2006; Lepetit et al., 2008a; De Jonghe, 2010; Demirguc-Kunt and Huizinga, 2010; Moshirian et al., 2011; Brunnermeier et al., 2011; and DeYoung and Torna, 2013). The link between riskier investment banking revenue and the 2007-8 crisis has also prompted a series of reforms in the US and Europe (Dodd Frank Act, 2010; Liikanen Report, 2012 and the Independent Commission on Banking – Vickers Report, 2011) that recommend restrictions on various banks' non-interest income-based activities (International Monetary Fund, 2011).

While the academic literature on bank diversification has focused on performance and stability issues associated with non-traditional banking activities, little attention has been paid to the potential consequences for lending of income diversity. This is somewhat surprising given that bank/borrower relationships can lead to the cross-selling of fee and commission-based services as well as potential cost savings through the realization of scope economies. Hellmann et al. (2008) find that prior relationships with early stage venture capital firms increase the chances of bank loan origination. Firms may also benefit from established bank relationships by signaling quality to benefit from lower loan rates. In addition, incentives to cross-sell fee and non-interest based products are higher when margins on traditional intermediation are low. Carbo and Rodriguez (2007) show that income from non-traditional activities influence net interest margins through possible cross-subsidization effects and Lepetit et al. (2008b) also find that banks may charge lower interest rates on loans (under-pricing credit risk) if they expect to obtain additional fees from borrowers. Such behavior could, therefore, undermine banks' major role in the financial system. Sound monitoring of borrowers and accurate loan-pricing are essential for the banking industry and the economy as

a whole. 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. Alternatively, banks may have the ability to monitor borrowers that are tied by non-interest activities more closely and more efficiently. A closer look at how credit risk is affected by combining both traditional lending activities and non-interest businesses is therefore an important question.

Relationships with clients influence banks' performance. Banks can collect customer-specific information (beyond that available publicly) over time via multiple interactions with the same customer (Berger, 1999; Boot, 2000). Boot (2000) also emphasizes that relationship banking is not limited to lending and can cover other financial services. Hence, expanding the scope of client relationships may improve a bank's lending position, as it can provide banks with the opportunity to reach a wider array of potential borrowers and can offer more information on client quality. Moreover, information obtained from offering multiple products can build new, as well as enhance existing relationships. Such new and enhanced relationships can potentially increase banks' franchise value and hence increase indirect financial distress cost, leading to more prudent behavior in lending and investment activities (Marcus, 1984 and Keeley, 1990 among others).

Boot (2003) argues that scale and scope expansion leads to a form of strategic positioning that drives industry consolidation. He points out that distribution channels are essential and that technological developments that make it more effective to interrogate business-line databases encourage scope expansion. The building of relationships can mitigate risk, as illustrated by Puri et al. (2011) who show 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.

Alternatively, a greater reliance on non-interest activities may increase credit risk due to agency problems or/and a loss of focus. Several studies show that agency problems and information asymmetries stemming from activity diversification outweigh the benefits from scope economies (Laeven and Levine, 2007; Elyasiani and Wang, 2009; Akhigbe and Stevenson 2010). Others, such as Peterson and Rajan (1995) note that banks extend credit subsidies to young firms and expect to offset the expected loss through future long-run rents. In a similar vein, a diversified commercial bank may decide to grant loss-making loans to cross-sell profit-making fee and commission-based services. Banks expanding into non-interest income activities may also lose their focus on lending. Moreover, lower credit exposure may encourage managers to be less conservative in their loan-granting activities.

In this paper, we investigate the impact on lending of banks' diversification into seven major business lines[1] which we identify as playing an important role among a broader array of non-interest income items. They range from traditional activities such as fiduciary and life insurance to securities brokerage and investment banking. These business lines provide banks with the opportunity to have access to more private information, and can enable them to reach a wider array of potential customers. Moreover, they are also likely to expand the scope of relationships with clients beyond merely lending-deposit activities, providing more soft information, financial resources and also helping to enhance bank franchise values. We investigate the influence of these activities on banks' lending in terms of loan quality, interest spread and loan portfolio composition. We also explore whether cost complementarities can explain their joint production with lending.

We use quarterly data on 7,578 U.S. commercial banks and our data span from 2003 to 2010 covering the period before and after the 2007-2008 financial crises. Since the U.S.

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[1] Fiduciary activities, life insurance, other insurance services, loan servicing, annuity sales, securities brokerage and investment banking.

banking system is dominated by small banks, we also study banks with less than $100 million in total assets (3,206 *'micro'* commercial banks) separately from the rest of our sample.

Our credit risk analysis for commercial banks with total assets above $100 million indicates that an increase in income from fiduciary activities lowers credit risk. Banks that have a larger share of income from life insurance business also appear to have lower credit risk before the crisis; the relationship, however, becomes positive during the crisis period and disappears thereafter. We also observe that non-interest income activities are connected to loan portfolio compositions. For instance, a greater reliance of income from fiduciary business is linked to a smaller share of commercial and industrial (*C&I*) loans in total loans and a larger share of loans to financial institutions in post-crisis period. In the same period, however, income from life insurance is negatively associated to lending to financial institutions. We find little evidence to support the view that income or price cross-subsidy exists between traditional intermediation and non-interest income activities except in the case of loan servicing, after the crisis, where we observe that a higher income share from this activity is associated with lower lending-deposit spreads.

Our analysis of micro commercial banks (those with assets under $100 million) provides us with little evidence to support any link between non-interest income activities and credit risk, loan composition and price cross-subsidization. However, we find some evidence that an increase in income from other insurance services and fiduciary activities is associated with higher lending-deposit spreads. Finally, we investigate whether pair-wise cost complementarity exists between lending (both secured and unsecured) and non-interest income activities that may explain possible joint production. The results provide us with little evidence to support this hypothesis.

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

We are interested in investigating the impact of non-interest income activities on lending from three perspectives, namely, on how it influences credit risk, loan pricing and portfolio composition. To analyze these issues we estimate the following models using the variables which are addressed by the literature as the determinants of credit risk, lending-deposit spread and loan composition (Diamond, 1984; McShane and Sharpe, 1985; Clair, 1992; Angbazo, 1997; Kwan and Eisenbeis, 1997; Maudos and De Guevara, 2004; Dell'Ariccia and Marquez, 2006; Ogura, 2006; Carbo and Rodriguez, 2007; Lepetit et al., 2008b; Foos, et al., 2010; Delis and Kouretas, 2011; Fiordelisi, et al., 2011; Maddaloni and Peydró, 2011):

$$
\begin{aligned}
\text{Credit\_Risk}_{i,t} = {}& \beta_0 + \sum_{k=1}^{7} \beta_{1,k} \times \text{Non-interest\_Income\_Activities}_{k,i,t-1} + \\
& \beta_2 \times \text{Unused\_Commitment}_{i,t-1} + \beta_3 \times \text{Loans\_Sale}_{i,t-1} + \\
& \beta_4 \times \text{Unsecured\_Loans}_{i,t-1} + \beta_5 \times \text{Loan\_Growth}_{i,t-1} + \\
& \beta_6 \times \text{Capital}_{i,t-1} + \beta_7 \times \text{Spread}_{i,t-1} + \beta_8 \times \text{Inefficiency}_{i,t-1} + \beta_9 \times \text{Size}_{i,t-1} + \\
& \beta_{10} \times \text{Log(Age)}_{i,t-1} + \beta_{11} \times \text{Interest\_Rate}_{t-1} + \beta_{12} \times \text{Home\_Price\_Growth}_{j,t-1} + \\
& \beta_{13} \times \text{Income\_Growth}_{j,t-1} + \sum_{k=1}^{4} \beta_{14,k} \times \text{Year\_Dummies}_k + \varepsilon_{i,t}
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
\text{Spread}_{i,t} = {}& \alpha_0 + \sum_{k=1}^{7} \alpha_{1,k} \times \text{Non-interest\_Income\_Activities}_{k,i,t-1} + \\
& \alpha_2 \times \text{Unused\_Commitment}_{i,t-1} + \alpha_3 \times \text{Loans\_Sale}_{i,t-1} + \\
& \alpha_4 \times \text{Loan\_Asset\_Ratio}_{i,t-1} + \alpha_5 \times \text{Unsecured\_Loans}_{i,t-1} + \\
& \alpha_6 \times \text{Non-Performing\_Loans}_{i,t-1} + \alpha_7 \times \text{Core\_Deposit}_{i,t-1} + \\
& \alpha_8 \times \text{Capital}_{i,t-1} + \alpha_9 \times \text{Size}_{i,t-1} + \alpha_{10} \times \text{Log(Age)}_{i,t-1} + \\
& \alpha_{11} \times \text{Interest\_Rate}_{t-1} + \alpha_{12} \times \text{Home\_Price\_Growth}_{j,t-1} + \\
& \alpha_{13} \times \text{Income\_Growth}_{j,t-1} + \sum_{k=1}^{4} \alpha_{14,k} \times \text{Year\_Dummies}_k + \eta_{i,t}
\end{aligned}
\tag{2}
$$

$$
\begin{aligned}
\text{Loan\_Composition}_{i,t} = {}& \delta_0 + \sum_{k=1}^{7} \delta_{1,k} \times \text{Non-interest\_Income\_Activities}_{k,i,t-1} + \\
& \delta_2 \times \text{Core\_Deposit}_{i,t-1} + \delta_3 \times \text{Capital}_{i,t-1} + \delta_4 \times \text{Size}_{i,t-1} + \\
& \delta_5 \times \text{Log(Age)}_{i,t-1} + \delta_6 \times \text{Interest\_Rate}_{t-1} + \delta_7 \times \text{Home\_Price\_Growth}_{j,t-1} + \\
& \delta_8 \times \text{Income\_Growth}_{j,t-1} + \sum_{k=1}^{4} \delta_{9,k} \times \text{Year\_Dummies}_k + \xi_{i,t}
\end{aligned}
\tag{3}
$$

where individual banks, time dimension and U.S. states in which they operate are represented by i, t and j subscripts, respectively. Variation in credit risk (*Credit Risk*), lending-borrowing spread (*Spread*) and loan composition (*Loan Composition*) are modeled in Equations (1) to (3) as a function of income shares from various non-interest income activities including fiduciary activities, life insurance, other insurance services, loan servicing, annuity sales, securities brokerage and investment banking. These are activities that are expected to increase the scope of relationship with borrowers (see section 2.2.). All three models also include a range of bank-level, U.S. state-level, macroeconomic and time control variables. We estimate the equations using fixed effects[2].

2.1. DEPENDENT VARIABLES

In model (1) we use the ratio of non-performing loans to gross loans (*Non-performing Loans*) as a proxy for *Credit Risk*. Non-performing loans consist of non-accrual loans and loans which are past due for 90 days or more and still accruing. This proxy is widely used in the literature as an accounting-based credit risk indicator (for instance Kwan and Eisenbeis, 1997; Gonzalez, 2005; Carbo and Rodriguez, 2007; Delis and Kouretas, 2011; Fiordelisi, et al., 2011).

For our loan 'price' model (2) we use the lending-borrowing spread otherwise known as the net interest spread and defined as $\frac{\text{total interest income}}{\text{average total earning assets}} - \frac{\text{total interest expense}}{\text{average total interest−bearing liabilities}}$ (*Spread*) following Carbo and Rodriguez (2007) and Lepetit et al. (2008b). Finally, in model (3) we use the share of unsecured loans in the total loan

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portfolio (*Unsecured Loans*) as the dependent variable to investigate the relationship between non-interest income activities and total loan composition[3].

2.2. VARIABLES OF INTEREST

On the basis of the breakdown provided in the Federal Financial Institutions Examination Council (FFIEC) 031 Reports of Income and Condition (Call Reports), we identify seven major non-interest income business lines that may have an impact on customer credit relationships[4].

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

   Clients using fiduciary services have entrusted assets to the bank for management or safekeeping, and hence are expected to be relatively risk-averse. Moreover, banks do not have an unconditional obligation to pay a pre-determined interest rate; instead, they simply receive a fee for the services. The trust of such clients is worthy and valuable for the banks and is likely to increases banks' franchise value. We expect that banks with more *Fiduciary Activities* have less incentive for risky lending and excessive risk-taking[5].

2) Earnings on/increases in value of cash surrender value of life insurance policies (*Life Insurance*).

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[3] *Unsecured Loans* are classified in five main categories as follows: loans to finance agricultural production and other loans to farmers (*Agricultural Loans*), commercial and industrial loans (*C&I Loans*), consumer loans (*Consumer Loans*), loans to depository and non-depository financial institutions (*Financial Institution Loans*) and other loans not secured by real estate (*Other Unsecured Loans*). In section 4.5.b, we further explore the relationship using components of *Unsecured Loans* as the dependent variable.

[4] Due to a lack of data, we are unable to take into account income from venture capital activities. Because we focus primarily on lending we do not analyze various other items of non-interest income which are not expected to expand the scope of clients' relationships. These other items include deposit activities, trading revenues, loan sales and other assets sales. The service charge on deposit accounts was included in the first set of estimates representing the scale of relationships; however, it depicted an insignificant effect on loan quality. As such we excluded it from our model for further analysis as we found that its omission had no effect on our results. Such a variable is difficult to interpret since it will affect the actual interest rate served on deposits and as such can be considered as a traditional interest activity. Hence, we do not regard it as a business which is expected to expand the scope of relationships beyond merely lending-deposit activities.

[5] It can be argued that clients have a strong preference for using reputable and conservative banks for their fiduciary activities. We address this causal relationship in section 4.5.a.

Clients can establish a long-run relationship and provide banks with fairly stable funding by entrusting cash surrender value on their policies to the bank. This financial resource is likely to enhance client relationships (by increasing the bank's franchise value) and is also expected to mitigate banks' risky lending.

3) Underwriting income from insurance and reinsurance activities and income from other (non-life) insurance activities (*Other Insurance Services*).

Other insurance income provides banks with financial resources (pool of premiums) that may also be linked to lending. 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. In addition, existing borrowers may request insurance services which merely strengthen relationships and therefore enhance banks' franchise value.

4) Net servicing fees (*Loan Servicing*). [6]

Servicers can collect soft information and identify borrowers who regularly fulfill their repayment obligations and this information can be used by banks for future loan origination. However, to collect more late fees, servicing companies may target borrowers less likely to make timely installments (Wagner, 2009). Moreover, having loan servicers, banks may undermine loan quality and originate more mortgage loans while under-pricing risk. As such, the relationship between *Loan Servicing* and lending quality is indeterminate prior to estimation.

5) Fees and commissions from annuity sales (*Annuity Sales*).

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[6] 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 installments to a loan servicing firm. Most of mortgages are backed by Federal housing programs such as Fannie Mae and Freddie Mac.

Similar to life insurance, clients establish a long-run relationship and may provide banks with stable funding. It is also similar to fiduciary, as at the end of the contract banks must pay back to clients the investment made plus the gains earned.

6) Fees and commission from securities brokerage (*Securities Brokerage*).

Clients using securities brokerage services are expected to be relatively financially sophisticated. This business line provides banks with less financial resources as compared to *Fiduciary Activities*, *Life Insurance*, *Other Insurance Services* and *Annuity Sales*. The activity is more cyclical and prone to systematic risk. Moreover, switching costs from one broker to another is not expected to be as large as for other non-interest income activities. As such securities brokerage creates little franchise value for banks. Ex-ante, such activity is also expected to have little effect on lending.

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

Banks have access to private insider information which is not publically available. As such we expect more investment banking activities to improve banks' position in lending; however, this potential positive impact might be cancelled out by the associated agency problem and/or loss of focus caused by activity diversification.

Our aim is to analyze the implications for loan risk, pricing and loan portfolio composition resulting from variation in the aforementioned non-interest income activities. The income from such activities is measured as a percentage of total net operating income following the existing literature (Stiroh, 2004 among others). For Equation (2), however, we scale the non-interest income items by total assets in lieu of total net operating income, since the latter includes net interest income (alongside non-interest income) and may cause a

mechanical inverse relationship between the share of non-interest income in total operating income and *Spread*[7].

2.3. CONTROL VARIABLES

2.3.a. Loans Portfolio Structure and Characteristics

In our Credit Risk model (1) unused credit lines and loan commitments (*Unused Commitment*) are included to indicate that banks' borrowers with higher *Unsecured Commitment* face, on average, lower liquidity shocks and have the capacity to be more leveraged. As such, we expect a negative relationship between *Unused Commitment* and *Credit Risk*. We include in our *Credit Risk* model the face value of *Unused Commitment* as a proportion of total assets. Berg et al. (2013) 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). Hence, higher *Unused Commitments* may represent greater borrowing cost smoothing and lower *Spreads*. We also include *Unused Commitment* in our *Spread* model (Equation (2)).

We add the share of net gains (losses) on sales of loans and leases and net securitization income (*Loans Sale*) in total operating income to our *Credit Risk* model (Equation (1)). A higher income share of *Loans Sale* suggests better loan quality; however, banks active in the loan sales market may target riskier loans. As such, the relationship between *Loans Sale* and loan quality is not clear.

We also include the quarterly growth rate of gross loans (*Loan Growth*) in 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).

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[7] An increase in non-interest income share might be due to a decline in net interest income caused by a decrease in *Spread*.

We also control for *Loan Composition* by including *Unsecured Loans* in the Equations (1) and (2), since *Credit Risk* and *Spread* might be influenced by loan portfolio composition. *Unsecured Loans* might be more or less risky than loans secured by real estate (*Secured Loans*). On the one hand, *Unsecured Loans* may reflect loose credit origination; on the other hand, banks may require collateral only from risky borrowers. As such, *Unsecured Loans* may suggest higher or lower credit quality. *Unsecured Loans* may also reflect different loans (for instance mortgage loans vs. other loans) and borrower types. Banks may determine their *Spread* based on the structure of the loan portfolio. *Non-performing Loans* are introduced into the *Spread* model (2) since an increase in *Non-performing Loans* is expected to increase *Spread* (Angbazo, 1997; Carbo and Rodriguez, 2007 among others). We also include the share of total loans in total assets (*Loan Asset Ratio*) in the second Equation, as loan pricing may depend on loan quantity. Banks more focused on lending are expected to have higher expertise in loan origination and hence enjoy a higher *Spread*. Alternatively, focused banks might enjoy greater synergies and may be expected to be more competitive in lending by lowering *Spread*.

2.3.b. Other Bank Level Heterogeneities

The share of equity capital in total assets (*Capital*) is controlled for in all three models. On the one hand, higher *Capital* is associated with lower moral hazard problems and better capitalized banks have greater monitoring incentives (Diamond, 1984). On the other hand, equity capital provides banks with an enhanced capacity for risk-taking. It can represent equity-holders' risk preferences (McShane and Sharpe, 1985 and Maudos and De Guevara, 2004) and banks with a higher capital ratio may target riskier activities to compensate for the higher cost of equity compared to debt finance. *Spread* is included in our *Credit Risk* model because a higher *Spread* should translate into greater risk due to adverse selection problems.

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We also control for cost inefficiency represented by the ratio of non-interest expense to total operating revenue (*Inefficiency*) in the *Credit Risk* model since less efficient banks are expected to have lower loan quality due to poorer loan monitoring. They might even have greater incentives for risk-taking (Kwan and Eisenbeis, 1997). The share of core deposits in total assets (*Core Deposits*) is included in both Equations (2) and (3), as both *Spread* and *Loan Composition* may depend on the structure of debt financing.

We also control for bank size by including the logarithm of total assets (*Size*) in all three models. *Size* can have several impacts on *Credit Risk*, *Spread* and *Loan Composition*: Large and small banks have different business models, the former relying more heavily on non-interest generating 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 opaque firms which may be more risky. Alternatively, 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, lower spreads and a different loan composition. The logarithm of the bank's age (*Log(Age)*) is expected to capture the longevity /experience on the bank's *Credit Risk*, *Spread* and *Loan Composition*.

2.3.c. Macroeconomic, State-Level and Time Fixed Effect Controls

All three models include the level of interest rates (*Interest Rate*) using the average annualized U.S. 3-month T-bill rate. Previous studies show that banks' risk appetite inversely depends on the level of interest rates (Dell' Ariccia and Marquez, 2006; Rajan, 2006; Borio and Zhu, 2008; Delis and Kouretas, 2011; Maddaloni and Peydró, 2011). Banks typically have higher risk-taking appetites when rates are low. However, at higher levels, borrower

default probabilities rise as their ability to re-pay loans decreases (Jarrow and Turnbull, 2000; Carling et al., 2007; Drehmann et al., 2010; Alessandri and Drehmann, 2010). We attempt to control for state-level heterogeneity by including indexes for house prices (*House Price Growth*) and growth in personal income (*Income Growth*). Finally, yearly fixed effects are controlled for by introducing four, two and one year dummies for the pre, acute and post-banking crisis periods, respectively. 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 7,578 commercial banks domiciled in the U.S. operating between 2003 and 2010. The sample is constructed on a quarterly basis, providing a total of 207,468 bank-quarter observations. Bank-level data is collected from the web-site of the Federal Reserve Bank of Chicago, the annualized 3-month T-Bill rate is obtained from Datastream, state-level home price indexes and personal income data are retrieved from the Office of Federal Housing Enterprise Oversight and the Bureau of Economic Analysis, respectively. We exclude banks that have been in operation for less than 3 years and banks with no loans and deposits. Similar to the FDIC's (2012) definition of community banks[8], we include all other commercial banks with total assets below $ 1 billion; and for commercial banks with more than $ 1 billion in total assets, however, we only include banks with core deposits that account for more than 50% of total liabilities and at least one-third of their assets are allocated to loans[9]. Outliers are removed from the sample by winsorizing up to 2% of each tail[10]. All the variables are de-seasonalized[11] and income

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[8] See http://www.fdic.gov/regulations/resources/cbi/report/CBSI-1.pdf.

[9] In other words, below the asset size limit which is $ 1 billion, the structures of assets and liabilities are waived. FDIC has more restrictive conditions in their definition of community banks; they claim that 94 percent of all U.S. banking organizations were community banks as of 2010.

[10] We winsorize the data to the extent that the sample lies in the (mean $\pm$ 4×S.D., mean $\pm$ 6×S.D.) domain. Hence, each variable is winsorized based on how dispersed its distribution is and how flat the tails are.

statement figures have been annualized. We also remove banks with negative non-interest income ratios[12]. We use the definition provided by the Bank for International Settlements (2010) to examine relationships pre-crisis (January 2003 to June 2007); over the acute-crisis (July 2007 to March 2009) and post-crisis (April 2009 to December 2010). We also study two samples of banks: 3,206 very small banks (82,807 observations) with less than $100 million in total assets (*Micro Commercial Banks*). The second sample consists of the remaining 4,372 commercial banks (*Non-Micro Commercial Banks*) with 124,661 observations. The reason for examining the smallest banks separately is that the U.S. banking system is dominated by small banks and their business model is traditional intermediation (deposits and loans) . As banks become larger their business model tends to shift towards a larger noninterest income orientation. The aim is to see if this matters for credit purposes.

Table I (PANELS A and B) presents the descriptive statistics for pre, acute and post crisis periods for *Micro* and *Non-Micro Commercial Banks*, respectively. The figures show that during the period under study, *Non-performing Loans* of *Micro Commercial Banks* increased from 0.50% before the crisis to 1.14% in the acute-crisis and 1.87% thereafter. The *Credit Risk* proxy of *Non-Micro Commercial Banks* has risen more than those of *Micro Commercial Banks*. While during the pre-crisis period, it is on average lower for *Non-Micro Commercial Banks*, we end up with a lower value of the *Credit Risk* proxy for *Micro Commercial Banks* in the post-crisis period. *Non-performing Loans* of *Non-Micro Commercial Banks* are on average 0.30% before the credit-crisis, which increased to 1.45% and 2.92% in the acute and post-crisis periods, respectively.

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[11] We regress bank level data and the interest rate on three quarter dummies and use the residual as the de-seasonalized value. The state-level data (*Home Price Growth* and *Personal Income Growth*) have already been de-seasonalized.

[12] Totally, 6, 90 and 65 observations on non-interest income scaled by total operating income are excluded from our samples for the pre, acute and post-crisis periods, respectively. We also scale the non-interest income components by total assets, as a robustness check, in which case we do not need to exclude these observations.

Unused Commitments are on average higher for *Non-Micro Commercial Banks*; however variation across different time periods is similar for both *Micro* and *Non-Micro Commercial Banks*. The value of *Unused Commitment* scaled by total assets for both *Micro* and *Non-Micro Commercial Banks* has increased from 1.45% and 3.52%, respectively, in the pre-crisis period to 1.65% and 3.65% in the acute crisis; then falls to 1.38% and 2.71% in the post-crisis period.

The quarterly *Loan Growth* of both *Micro* and *Non-Micro Commercial Banks* declines over the sample period; however, the slowdown is greater for the latter group. It drops from 2.71% in the pre-crisis to minus 0.06% during the post-crisis period for *Non-Micro Banks*, whereas the *Loan Growth* of *Micro Banks* falls to a 0.5% after the crisis from 1.67% before the crisis. *Unsecured Loans* have less weight in the loan portfolios of *Non-Micro Commercial Banks* compared to *Micro Commercial Banks*. The loan composition of *Micro Commercial Banks* remains almost stable across the sample periods with around an 18.60% share of *Unsecured Loans* in total loans, while the weight for *Non-Micro Commercial Banks* slightly increases from 12.12% in the pre-crisis to 12.58% in the post-crisis.

Spread is equal to 3.78% and 3.67% in the pre-crisis period for *Micro* and *Non-Micro Commercial Banks*, respectively; however, it shrinks during the crisis to 3.42% and 3.31% and then partly recovers post-crisis to 3.61% and 3.47%, respectively. The figures also show that commercial banks' reliance on non-interest income falls slightly over time. *Non-interest Income* share in total operating income is on average 14.57, 14.22% and 12.95% during the pre-, acute- and post-crisis periods, respectively for *Micro Commercial Banks*, whereas it stood at 17.68%, 17.18% and 15.83% for *Non-Micro Commercial Banks* over the same periods.

[TABLE I]

The second part of *PANELS A & B* illustrates the income shares of the relationship expanding non-interest income activities consist of *Fiduciary Activities*, *Life Insurance*, *Other Insurance Services*, *Loan Servicing*, *Annuity Sales*, *Securities Brokerage* and *Investment Banking*, in total net operating income for *Micro* and *Non-Micro Commercial Banks*, respectively. The descriptive statistics show that the income share for *Fiduciary Activities* reaches its highest value during the credit crisis at 0.16% and 0.85% for *Micro* and *Non-Micro Commercial Banks*, respectively and then it falls to 0.12% and 0.73% after the crisis. *Life Insurance* has a stable income share in total operating income for *Micro Commercial Banks* at around 0.39%, whereas *Non-Micro Commercial Banks* have experienced an up-ward trend in the contribution of *Life Insurance*'s income in total operating income reaching 0.74% after the crisis. The income share of *Other Insurance Services* in total operating income for both *Micro* and *Non-Micro Commercial Banks* declined during the post crisis period standing, at 0.40% and 0.39%, respectively. *Loan Servicing* income contribution to total operating income for both *Micro* and *Non-Micro Commercial Banks* remains stable before and during the crisis, and increases thereafter to 0.25% and 0.45%. We have insufficient observations on the income share of *Annuity Sales*, *Securities Brokerage* and *Investment Banking* before the crisis. For acute and post-crisis periods, however, the data show that they have a tiny weight in total operating income of *Micro Commercial Banks* and their share declined during the post-crisis period to 0.01%, 0.05% and 0.01%, respectively. *Non-Micro Commercial Banks* have also experienced a decline in the income share of these three businesses to 0.10%, 0.22% and 0.06%, respectively, after the crisis.

The third part of PANELS A & B also exhibits other elements of non-interest income businesses. *Venture Capital*'s income has a tiny weight in total operating income of both *Micro* and *Non-Micro Commercial Banks* during all three periods of study. *Service Charges* have an almost similar weight in total net operating income for both groups of banks in the

pre-crisis period; however, the weight is slightly lower in the acute and post-crisis period for *Micro Commercial Banks* (8.71%, 8.68% and 8.20%, respectively), whereas its income share moderately increased for *Non-Micro Commercial Banks* in the acute-crisis from 8.23% to 8.92% and then fell to 8.72% in the post-crisis period. Income share of *Loan Sales* in total net operating income declined during the acute-crisis period and increased thereafter standing at 0.67% and 1.77% for *Micro* and *Non-Micro Commercial Banks*, respectively. *Trading* income makes a small contribution to total net operating income for both *Micro* and *Non-Micro Commercial Banks*. *Other Assets Sale*, on average, has a negative weight in total net operating income of *Micro Commercial Banks* during the post-crisis period. It also appears with a negative sign for *Non-Micro Commercial Banks* in both the acute and post-crisis periods.

Finally, the fourth part of PANELS A & B displays the descriptive statistics for the *Unsecured Loans* breakdown for *Micro* and *Non-Micro Commercial Banks*, respectively. *Unsecured Loans* are classified into five main categories as follows: loans to finance agricultural production and other loans to farmers (*Agricultural Loans*), commercial and industrial loans (*C&I Loans*), consumer loans (*Consumer Loans*), loans to depository and non-depository financial institutions (*Financial Institution Loans*) and other loans not secured by real estate (*Other Unsecured Loans*). All are scaled by total loans. For *Micro Commercial Banks*, *Agricultural Loans* are the major component of *Unsecured Loans* and others have a small weight in total loan portfolios. *Non-Micro Commercial Banks* have a different loan composition: *Agricultural Loans* after *C&I Loans* are the major type of *Unsecured Loans*. We also observe that loan composition remains relatively stable across different study periods for both groups of banks.

PANEL C shows that interest rates have fallen from 2.82% in the pre-crisis period to 1.92% and 0.13% during the acute and post crisis periods, respectively. The home price index, on average, has experienced a negative quarterly growth during the acute- and post- crisis

periods, whereas it increased by 1.79% (on average across different U.S. states) before the crisis (January 2003 to June 2007). The quarterly growth rate of personal income has also fallen since the onset of the crisis but has increased modestly to 0.72% in the post-crisis period.

4. Empirical Results

4.1. CREDIT RISK

We estimate the *Credit Risk* model (Equation (1)) using our quarterly panel data and the fixed effects technique to investigate whether the various non-interest income activities that we consider have any significant impact on banks' loan quality. Table II presents the estimation results for 4,092 *Non-Micro Commercial Banks* and 3,293 *Micro Commercial Banks* during the study periods.

The first four columns present the results for *Non-Micro Commercial Banks* in the pre-crisis period. Column (1) illustrates the estimation where we regress the *Credit Risk* proxy on non-interest income activities, namely, *Fiduciary Activities, Life Insurance, Other Insurance Services* and *Loan Servicing*[13] while controlling for macroeconomic, state-level and year fixed effect controls, (*Interest Rate*, *Home Price Growth*, *Income Growth* and year dummies). In column (2), we try to capture heterogeneities caused by loan portfolio structures and other characteristics by adding *Unused Commitment*, *Loans Sale, Loan Growth* and *Unsecured Loans* to our model. We introduce *Capital*, *Spread* and *Inefficiency* to the model in column (3). Finally, *Size* and *Log(Age)* are controlled for in the fourth column. In all specifications the results show a significant and negative coefficient for *Fiduciary Activities* and *Life Insurance* implying that income from these businesses appears to lower *Credit Risk*. The result is also economically meaningful. A one percent increase, evaluated at the mean, in the income share

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[13] We exclude *Annuity Sales*, *Securities Brokerage* and *Investment Banking* due to insufficient data in the pre-crisis period.

of *Fiduciary Activities* or *Life Insurance* in total net operating income lowers *Non-performing Loans*, on average, respectively by 0.012% and 0.011%. The average *Non-performing Loans* in the pre-crisis period is 0.30%, so the effects are economically significant and equal to a 4% (4%=$\frac{0.012\%}{0.30\%}$) and 3.67% (3.67%=$\frac{0.011\%}{0.30\%}$) fall in the average *Non-performing Loans*. *Other Insurance Services* appears with a negative coefficient only in the last two specifications and merely at a ten percent significance level. *Loan Servicing* depicts no significant relationship with *Credit Risk*.

Among the control variables, *Unused Commitments* and *Loan Growth* are associated with lower *Credit Risk* which is in line with our expectations. An increase in the proportion of *Unsecured Loans* in total loans translates into higher *Credit Risk* (at the ten percent significance level), whereas we observe no significant relationship between *Loan Sales* and *Credit Risk*. More capitalized or inefficient banks have, on average, greater *Credit Risk*. *Spread* appears to have no link with our dependent variable. Larger or older banks have higher *Credit Risk*. We find that *Interest Rate* is positively correlated with *Credit Risk*. An increase in *Home Price Growth* appears to lower *Credit Risk*, whereas an increase in *Income Growth* increases *Credit Risk*.

In columns (5) and (6), we estimate our model for *Non-Micro Commercial Banks* in the acute and post-crisis periods where we include *Annuity Sales*, *Securities Brokerage* and *Investment Banking* in our model. The results show that the negative relationship between *Fiduciary Activities* and *Credit Risk* persists across acute and post-crisis periods with different economic magnitudes. A one percent increase, evaluated at the mean, in the income share from *Fiduciary Activity* in total net operating income lowers *Non-performing Loans*, on average, by 0.076% and 0.089% during the acute and post-crisis periods, respectively. These effects equal to 5.24% and 3.05% of average *Non-performing Loans* in the respective periods (i.e. 5.24% = $\frac{0.076\%}{1.45\%}$ and 3.05% = $\frac{0.089\%}{2.92\%}$). However, despite our finding for the pre-crisis

period, *Life Insurance* depicts a positive correlation with *Credit Risk* in the acute-crisis period and no significant relationship thereafter. The negative linkage between *Other Insurance Services* and *Credit Risk* disappears in the acute-crisis period and reappears in the post-crisis at the ten percent significance level. *Annuity Sales* also displays a negative linkage with *Credit Risk* after the crisis period only at the ten percent significance level. *Securities Brokerage* and *Investment Banking* show no significant association with *Credit Risk* during and after the crisis.

Finally, columns (7) to (9) report estimations of our model for *Micro Commercial Banks* in the pre, acute and post-crisis periods, respectively. During the pre-crisis period, we only observe a negative relationship between *Other Insurance Services* and *Credit Risk* at the ten percent significance level - similar to our finding for *Non-Micro Commercial Banks*. In the crisis period, however, we find no significant relationship between any of our non-interest income variables of interest and credit risk. After the crisis, *Securities Brokerage* has a negative link with *Credit Risk* with a relatively large economic magnitude. A one percent increase, evaluated at the mean, in the income share of *Securities Brokerage* in total net operating income lowers *Non-performing Loans* on average, by 0.515%.

[TABLE II]

4.2. SPREAD

We estimate model (2) to investigate whether the non-interest income activities (*Fiduciary Activities, Life Insurance, Other Insurance Services*, *Loan Servicing*, *Annuity Sales*, *Securities Brokerage* and *Investment Banking*)[14] have any significant effect on *Spread*. Table III presents the estimation results using fixed effects and quarterly data of 4,092 *Non-Micro Commercial Banks* and 3,293 *Micro Commercial Banks*.

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[14] Scaled by total assets in lieu of total operating income to avoid the negative mechanical relationship with *Spread*.

Columns (1) to (3) illustrate the regression estimations for *Non-Micro Commercial Banks* in the pre, acute and post-crisis. In the first column, we find little evidence of a link between any components of non-interest income activities (*Fiduciary Activities*, *Life Insurance*, *Other Insurance Services* and *Loan Servicing*)[15] and *Spread* before the crisis. During the crisis (column (2)), however, an increase in income share of *Other Insurance Services* increases *Spread*. We only observe cross-selling in the post-crisis between *Loan Servicing* and *Spread*, as banks with higher income share of *Loan Servicing* in total net operating income have, ceteris paribus, a lower *Spread* suggesting that banks may under-price risk for the sake of higher *Loan Servicing* income. The economic impact is considerable. A one percent increase, evaluated at the mean, in income share of *Loan Servicing* in total net operating income lowers *Spread* by 33 basis points, which equal to 9.75% of average *Spread*. The relationship might also be driven by different loan compositions, namely, that banks with higher income share of *Loan Servicing* might issue more mortgage loans with lower *Spreads*.

Our controls show that an increase in the share of total loans or core deposits in total assets (*Loan Asset Ratio* and *Core Deposits*) raises the *Spread*. *Unused Commitment* depicts a significant positive association with *Spread* during the acute-crisis period. The relationship, however, turns negative after the crisis at the ten percent significance level. *Unsecured Loans* appears with an insignificant coefficient during the periods of study. Higher *Credit Risk* is associated with lower *Spread* during and after the crisis. More capitalized banks have, on average, larger *Spread* in the pre and acute-crisis periods. The relationship disappears after the crisis. We obtain a negative link between *Size* and *Spread* before and after the credit crisis. Older banks have, on average, a higher *Spread* in the pre and post-crisis period, but a lower *Spread* during the crisis. Higher *Interest Rate* is associated with a lower *Spread* before the

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[15] *Annuity Sales*, *Securities Brokerage* and *Investment Banking* are included in the model for acute and post-crisis analysis.

crisis but higher *Spread* after the crisis. Higher growth in home prices (*Home Price Growth*) increases the *Spread*, while greater *Income Growth* has the opposite effect.

Columns (4) to (6) display the results for *Micro Commercial Banks*. We find little evidence to support cross-subsidization across different periods of study; however, we observe that before the crisis, a higher income share of *Other Insurance Services* in total net operating income is associated with a higher *Spread*. *Fiduciary Activities* also depicts a positive relationship with *Spread* during the acute-crisis period.

[TABLE III]

4.3. LOAN COMPOSITION

In this sub-section, we explore whether the degree of reliance on the non-interest income activities[16] has any significant effect on the composition of the loan portfolio. Table IV illustrates the regression results from the *Loan Composition* model (Equation (3)) using fixed effects and quarterly data on 4,092 *Non-Micro Commercial Banks* and 3,294 *Micro Commercial Banks*.

We study *Non-Micro Commercial Banks* in columns (1) to (3) for the pre, acute and post-crisis periods, respectively. Column (1) shows that before the crisis an increase in the income share of *Fiduciary Activities* increases the proportion of *Unsecured Loans* in total loans. The result is not only statistically significant but also economically meaningful. A one percent increase, evaluated at the mean, in income share of *Fiduciary Activities*, increases the weight of *Unsecured Loans* by 0.221%. The effect equals to an increase of 1.82% in the average share of *Unsecured Loans* in total loans. In the second column, the positive association of *Fiduciary Activities* and *Unsecured Loans* turns into negative at the ten percent significance level. We observe no significant links between any other components of non-

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[16] *Fiduciary Activities, Life Insurance, Other Insurance Services*, *Loan Servicing, Annuity Sales, Securities Brokerage* and *Investment Banking*.

interest income and the share of *Unsecured Loans* in total loans during the acute-crisis period. The result for the post-crisis period presented in column (3) displays a positive correlation between the income share of *Other Insurance Services* in total net operating income and the weight of *Unsecured Loans* in total loans[17].

The results for the control variables show no significant relationship between the share of *Core Deposits* in total assets and the share of *Unsecured Loans* in total loans. *Unsecured Loans* have a greater weight in total loans for more capitalized banks during the pre and post-crisis periods. An increase in the *Size* or *Age* of banks is associated with an increase in the share of *Unsecured Loans*. A higher *Interest Rate* is negatively linked to the share of *Unsecured Loans* in total loans. *Home Price Growth* depicts little linkage with the share of *Unsecured Loans* in total loans in the pre and post-crisis periods and appears with a positive coefficient during the acute-crisis period only at the ten percent significance level. *Income Growth* is positively correlated with the weight of *Unsecured Loans* in total loans during the pre and acute-crisis periods.

Columns (4) to (6) exhibit the estimation results for *Micro Commercial Banks* during the three study periods. The results provide little evidence of a significant relationship between the income share of non-interest income activities in total net operating income and the weight of *Unsecured Loans* in total loans in all periods studied. We also observe that despite our findings for *Non-Micro Commercial Banks*, an increase in *Size* of *Micro Commercial Banks* lowers the share of *Unsecured Loans* in total loans, before and after the crisis. Moreover before the crisis, an increase in *Interest Rate* is associated with a lower share

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[17] Economically, a one percent increase, evaluated at the mean, in the income share of *Other Insurance Services* increases the share of *Unsecured Loans* by 0.095%. The magnitude equals to 0.76% of the average share of *Unsecured Loans* in total loans. *Annuity Sales* also displays a positive linkage with *Unsecured Loans* at the ten percent significance level. A one standard deviation increase in the income share of *Annuity Sales* increases the weight of *Unsecured Loans* in total loans by 0.027%, which is equal to 0.21% of the average share of *Unsecured Loans* in total loans.

of *Unsecured Loans* in total loans which contrasts with our results for *Non-Micro Commercial Banks*.

[TABLE IV]

4.4. FURTHER ISSUES - COST COMPLEMENTARITIES

The linkage of the relationship expanding non-interest income activities with loan quality, composition and spreads may be due to informational and/or cost synergies. In this section, we investigate whether pair-wise cost complementarity exists between lending and the non-interest income activities that help explain joint production[18]. As such, we examine whether the marginal cost of producing loans decreases when they are generated jointly with the non-interest income activities. Appendix A2 illustrates our multi-product cost function from which marginal costs are derived.

In a multi-product firm the pair-wise cost complementarity (PCC) between two products exists when an increase in product A lowers the marginal cost of producing product B (Clark, 1988). The measure of cost complementarity is as follows:

$$PCC(Y_A, Y_B) = \frac{\partial^2 TC}{\partial Y_A \partial Y_B} = \left(\frac{TC}{Y_A Y_B}\right) \times \left[\frac{\partial^2 LnTC}{\partial LnY_A \partial LnY_B} + \left(\frac{\partial LnTC}{\partial LnY_A}\right) \times \left(\frac{\partial LnTC}{\partial LnY_B}\right)\right] \qquad (4)$$

PCC < 0 implies the existence of cost complementarity between products A and B. The necessary condition for the existence of cost complementarity (PCC<0) is:

$$NC\_PCC = \frac{\partial^2 LnTC}{\partial LnY_A \partial LnY_B} < 0 \qquad (5)$$

PCC = 0 implies the non-jointness or absence of cost complementarities. At any non-zero production level of Y_A and Y_B, $\frac{TC}{Y_A Y_B} > 0$. Hence, the non-jointness requires:

$$\left[\frac{\partial^2 LnTC}{\partial LnY_A \partial LnY_B} + \left(\frac{\partial LnTC}{\partial LnY_A}\right) \times \left(\frac{\partial LnTC}{\partial LnY_B}\right)\right] = 0 \qquad (6)$$

PCC > 0 implies existence of diseconomy of joint production.

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

Table V illustrates the empirical results on cost complementarity between the relationship expanding non-interest income activities and lending (secured and unsecured loans (Y1 & Y2)) for *Micro* and *Non-Micro Commercial Banks* during the pre, acute and the post-crisis periods. The first two columns display the analysis for *Non-Micro Commercial Banks* and columns (3) and (4) exhibit the results for *Micro Commercial Banks*[19]. In columns (1) and (3) the necessary condition for the existence of cost complementarity between the non-interest income activities and *Secured* or *Unsecured Loans* is presented. The results show that the necessary condition is achieved, except for *Unsecured Loans* of *Non-Micro Commercial Banks* in the acute and post-crisis periods. Columns (2) and (4) exhibit the measure of cost complementarity. The findings indicate that the sufficiency condition is not fulfilled suggesting non-jointness[20].

[TABLE V]

As a robustness check, we also follow the production approach (Berger and DeYoung, 1997 among others) and include transaction deposits in our model as a further output. The results are similar to our previous findings. Overall, we find little evidence for the existence of cost complementarity between lending and the relationship expanding non-interest income activities.

4.5. ROBUSTNESS CHECKS

4.5.a. Credit Risk

As a robustness check, we use a dynamic panel setting to study the effect of the relationship expanding non-interest income activities on *Credit Risk*. This allows us to address

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[19] We do not report the measure of cost complementarity for *Micro Community Banks* during the acute and post-crisis, where we obtain a negative elasticity of total costs to either loans or the non-interest income activities.

[20] Normally total cost is much less than the products of loans (whether *Secured* or *Unsecured*) with other financial services (in our case the relationship expanding non-interest income businesses). Hence, the first component of the measure of cost complementarity, $\frac{TC}{Y_A Y_B}$, is too small such that its product with the second component makes the measure very close to zero, implying non-jointness.

the persistence in bank risk-taking which is pointed out by previous literature (Delis and Kouretas, 2011, among others).

Table A3 of the appendix presents the results. Columns (1) to (6) display our analysis for *Non-Micro Commercial Banks* during the periods under study. In the first column, we explore the relationship before the crisis. We estimate the model using the fixed effect technique, similar to Loutskiana (2011)[21] and find significant and negative coefficients for *Fiduciary Activities* and *Life Insurance* which supports our previous finding; however, the negative relationship primarily observed (at the ten percent significance level) between *Other Insurance Services* and *Credit Risk* disappears. We also scale income of the non-interest income activities with total assets in lieu of total net operating income and find similar results[22].

The second column shows the results of our acute-crisis analysis. We estimate our dynamic panel model using the 2SLS approach where only Y_{it-2} is used as the instrument for ΔY_{it-1} (a just-identified case) as suggested by Anderson and Hsiao (1981).[23] The estimation results provide us with little evidence to support our previous finding on the negative link between *Fiduciary Activities* and *Credit Risk*; however, the positive association of *Life Insurance* and *Credit Risk* remains unchanged. We find similar results when we scale our variables of interest with total assets.

Columns (3) to (6) present estimations for the post-crisis period. In the third column, since we have relatively small time periods in the post-crisis, we estimate our model using the

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[21] In the dynamic panel specification, the lagged dependent variable becomes endogenous when the sample has a small time dimension (the literature considers the problem for a sample with less than 15 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.

[22] The results are not reported here but are available from the authors on request.

[23] Since we have a limited number of time periods, fixed effect techniques are not appropriate due to the correlation of lagged values of the dependent variable with the error term. Moreover, we cannot use system GMM technique since both the Hansen and Sargan tests reject the null hypothesis of instrument validity.

two step system GMM technique introduced by Roodman (2006). This performs the Windmeijer (2005) finite-sample correction to the stated standard errors. We observe that *Fiduciary Activities* and *Other Insurance Services* appear with a negative coefficient similarly to our previous finding. We run the Arellano and Bond (A.B.) test (1991) for serial correlation in the error terms. The null hypothesis is no auto-correlation in the first-differenced residuals at the second order[24]. The A.B. test result does not reject the null hypothesis. We also carry out the Hansen and Sargan tests of over-identification, where the null hypothesis is the joint validity of moment conditions. The Hansen (1982) J test result does not reject the null hypothesis, while the Sargan (1958) test does. In column (4), we limit the instruments of system GMM estimators to the second lag of the dependent variable which reduces the number of instruments from 41 to 29. This time, both Sargan and Hansen tests do not reject the null, whereas our finding in the previous column remains almost unchanged. The results persist when our variables of interest are scaled by total assets in lieu of total net operating income.

The relationship expanding non-interest income activities might be endogenous, due to a possible contemporaneous relationship with *Credit Risk*. Diversifying into non-interest income activities may depend on a bank's position in lending. For instance clients may select banks with lower *Credit Risk* for *Fiduciary Activities*. Alternatively, banks with poor performance in lending may also rely more on non-interest income activities such as *Loan Servicing*. Column (5) displays the result, where we deal with possible endogeneity issues. The result shows that the negative relationship between *Fiduciary Activities* and *Credit Risk* persists, while its negative linkage with *Other Insurance Services* disappears. The A.B. test for serial correlation in the error terms does not reject the null hypothesis. The Hansen (1982) J test of over-identification does not reject the null hypothesis, while the Sargan (1958) test

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[24] Rejecting the null hypothesis at the first order does not imply that the moments are not valid, since the first difference of independently and identically distributed errors is serially correlated.

does. In column (6), we limit the instruments of system GMM estimators to the second lag of the dependent variable which reduces the number of instruments from 210 to 198. Both the Sargan and Hansen tests do not reject the null, and our finding from the previous column persists.

In sub-section (4.1), we observe that a rise in the income share of *Securities Brokerage* in total net operating income decreases *Credit Risk* of *Micro Commercial Banks* during the post-crisis period. Column (7) presents a dynamic panel analysis of our model. We estimate our model using the two step system GMM technique introduced by Roodman (2006). The estimation result provides us with little evidence to support our previous finding on the relationship between *Securities Brokerage* and *Credit Risk*. *Other Insurance Services* depicts a negative association with *Credit Risk* despite our initial results which suggests a weak link. The A.B. test for serial correlation in the error terms does not reject the null hypothesis. The Hansen (1982) J test of over-identification result does not reject the null hypothesis, while the Sargan (1958) test does. In column (8), we limit the instruments of system GMM estimators to the second lag of the dependent variable which reduces the number of instruments from 41 to 29. The Sargan test rejects the null only at the ten percent significance level, and so our findings in the previous column remain unchanged.

4.5.b. Loan Composition

We find that an increase in the income share of *Fiduciary Activities* in total operating income of *Non-Micro Commercial Banks* increases the share of *Unsecured Loans* in total loans in the pre-crisis period. The relationship turns into negative in the acute-crisis period. During the post-crisis period, we observe that a greater income share of *Other Insurance Services* or *Annuity Sales* in total operating income is associated with a higher weight of *Unsecured Loans* in total loans.

As a further analysis, we replace the *Unsecured Loans* with its four major components - *Agricultural Loans*, *C&I Loans*, *Consumer Loans* and *Financial Institutions Loans* – in our Loan Composition model (Equation (3)). We estimate the model using fixed effect technique and quarterly data of 4,092 *Non-Micro Commercial Banks* during the pre, acute and post-crisis periods.

The results are presented in table A4 of the appendix. Columns (1) to (4) illustrate the estimations respectively for *Agricultural Loans*, *C&I Loans*, *Consumer Loans* and *Financial Institutions Loans* in the pre-crisis. We find that an increase in the income share of *Fiduciary Activities* in total operating income decreases the share of *Consumer Loans*, but increases the share of *Financial Institution Loans* in total loans. Both relationships are observed only at the ten percent significance level and disappear when we scale our variables of interest (namely, relationship expanding non-interest income activities) with total assets in lieu of total operating income.

Columns (5) to (8) exhibit the results for the acute-crisis period. We find a negative relationship between *Fiduciary Activities* and *C&I Loans*. The relationship persists even when we use total assets to scale our variables. We also observe a positive correlation between *Fiduciary Activities* and *Financial Institution Loans* only at the ten percent significance level which disappears when we scale our variables of interest with total assets. The findings also show that an increase in the income share of *Other Insurance Services* decreases the share of *Agricultural* and *Consumer Loans*. Moreover, *Investment Banking* is negatively linked to *C&I Loans*. As a robustness check, we scale our variables of interest with total assets and find similar results.

The analyses of the post-crisis period for the components of *Unsecured Loans* are displayed in columns (5) to (8). Similar to our findings for the acute-crisis period, *Fiduciary Activities* are negatively linked to *C&I Loans* and have a positive correlation with *Financial*

Institution Loans. An increase in the income share of *Life Insurance* in total operating income decreases the share of *Financial Institution Loans*. We also observe that the positive association between income share of *Other Insurance Services* in total operating income and the share of *Unsecured Loans* in total loans during the post-crisis period is mainly driven by the positive linkage between *Other Insurance Services* and *Agricultural Loans*. The findings remain unchanged when scaling by total assets is used as a robustness check. The results also show that banks with greater income share of *Securities Brokerage* have, on average, lower *Consumer Loans*. The relationship is only significant at the ten percent level and disappears when we scale our variables of interest with total assets in lieu of total operating income.

5. Summary and Conclusion

This paper analyzes the impact of potential relationship expanding non-interest income activities on banks' lending in terms of its quality, spreads and structure. Agency problems and a potential loss of focus associated with diversification into non-interest income businesses may cause deterioration in loan quality. Alternatively, expanding client relationships might improve the quality of banks' credit through increased franchise value and the ability to collect more soft information via multiple interactions and cross-selling non-traditional banking services. Banks with a wider scope of relationships are able to reach more potential borrowers. This may result in different loan portfolio structures. Moreover, non-interest earnings may also influence banks' loan pricing strategy through possible cross-subsidization effects.

Using quarterly data on 7,578 U.S. deposit and loan orientated commercial banks between 2003 and 2010, we examine such relationships before, during and after the 2007/2008 financial crisis. We study a sub-sample of 3,206 commercial banks with less than $100 million of total assets ('*micro*' commercial banks) separately from larger institutions that

have developed a broader array of non-interest lines of businesses ('*non-micro*' commercial banks). Non-interest income activities of *micro* commercial banks have fallen from around 14.6% of total net operating income pre-crisis to just below 13% post-crisis. *Non-micro* commercial banks have also experienced a moderate decline in the contribution of non-interest income to total operating income from about 17.7% to approximately 15.8%. Credit risk has increased over the study period for both groups of banks.

We examine the possible influence of non-interest income business lines that are likely to expand the scope of relationship with clients have on banks' credit risk, spreads and loan composition.

Overall, our analysis of *non-micro* commercial banks shows that an increase in the income share of fiduciary activities in total operating income lowers credit risk, especially during the pre and post-crisis periods. It also reduces the proportion of commercial and industrial loans in total loans in the acute and post-crisis periods, while increasing the weight of loans to financial institutions (in total loans) post-crisis.

Life insurance depicts a negative relationship with credit risk before the crisis; the relationship, however, turns positive during the crisis and disappears thereafter. It is also negatively associated with loans to financial institutions in the post-crisis period. Moreover, the results show that an increase in the income share of investment banking is associated with a lower proportion of C&I loans in total loans during the recent credit-crisis period.

We find little evidence to support the view that there is cross-subsidization between traditional intermediation and non-interest income activities except for loan servicing in the post-crisis period where we observe that a higher income share of loan servicing is associated with lower lending-deposit spreads.

The analysis of *micro* commercial banks provides us with little evidence of any link between our non-interest income variables and credit risk and loan composition. However, we

find that a greater income share of fiduciary activity is associated with higher lending-deposit spreads in the acute-crisis. Other insurance services also depict a positive relationship with the spread during the pre-crisis period in all three periods of study.

Finally, we investigate whether pair-wise cost complementarity exists between lending (both secured and unsecured) and our non-interest income activities that could explain their joint production. Our results provide us with little evidence to support this hypothesis.

Overall, this paper attempts to shed light on the linkage between bank lending and the relationship expanding non-interest income activities. In general, we find that non-interest business areas that provide stable financial resources – such as fiduciary and life insurance activities – are likely to reduce credit risk – presumably because such activities generate more soft information and also have a positive impact on bank franchise values. Our analysis also reveals that links between other non-interest income activities and features of bank lending (credit risk, spreads and loan composition) tends to vary both over the crisis period (pre-, acute-, and post-crisis) and for different size banks (micro and non-micro). Overall, our results indicate that such non-interest income activities influence bank franchise values, risk-taking and loan composition features.

Appendices

Table A1. Variable Description

This table presents description of variables used in this study.

Dependent Variables	Description
Credit Risk	The ratio of non-performing loans on gross loans (*Non-performing Loans*). *Non-performing Loans* consist of non-accrual loans and loans which are past due for 90 days or more and still accruing.
Spread	Net interest spread equals to (Interest income / average earning assets) – (interest expense / average interest-bearing liabilities).
Loan Composition	Represented by the share of loans unsecured on real estate in total loans (*Unsecured Loans*).
Variable of Interest	
Fiduciary Activities	Income from fiduciary activities.
Life Insurance	Earnings on/increase in value of cash surrender value of life insurance.
Other Insurance Services	Underwriting income from insurance and reinsurance activities and income from other insurance activities.
Loan Servicing	Net servicing fees.
Annuity Sales	Fees and commissions from annuity sales.
Securities Brokerage	Fees and commission from securities brokerage.
Investment Banking	Investment banking, advisory, and underwriting fees and commissions.
Control Variables	
Unused Commitment	The ratio of face value of unused credit lines and loans commitment to total assets.
Loan Growth	Quarterly growth rate of gross loans.
Asset Growth	Quarterly growth rate of total assets.
Inefficiency	Total non-interest expense divided by total operating revenue.
Capital	Equity capital to asset ratio.
Core Deposits	Share of core deposits in total assets.
Size	Logarithm of total assets.
Log(Age)	Logarithm of bank's age.
Interest Rate	Average annualized 3-month T-Bill rate, obtained from Datastream.
Home Price Index Growth	Quarterly growth rate of home price index per state, retrieved from the Office of Federal Housing Enterprise Oversight
Personal Income Growth	Quarterly growth rate in personal income per state, collected from Bureau of Economic Analysis.
Other Non-interest Income Activities	
Venture Capital	Venture capital revenue.
Service Charges	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.
Trading	Trading revenue and net change in the fair values of financial instruments accounted for under a fair value option.
Loan Sales	Net gains (losses) on sales of loans and leases and net securitization income.
Other Assets Sales	Net gains (losses) on sales of other real estate owned, net gains (losses) on sales of other assets (excluding securities), rent and other income from other real estate owned.
Other Activities	Other non-interest income.
Unsecured Loans Breakdown	
Agricultural Loans	Share of loans to finance agricultural production and other loans to farmers in total loans.
C&I Loans	Share of commercial and industrial loans in total loans.
Consumer Loans	Share of consumer loans in total loans.
Financial Institution Loans	Share of loans to depository and non-depository financial institutions in total loans.
Other Unsecured Loans	Share of other loans not secured by real estate in total loans.

Appendix A2. Cost Complementarities Analysis – Cost Function & Descriptive Statistics

Using the intermediation approach (Berger and Mester, 1997 among others), we set-up the following multi-product cost function with a trans-logarithmic functional form (Berndt and Christensen, 1973):

$$LnTC = C_0 + \sum_{i=1}^{6} \alpha_i LnY_i + \sum_{j=1}^{3} \beta_j LnW_j + \gamma_1 LnZ + \tau_1 Trend$$

$$+ \frac{1}{2}\left[\sum_{i=1}^{6}\sum_{k=1}^{6} \delta_{i,k} LnY_i LnY_k + \sum_{j=1}^{3}\sum_{l=1}^{3} \theta_{j,l} LnW_j LnW_l + \gamma_2 (LnZ)^2 + \tau_2 Trend^2\right]$$

$$+ \sum_{i=1}^{6}\sum_{j=1}^{3} \mu_{i,j} LnY_i LnW_j + \sum_{i=1}^{6} \vartheta_i LnY_i\, LnZ + \sum_{i=1}^{6} \pi_i LnY_i\, Trend + \sum_{j=1}^{3} \varphi_j LnW_j\, LnZ$$

$$+ \sum_{j=1}^{3} \sigma_j LnW_j\, Trend + \varepsilon \qquad\qquad (A2-1)$$

Wherein *TC* is the total costs including total interest and non-interest expenses; Y is the output vector consisting of:

Y1 = loans secured on real estate,

Y2 = loans unsecured,

Y3 = securities plus federal funds sold and securities purchased under agreements to resell,

Y4 = total nominal value of off-balance sheet items,

Y5 = the income from relationship expanding non-interest income activities,

Y6 = 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 is the total capital equity and is added to the model to control for unmeasured cost of equity capital. Banks with higher equity capital have lower total costs as they have less debt financing and hence interest expense, assuming all other factors equal (Hughes and Mester, 2013).

We consider the homogeneity and symmetry assumptions which require:

$$\sum_{j=1}^{3} \beta_j = 1, \sum_{j=1}^{3} \sum_{l=1}^{3} \theta_{j,l} = 0, \quad \sum_{i=1}^{6} \sum_{j=1}^{3} \mu_{i,j} = 0, \sum_{j=1}^{3} \varphi_j = 0 \qquad \text{(A2-2)}$$

$$\delta_{i,k} = \delta_{k,i} \text{ and } \theta_{j,l} = \theta_{l,j} \text{ for all } i, k, j \text{ and } l \qquad \text{(A2-3)}$$

We also impose input price homogeneity restrictions (an increase in all input prices increases the total costs by the same percentage) on the cost function parameters by dividing all input prices (W1 and W2) and total costs (TC) with one other factor price (W3).

The total cost function is estimated using a stochastic frontier approach introduced by Aigner et al. (1977) which fits the cost function to best practice banks. This approach assumes that the error term (ε) has two components which are independently distributed: One idiosyncratic error (or random noise) term with a symmetric distribution (υ) and the inefficiency term with a strictly nonnegative distribution (u). We assume that the inefficiency component follows a time-varying decay model proposed by Battese and Coelli (1992), so $\exp\{-\eta(t - T_i)\}u_i$. T_i is the last period in the ith panel and η is the parameter to be estimated. Table A2 presents the descriptive statistics of the total costs, output and input price vectors and total equity capital for *Micro* and *Non-Micro Commercial Banks*.

TABLE A2. Cost Complementarities Analysis - Descriptive Statistics

This table presents general descriptive statistics of total costs, output vectors, input price vectors and capital equity for *Micro* and *Non-Micro Commercial Banks* across the pre-, acute- and post-crisis periods. *Micro Commercial Banks* are defined as banks with less than $100 million in total assets. *Non-Micro Commercial Banks* are commercial banks with total assets above $100 million.

	Variables	Non-Micro Commercial Banks					Micro Commercial Banks				
		Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Pre-Crisis Period	TC	50,302	47.9	238	1.66	3,628	25,270	2.99	1.30	0.34	15.3
	Y1	50,302	450.2	1,910	0.47	25,400	25,270	24.55	14.32	0.47	84.2
	Y2	50,302	160.8	1,159	0.00	19,200	25,270	4.41	5.46	0.00	49.7
	Y3	50,302	230.7	1,053	0.11	15,300	25,270	16.87	11.03	0.11	79.5
	Y4	50,302	210.8	2,408	0.00	47,900	25,270	1.38	2.32	0.00	64.4
	Y5	50,302	4.1	44	0.00	1,022	25,270	0.07	0.20	0.00	11.9
	Y6	50,302	4.8	25	0.00	322	25,270	0.26	0.20	0.00	4.3
	W1 (%)	50,302	52.61	13.93	22.95	162.5	25,270	47.32	10.92	22.95	162.5
	W2 (%)	50,302	29.17	32.42	4.12	800	25,270	36.00	41.87	4.12	800
	W3 (%)	50,302	2.44	0.82	0.50	5.12	25,270	2.33	0.72	0.50	5.12
	Z	50,302	105.6	551.8	0.9	7,917	25,270	6.44	2.93	0.86	25.67
Acute-Crisis Period	TC	21,715	50.6	238	1.18	3,418	7,591	3.48	1.45	0.50	17.5
	Y1	21,715	468.1	1,907	0.99	25,600	7,591	26.78	15.31	0.84	80.4
	Y2	21,715	160.8	1,102	0.00	16,900	7,591	4.83	6.05	0.00	52.8
	Y3	21,715	188.1	913	0.29	14,100	7,591	16.32	10.82	0.29	80.1
	Y4	21,715	154.7	1,571	0.00	29,100	7,591	1.56	2.20	0.00	20.1
	Y5	21,715	3.7	34	0.00	709	7,591	0.09	0.33	0.00	17.2
	Y6	21,715	4.9	27	0.00	355	7,591	0.27	0.21	0.00	4.3
	W1 (%)	21,715	59.19	15.55	27.21	161.43	7,591	53.28	12.95	27.21	161.4
	W2 (%)	21,715	29.44	35.33	4.49	675	7,591	38.27	52.62	4.49	675
	W3 (%)	21,715	3.15	0.72	0.78	5.34	7,591	3.12	0.67	0.78	5.34
	Z	21,715	108.9	603.4	1.5	8,895	7,591	6.93	3.14	1.12	25.64
Post-Crisis Period	TC	22,067	49.5	251	2.48	3,502	6,436	2.98	1.24	0.47	11.3
	Y1	22,067	515.4	2,161	1.01	26,800	6,436	27.13	15.30	1.01	82.8
	Y2	22,067	182.1	1,243	0.00	17,100	6,436	5.00	6.11	0.00	49.1
	Y3	22,067	222.7	1,079	0.10	14,900	6,436	15.89	10.80	0.10	68.5
	Y4	22,067	148.9	1,442	0.00	22,700	6,436	1.39	1.94	0.00	29.6
	Y5	22,067	3.9	32	0.00	532	6,436	0.08	0.18	0.00	2.6
	Y6	22,067	5.9	34	0.00	423	6,436	0.25	0.21	0.00	4.1
	W1 (%)	22,067	61.83	16.20	28.73	167	6,436	55.35	12.99	28.73	159
	W2 (%)	22,067	31.52	45.07	4.81	1,017	6,436	41.76	66.81	4.81	1,017
	W3 (%)	22,067	1.83	0.58	0.26	3.82	6,436	1.83	0.53	0.26	3.82
	Z	22,067	131.74	770.81	0.97	10,600	6,436	7.03	3.04	0.97	24.73

TC is the total costs including total interest and non-interest expenses; Y1 = Loans secured by real estate; Y2 = Loans unsecured on real estate; Y3 = Securities plus federal funds sold and securities purchased under agreements to resell; Y4 = total off-balance sheet items; Y5 = Relationship expanding non-interest income activities; Y6 = Income from service charges on deposit accounts; W1 = salary expenses divided by 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. Total costs (TC), output vectors (Ys) and capital equity (Z) are in million $ and the input prices (Ws) are in percentage.

Table A3. Credit Risk Model – Robustness Checks

This table reports estimations of *Credit Risk* model (Equation (1)) using dynamic panel setting and quarterly data on 4,092 *Non-Micro Commercial Banks* during pre and post-crisis periods and 2,272 *Micro Commercial Banks* in the acute-crisis. *Non-Micro Commercial Banks* are defined as commercial banks with total assets above $100 million, whereas *Micro Commercial Banks* are banks with less than $100 million in total assets. We use *Non-performing Loans* as our *Credit Risk* proxy and regress it on its lagged value, our variables of interest and a set of control variables.

In columns (1) to (6), we estimate the model for *Non-Micro Commercial Banks*. The first column illustrates the estimation of *Credit Risk* model for pre-crisis period where we regress the *Credit Risk* proxy on *Fiduciary Activities*, *Life Insurance*, *Other Insurance Services* and *Loan Servicing* while controlling for loan portfolio characteristics (i.e. *Unused Commitment*, *Loans Sale, Loan Growth* and *Unsecured Loans*), other bank-level heterogeneities (i.e. *Capital*, *Spread*, *Inefficiency*, *Size* and *Log(Age)*) and finally macroeconomics, state-level and year fixed effect controls, i.e. *Interest Rate*, *Home Price Growth*, *Income Growth* and year dummies. We use fixed effect technique to estimate the model. In column (2) we estimate the model for acute-crisis period using 2SLS technique, where only Y_{it-2} is used as the instrument for ΔY_{it-1} (a just-identified case) as suggested by Anderson and Hsiao (1981). We add *Annuity Sales*, *Securities Brokerage* and *Investment Banking* to the model for acute and post-crisis analyses. We keep out the *Interest Rate* from the acute-crisis period analysis, due to its high correlation with *Income Growth*.

 Columns (3) to (6) display estimation of our model for post-crisis period. In column (3) we estimate our model using two step system GMM technique introduced by Roodman (2006). We perform the Arellano and Bond (AB) test (1991) for serial correlation in the error terms and Hansen and Sargan tests of over-identification, where the null hypothesis is joint validity of moment conditions. The Hansen (1982) J test result does not reject the null hypothesis, while Sargan (1958) test does. In column (4), we limit the instruments of system GMM estimators to the second lag of dependent variable to reduce the number of instruments from 41 to 29. The results show that both Sargan and Hansen tests do not reject the null. Column (5) shows the result where we define our variables of interest, i.e. *Fiduciary Activities*, *Life Insurance*, *Other Insurance Services*, *Loan Servicing*, *Annuity Sales*, *Securities Brokerage* and *Investment Banking* as endogenous. In column (7), we limit the instruments of system GMM estimators to the second lag of dependent variable which decreases the number of instruments from 210 to 198. Columns (7) and (8) illustrate analysis of our model for *Micro Commercial Banks* during the post-crisis period, with the same specifications and techniques used in the column (3) and (4).

Year dummies are included in the model, but not reported in the table. All the right-hand-side variables are lagged for one quarter. See Table A1 for variable definitions. Robust z-statistics are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

	Non-Micro Commercial Banks						Micro Commercial Banks	
	Pre-Crisis	Acute-Crisis	Post-Crisis				Post-Crisis	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Credit Risk	0.620***	0.394	0.947***	0.941***	0.942***	0.942***	0.676***	0.804***
	(50.77)	(1.05)	(64.86)	(59.90)	(66.32)	(60.78)	(16.78)	(13.78)
Fiduciary Activities (β_1)	-0.008***	-0.004	-0.012***	-0.013***	-0.029**	-0.028**	-0.019	-0.012
	(-2.93)	(-0.12)	(-3.31)	(-3.52)	(-2.29)	(-2.27)	(-0.92)	(-0.74)
Life Insurance (β_2)	-0.007**	0.060***	-0.011	-0.013	-0.036	-0.040	0.017	0.010
	(-1.98)	(3.37)	(-1.11)	(-1.27)	(-1.37)	(-1.54)	(1.21)	(0.77)
Other Insurance Services (β_3)	-0.003	0.044	-0.015***	-0.016***	0.005	0.002	-0.019***	-0.012*
	(-1.06)	(1.32)	(-2.86)	(-3.06)	(0.22)	(0.08)	(-2.74)	(-1.85)
Loans Servicing (β_4)	0.002	-0.003	-0.004	-0.003	0.010	0.006	0.026	0.003
	(0.76)	(-0.14)	(-0.55)	(-0.37)	(0.49)	(0.30)	(1.19)	(0.11)
Annuity Sales (β_5)		-0.025	-0.024	-0.013	0.059	0.048	0.221	0.125
		(-0.46)	(-0.73)	(-0.41)	(0.87)	(0.71)	(1.18)	(0.74)
Securities Brokerage (β_6)		-0.053	-0.018	-0.019	-0.088**	-0.083**	-0.018	-0.011
		(-1.25)	(-1.14)	(-1.23)	(-2.19)	(-2.10)	(-0.30)	(-0.22)
Investment Banking (β_7)		0.030	-0.067**	-0.075**	-0.141	-0.143	-0.176*	-0.206***
		(0.26)	(-2.22)	(-2.49)	(-1.55)	(-1.57)	(-1.81)	(-2.65)
Unused Commitment (β_8)	-0.003***	-0.022	-0.002	-0.003	-0.002	-0.002	-0.017***	-0.010*
	(-2.98)	(-1.48)	(-0.67)	(-0.83)	(-0.59)	(-0.60)	(-2.64)	(-1.66)
Loan Sales (β_9)	-0.003***	0.002	-0.003	-0.003	-0.004	-0.004	0.002	0.001
	(-2.89)	(0.23)	(-0.89)	(-0.96)	(-1.14)	(-1.33)	(0.24)	(0.14)
Loan Growth (β_{10})	-0.003***	-0.004	-0.011***	-0.014***	-0.010***	-0.012***	-0.014***	-0.012***
	(-6.38)	(-1.53)	(-3.59)	(-4.19)	(-3.41)	(-3.84)	(-5.15)	(-4.19)
Unsecured Loans (β_{11})	0.000	0.004	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.003***
	(0.56)	(1.18)	(-6.22)	(-6.29)	(-5.29)	(-5.24)	(-5.84)	(-4.51)
Capital (β_{12})	0.002	-0.031	-0.019***	-0.019***	-0.020***	-0.020***	-0.005	-0.003
	(0.88)	(-1.63)	(-3.90)	(-3.79)	(-4.19)	(-4.11)	(-1.06)	(-0.86)
Spread (β_{13})	0.014**	0.139	-0.017	-0.022	-0.021	-0.019	0.017	0.019
	(2.07)	(1.03)	(-1.08)	(-1.31)	(-1.30)	(-1.16)	(0.62)	(0.78)
Inefficiency (β_{14})	0.001**	0.002	0.002***	0.003***	0.003***	0.003***	0.008***	0.005***
	(2.01)	(0.63)	(2.63)	(2.81)	(2.80)	(2.81)	(5.27)	(3.15)
Size (β_{15})	0.077***	0.188	0.074***	0.075***	0.079***	0.077***	0.178***	0.131***
	(4.49)	(1.43)	(5.04)	(4.72)	(5.03)	(4.74)	(4.77)	(3.54)

Log(Age) (β_{16})	0.021	6.053***	-0.089***	-0.090***	-0.090***	-0.089***	-0.140***	-0.108***
	(0.58)	(2.63)	(-8.65)	(-8.45)	(-7.93)	(-7.69)	(-5.30)	(-3.99)
Interest Rate (β_{17})	0.050***		4.127***	4.394***	4.013***	4.270***	3.836***	4.188***
	(17.87)		(5.78)	(5.75)	(5.86)	(6.01)	(4.09)	(3.93)
Home Price Growth (β_{18})	-0.014***	-0.024***	-0.005	-0.006	-0.006	-0.006	-0.015*	-0.006
	(-8.12)	(-2.85)	(-0.66)	(-0.76)	(-0.81)	(-0.82)	(-1.65)	(-0.61)
Income Growth (β_{19})	0.002	0.037	-0.024*	-0.024	-0.026*	-0.027*	-0.012	-0.021
	(1.08)	(0.91)	(-1.66)	(-1.58)	(-1.85)	(-1.85)	(-0.70)	(-1.12)
Constant (β_0)	0.018		0.172***	0.175***	0.166***	0.173***	0.063	0.136***
	(1.10)		(5.82)	(5.60)	(5.75)	(5.83)	(1.14)	(2.62)
Observations	55,941	16,943	21,000	21,000	21,000	21,000	11,111	11,111
R-squared	0.386							
Number of Banks	4,092		3,788	3,788	3,788	3,788	2,045	2,045
AB test for AR (1)	-	-	-14.99***	-13.99***	-14.64***	-14.00***	-12.91***	-9.16***
AB test for AR (2)	-	-	0.14	0.09	0.15	0.12	1.16	1.09
Hansen Test	-	-	75.11***	4.49	233.15**	160.70	114.27***	12.62*
Sargan Test	-	-	21.92	1.73	174.23	148.86	26.80	5.01
Number of Instruments	-	-	41	29	210	198	41	29

Table A4. Loan Composition Model – Further Investigation

This table reports estimations of the *Loan Composition* model (Equation (3)) using quarterly data of 4,092 *Non-Micro Commercial Banks* during the pre, acute and post-crisis periods. *Non-Micro Commercial Banks* are defined as commercial banks with total assets above $100 million.

We replace our dependent variable, i.e. *Unsecured Loans*, with its four major components and regress them on our variables of interest and control variables: share of agricultural loans in total loans portfolio (*Agricultural Loans*), share of commercial and industrial loans in total loans (*C&I Loans*), share of consumer loans in total loans (*Consumer Loans*) and loans to depository and non-depository financial institutions (*Financial Institutions Loans*).

We regress *Agricultural Loans*, *C&I Loans*, *Consumer Loans* and *Financial Institutions Loans* on our variables of interest, i.e. *Fiduciary Activities*, *Life Insurance*, *Other Insurance Services*, *Loan Servicing*, *Annuity Sales*, *Securities Brokerage* and *Investment Banking* scaled by total operating income while controlling for capital and liabilities structures (i.e. *Core Deposits and Capital*), other bank-level heterogeneities (i.e. *Size and Log(Age)*) and finally macroeconomics, state-level and year fixed effect controls, i.e. *Interest Rate*, *Home Price Growth*, *Income Growth* and year dummies. The results are presented in columns (1) to (4), (5) to (8) and (9) to (12), respectively for the pre, acute and post-crisis periods. We exclude *Annuity Sales*, *Securities Brokerage* and *Investment Banking* from our pre-crisis period analysis due to lack of sufficient observations. We keep out the *Interest Rate* from the acute-crisis period analysis, due to its high correlation with *Income Growth*.

We estimate our model using fixed effect technique. All the right-hand-side variables are lagged for one quarter. Year dummies are included in the model, but not reported in the table. See Table A1 for variable definitions. Robust z-statistics are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

	PRE	PRE	PRE	PRE	ACUTE	ACUTE	ACUTE	ACUE	POST	POST	POST	POST
	Agricultural Loans	C&I Loans	Consumer Loans	Financial Institutions Loans	Agricultural Loans	C&I Loans	Consumer Loans	Financial Institutions Loans	Agricultural Loans	C&I Loans	Consumer Loans	Financial Institutions Loans
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Fiduciary Activities (δ_1)	0.009	0.138	-0.009*	0.031*	0.000	-0.135**	0.005	0.020*	0.039	-0.140*	-0.019	0.075*
	(0.30)	(1.33)	(-1.68)	(1.72)	(0.00)	(-1.97)	(0.42)	(1.67)	(1.05)	(-1.89)	(-1.42)	(1.88)
Life Insurance (δ_2)	-0.002	-0.028	-0.002	0.003	-0.011	-0.040	-0.000	-0.009	-0.008	0.028	0.004	-0.041**
	(-0.10)	(-0.45)	(-0.39)	(0.36)	(-0.62)	(-1.17)	(-0.03)	(-0.91)	(-0.28)	(0.54)	(0.98)	(-2.49)
Other Insurance Services (δ_3)	0.000	-0.010	-0.004	0.000	-0.088**	0.044	-0.018**	-0.006	0.075**	0.020	-0.006	0.013
	(0.00)	(-0.16)	(-0.97)	(0.02)	(-2.01)	(0.86)	(-2.13)	(-0.61)	(2.51)	(0.58)	(-1.58)	(0.92)
Loans Servicing (δ_4)	0.037	0.069	-0.008	0.001	-0.030	0.017	0.008	0.010	0.011	0.056	-0.003	-0.008
	(1.05)	(1.00)	(-1.25)	(0.07)	(-1.15)	(0.19)	(1.41)	(0.93)	(0.40)	(1.01)	(-0.75)	(-0.84)
Annuity Sales (δ_5)					0.034	0.182	-0.014	0.003	0.131	0.136	-0.007	-0.049
					(0.56)	(1.36)	(-0.64)	(0.12)	(1.54)	(1.08)	(-0.32)	(-1.00)
Securities Brokerage (δ_6)					-0.065	-0.048	-0.013	0.025	-0.082	-0.094	-0.033*	0.130
					(-1.19)	(-0.53)	(-0.95)	(1.45)	(-1.07)	(-0.84)	(-1.75)	(1.53)
Investment Banking (δ_7)					0.252	-0.575**	0.000	0.100	0.063	0.142	0.068	-0.340
					(1.36)	(-2.00)	(0.01)	(1.47)	(0.51)	(0.25)	(0.89)	(-1.57)
Core Deposits (δ_8)	0.002	-0.014	0.000	-0.000	-0.005	0.000	0.001*	0.000	-0.002	-0.006	-0.000	0.005**
	(0.64)	(-1.46)	(0.20)	(-0.08)	(-1.58)	(0.02)	(1.70)	(0.15)	(-0.95)	(-0.77)	(-0.63)	(2.27)
Capital (δ_9)	0.012	0.045	0.004	0.008	0.004	0.008	0.002	0.001	0.004	0.038	0.003	0.030***
	(1.04)	(0.93)	(0.96)	(1.23)	(0.36)	(0.19)	(0.40)	(0.15)	(0.46)	(0.90)	(0.81)	(3.83)
Size (δ_{10})	-0.854***	3.295***	-0.052*	0.077	-0.969***	1.850***	-0.056	0.004	-0.389**	1.616***	0.005	-0.044
	(-4.03)	(6.15)	(-1.75)	(1.24)	(-4.56)	(2.61)	(-1.30)	(0.05)	(-2.26)	(3.02)	(0.14)	(-0.52)
Log(Age) (δ_{11})	1.482***	4.078***	-0.060	0.114	0.758**	1.864	0.116	0.017	-0.145	3.272***	0.037	-0.189
	(5.29)	(4.62)	(-0.89)	(0.98)	(2.54)	(1.63)	(1.28)	(0.08)	(-0.81)	(3.28)	(0.38)	(-0.88)
Interest Rate (δ_{12})	-0.065***	-0.178***	-0.004	-0.009					-4.246***	1.542	-0.016	6.543***
	(-3.91)	(-4.73)	(-1.26)	(-1.48)					(-8.02)	(1.25)	(-0.14)	(13.63)

Home Price Growth (δ_{13})	-0.037***	0.044	-0.007***	-0.004	0.030***	0.020	0.002	0.006	-0.020***	0.010	0.002*	0.005
	(-3.50)	(1.29)	(-2.72)	(-0.73)	(3.63)	(1.03)	(1.08)	(1.53)	(-4.51)	(1.14)	(1.66)	(1.63)
Income Growth (δ_{14})	0.017**	-0.019	0.000	0.003	0.031***	0.007	0.003**	-0.001	-0.002	-0.012	-0.001	0.008
	(2.08)	(-1.13)	(0.21)	(1.08)	(3.47)	(0.48)	(2.01)	(-0.52)	(-0.17)	(-0.34)	(-0.64)	(0.73)
Constant (δ_0)	-4.471***	0.156	0.058**	-0.089*	-3.210***	0.817**	0.056**	-0.007	-3.403***	0.929***	0.029	0.105
	(-28.44)	(0.40)	(2.46)	(-1.82)	(-26.31)	(1.99)	(2.36)	(-0.15)	(-33.94)	(3.04)	(1.39)	(1.58)
Observations	55,947	55,947	55,947	55,947	20,483	20,483	20,483	20,483	21,006	21,006	21,006	16,946
R-squared	0.022	0.050	0.025	0.004	0.014	0.011	0.005	0.001	0.008	0.010	0.005	0.028
Number of Banks	4,092	4,092	4,092	4,092	3,742	3,742	3,742	3,742	3,789	3,789	3,789	3,782

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Table I. Descriptive Statistics

PANEL A. U.S. Micro Commercial Banks

General descriptive statistics and non-interest income activities of U.S. *Micro Commercial Banks* for the pre-, acute- and post-crisis periods. *Micro Commercial Banks* are defined as banks with less than $100 million in total assets.

	Variable	Pre-Crisis Period					Acute-Crisis Period					Post-Crisis Period				
		Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
General Descriptive Statistics	Total Assets (mil. $)	52,567	54	25	7	100	15,881	56	25	9	100	14,359	57	24	11	100
	Loan Loss Reserve (%)	52,520	1.52	0.81	0.00	5.19	15,860	1.46	0.82	0.00	5.21	14,338	1.67	1.01	0.00	6.82
	Non-performing Loans (%)	52,520	0.50	0.85	0.00	4.50	15,860	1.14	1.89	0.00	12.28	14,338	1.87	2.78	0.00	20.90
	Unused Commitment (%)	52,567	1.45	2.79	0.00	25.56	15,881	1.65	2.98	0.00	25.73	14,359	1.38	2.41	0.00	19.74
	Loan Growth (%)	52,553	1.67	6.14	-23.91	32.77	15,877	1.21	6.25	-22.92	30.15	14,359	0.50	5.83	-23.2	25.88
	Unsecured Loans (%)	52,496	18.69	21.13	0.00	100	15,860	19.04	21.31	0.00	100	14,335	18.60	21.11	0.00	100
	Loan Asset Ratio (%)	52,567	60.00	16.33	0.00	96.91	15,881	61.07	16.78	0.01	97.36	14,359	59.51	16.53	0.03	96.58
	Spread (%)	52,559	3.78	0.85	0.69	7.51	15,880	3.42	0.83	0.36	6.94	14,358	3.61	0.82	0.46	7.40
	Capital (%)	52,567	11.32	3.85	4.89	29.91	15,881	11.85	4.21	2.47	30.64	14,359	11.56	4.12	0.76	30.59
	Core Deposits (%)	52,567	70.23	11.66	0.01	91.12	15,881	66.73	12.45	0.00	89.33	14,359	66.48	12.75	0.00	89.86
	Inefficiency (%)	52,562	69.17	16.34	12.34	139.21	15,867	74.87	22.46	9.88	186.64	14,339	79.66	27.94	12.90	225.49
	Asset Growth (%)	52,567	1.20	5.04	-19.85	27.36	15,881	1.51	5.44	-18.57	31.47	14,359	0.89	4.98	-19.5	23.94
	Age	52,567	73.10	37.64	3.00	168.50	15,881	76.89	37.73	3.00	170.25	14,359	77.39	38.87	3.00	171.75
	Non-interest Income (%)	52,562	14.57	8.94	-1.23	70.26	15,867	14.22	9.56	-40.64	73.02	14,339	12.95	10.92	-38.4	79.44
Non-interest Income Activities	Fiduciary Activities (%)	52,567	0.14	0.92	0.00	11.14	15,880	0.16	1.11	0.00	12.21	14,358	0.12	0.89	0.00	10.51
	Life Insurance (%)	52,561	0.38	0.94	0.00	4.83	15,867	0.39	1.00	0.00	5.89	14,339	0.39	1.00	0.00	5.69
	Insurance Services (%)	52,562	0.49	1.33	-0.20	8.39	15,867	0.48	1.47	-0.12	8.86	14,338	0.40	1.29	-0.11	7.89
	Loans Servicing (%)	52,562	0.22	0.87	-1.03	6.33	15,866	0.22	0.87	-0.60	6.30	14,339	0.25	0.99	-1.08	7.02
	Annuity Sales (%)	4,960	0.02	0.15	0.00	1.78	15,881	0.02	0.14	0.00	1.82	14,359	0.01	0.12	0.00	1.56
	Securities Brokerage (%)	4,960	0.07	0.40	0.00	3.58	15,881	0.06	0.35	0.00	3.40	14,359	0.05	0.27	0.00	2.82
	Investment Banking (%)	4,960	0.02	0.16	0.00	1.60	15,881	0.02	0.16	-0.01	1.67	14,359	0.01	0.11	0.00	1.21
Other Non-interest Income Activities	Venture Capital (%)	52,567	0.00	0.00	0.00	0.00	15,881	0.00	0.00	0.00	0.00	14,359	0.00	0.00	0.00	0.00
	Service Charges (%)	52,562	8.71	5.22	0.00	35.21	15,867	8.68	5.44	0.00	41.37	14,339	8.20	5.42	0.00	36.31
	Loan Sales (%)	52,567	0.48	2.11	-1.55	17.40	15,878	0.37	1.77	-4.65	15.03	14,353	0.67	2.88	-3.96	23.34
	Trading (%)	52,567	0.00	0.00	0.00	0.00	15,881	0.00	0.01	-0.06	0.13	14,359	0.00	0.01	-0.18	0.24
	Other Assets Sales (%)	52,565	0.11	0.97	-4.42	5.67	15,875	0.03	1.40	-8.98	8.46	14,344	-0.67	3.98	-27.53	9.84
	Other Activities (%)	52,562	3.40	4.17	-0.17	30.58	15,867	3.05	3.84	-2.79	28.26	14,339	2.94	3.84	-4.96	26.32
Unsecured Loans Breakdown	Agricultural Loans (%)	52,496	16.51	20.34	0.00	100	15,860	16.85	20.38	0.00	100	14,335	16.61	20.31	0.00	100
	C&I Loans (%)	52,496	0.09	1.51	0.00	52.15	15,860	0.04	1.20	0.00	55.66	14,335	0.06	1.43	0.00	51.76
	Consumer Loans (%)	52,496	0.31	0.77	0.00	5.28	15,860	0.26	0.70	0.00	4.62	14,335	0.24	0.62	0.00	4.00
	Financial Institutions Loans (%)	52,496	0.44	1.14	0.00	8.37	15,860	0.45	1.23	0.00	8.67	10,271	0.42	1.27	0.00	9.67
	Other Unsecured Loans (%)	52,496	0.84	1.71	0.00	9.70	15,860	0.83	1.77	0.00	11.26	10,271	0.88	1.95	0.00	12.00

See Table A1 for variable definitions.

PANEL B. U.S. Non-Micro Commercial Banks

General descriptive statistics and non-interest income activities of U.S. *Non-Micro Commercial Banks* for the pre-, acute- and post-crisis periods. *Non-Micro Commercial Banks* are defined as commercial banks with total assets above $100 million.

	Variable	Pre-Crisis Period					Acute-Crisis Period					Post-Crisis Period				
		Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
General Descriptive Statistics	Total Assets (mil. $)	68,600	861	4,461	100	73,100	27,684	853	4,343	100	67,300	28,377	992	5,470	100	83,800
	Loan Loss Reserve (%)	68,596	1.31	0.57	0.00	5.19	27,680	1.33	0.63	0.00	5.21	28,370	1.83	1.01	0.00	6.82
	Non-performing Loans (%)	68,596	0.30	0.52	0.00	4.50	27,680	1.45	2.03	0.00	12.28	28,370	2.92	3.56	0.00	20.90
	Unused Commitment (%)	68,600	3.52	4.57	0.00	25.56	27,684	3.65	4.46	0.00	25.73	28,377	2.71	3.32	0.00	19.74
	Letter of Credit (%)	68,605	0.70	0.93	0.00	5.60	27,685	0.65	0.86	0.00	5.50	28,391	0.50	0.68	0.00	4.23
	Recourse (%)	68,605	0.04	0.18	0.00	0.99	27,685	0.07	0.28	0.00	1.52	28,391	0.09	0.32	0.00	1.73
	Loan Growth (%)	68,589	2.71	5.32	-23.91	32.77	27,681	2.02	5.17	-22.92	30.15	28,373	-0.06	4.63	-23.2	25.88
	Unsecured Loans (%)	68,583	12.12	14.83	0.00	100	27,669	12.49	14.50	0.00	100	28,358	12.58	14.60	0.00	100
	Loan Asset Ratio (%)	68,600	66.13	14.40	0.00	98.25	27,684	69.12	13.62	0.00	99.30	28,377	65.89	13.16	0.00	96.71
	Spread (%)	68,600	3.67	0.84	0.69	7.51	27,684	3.31	0.78	0.36	6.94	28,377	3.47	0.76	0.46	7.40
	Capital (%)	68,600	9.99	3.04	4.89	29.91	27,684	10.17	3.07	2.47	30.64	28,377	10.01	2.98	0.76	30.59
	Core Deposits (%)	68,600	65.11	13.49	0.01	91.12	27,684	59.86	13.48	0.00	89.33	28,377	61.12	13.00	0.00	89.86
	Inefficiency (%)	68,599	63.03	13.64	12.34	139.21	27,608	70.60	21.14	9.88	186.64	28,332	74.98	26.71	12.90	225.49
	Asset Growth (%)	68,600	2.30	5.03	-19.85	27.36	27,684	2.18	5.40	-18.57	31.47	28,377	0.80	4.79	-19.5	23.94
	Age	68,605	66.72	43.89	3.00	207.50	27,685	66.53	44.77	3.00	208.25	28,391	66.53	45.43	3.00	198.50
	Non-interest Income (%)	68,599	17.68	10.08	-1.23	70.26	27,608	17.18	10.79	-40.64	73.02	28,332	15.83	12.68	-38.4	79.44
Non-interest Income Activities	Fiduciary Activities (%)	68,601	0.85	2.14	0.00	11.14	27,670	0.85	2.26	0.00	12.21	28,369	0.73	1.97	0.00	10.51
	Life Insurance (%)	68,599	0.47	0.91	0.00	4.83	27,608	0.69	1.07	0.00	5.89	28,332	0.74	1.03	0.00	5.69
	Insurance Services (%)	68,599	0.48	1.32	-0.20	8.39	27,607	0.46	1.40	-0.12	8.86	28,331	0.39	1.25	-0.11	7.89
	Loans Servicing (%)	68,599	0.39	1.07	-1.03	6.33	27,608	0.39	1.04	-0.60	6.30	28,332	0.45	1.20	-1.08	7.02
	Annuity Sales (%)	7,811	0.12	0.34	0.00	1.78	27,671	0.13	0.35	0.00	1.82	28,370	0.10	0.30	0.00	1.56
	Securities Brokerage (%)	7,811	0.30	0.68	0.00	3.58	27,664	0.28	0.65	0.00	3.40	28,364	0.22	0.54	0.00	2.82
	Investment Banking (%)	7,811	0.08	0.30	0.00	1.60	27,678	0.08	0.31	-0.01	1.67	28,376	0.06	0.23	0.00	1.21
Other Non-interest Income Activities	Venture Capital (%)	68,600	0.00	0.00	0.00	0.00	27,682	0.00	0.00	0.00	0.00	28,374	0.00	0.00	0.00	0.00
	Service Charges (%)	68,600	8.23	5.10	0.00	35.21	27,612	8.92	5.69	0.00	41.37	28,336	8.72	5.63	0.00	36.31
	Loan Sales (%)	68,600	1.37	3.16	-1.55	17.40	27,659	1.10	2.62	-4.65	15.03	28,350	1.77	4.07	-3.96	23.34
	Trading (%)	68,601	0.00	0.00	0.00	0.00	27,666	0.00	0.02	-0.06	0.13	28,371	0.00	0.04	-0.18	0.24
	Other Assets Sales (%)	68,600	0.12	0.90	-4.42	5.67	27,627	-0.11	1.65	-8.98	8.46	28,334	-1.34	4.71	-27.5	9.84
	Other Activities (%)	68,599	4.94	4.75	-0.17	30.58	27,608	3.66	4.14	-2.79	28.26	28,332	3.09	4.09	-4.96	26.32
Unsecured Loans Breakdown	Agricultural Loans (%)	68,583	3.96	8.88	0.00	86.61	27,669	4.30	9.52	0.00	87.48	28,358	4.49	9.87	0.00	89.30
	C&I Loans (%)	68,583	5.59	9.81	0.00	52.15	27,669	5.80	9.51	0.00	55.66	28,358	5.75	9.20	0.00	51.76
	Consumer Loans (%)	68,583	0.47	0.85	0.00	5.28	27,669	0.38	0.73	0.00	4.62	28,358	0.35	0.66	0.00	4.00
	Financial Institutions Loans (%)	68,583	0.58	1.34	0.00	8.37	27,669	0.57	1.34	0.00	8.67	23,672	0.62	1.52	0.00	9.67
	Other Unsecured Loans (%)	68,583	0.80	1.57	0.00	9.70	27,669	0.92	1.82	0.00	11.26	23,672	0.98	1.92	0.00	12.00

See Table A1 for variable definitions.

PANEL C. Macroeconomic and State-level indicators

This panel shows the summary statistics of interest rate and the growth rate of home price index and personal income across 51 U.S. states during pre, acute and post-crisis periods.

	Pre-Crisis Period					Acute-Crisis Period					Post-Crisis Period				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Interest Rate (%)	18	2.82	1.66	0.92	4.98	7	1.92	1.52	0.21	4.32	7	0.13	0.04	0.06	0.17
Home Price Index Growth (%)	918	1.79	1.69	-2.72	11.1	357	-1.25	2.17	-12.94	4.10	357	-0.84	2.01	-11.34	8.19
Income Growth (%)	918	1.47	1.03	-8.05	11.14	357	0.37	2.01	-5.12	8.52	357	0.72	0.99	-4.27	3.88

See Table A1 for variable definitions.

Table II. Credit Risk Model

This table reports estimations of *Credit Risk* model (Equation (1)) using quarterly data of 4,092 *Non-Micro Commercial Banks* and 3,293 *Micro Commercial Banks* during pre, acute and post-crisis periods. *Non-Micro Commercial Banks* are defined as commercial banks with total assets above $100 million, whereas *Micro Commercial Banks* are banks with less than $100 million in total assets. We use *Non-performing Loans* as our *Credit Risk* proxy and regress it on our variables of interest and a set of control variables, using fixed effect technique.

In columns (1) to (6), we estimate the model for *Non-Micro Commercial Banks*. The first four columns present analysis for pre-crisis period. Column (1) illustrates the estimation of *Credit Risk* model where we regress the *Credit Risk* proxy on *Fiduciary Activities*, *Life Insurance*, *Other Insurance Services* and *Loan Servicing* while controlling for macroeconomics, state-level and year fixed effect controls, i.e. *Interest Rate*, *Home Price Growth*, *Income Growth* and year dummies. In column (2), we add loan portfolio controls, i.e. *Unused Commitment*, *Loans Sale*, *Loan Growth* and *Unsecured Loans*. *Capital*, *Spread* and *Inefficiency* are introduced to the model in column (3). *Size* and *Log(Age)* are included in the fourth column. In columns (5) and (6), we estimate our model for acute and post-crisis periods, where we include *Annuity Sales*, *Securities Brokerage* and *Investment Banking*. We keep out the *Interest Rate* from the acute-crisis period analysis, due to its high correlation with *Income Growth*. Finally, columns (7) to (9) display estimations of our model for *Micro Commercial Banks* in pre, acute and post-crisis periods, respectively.

All the right-hand-side variables are lagged for one quarter. Year dummies are included in the model, but not reported in the table. See Table A1 for variable definitions. Robust z-statistics are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

	Non-Micro Commercial Banks						Micro Commercial Banks		
	Pre-Crisis				Acute-Crisis	Post-Crisis	Pre-Crisis	Acute-Crisis	Post-Crisis
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fiduciary Activities (β_1)	-0.013**	-0.013**	-0.014***	-0.012**	-0.076**	-0.089***	-0.016	0.078	-0.087
	(-2.45)	(-2.52)	(-2.77)	(-2.46)	(-2.50)	(-2.80)	(-1.30)	(1.38)	(-1.02)
Life Insurance (β_2)	-0.010*	-0.010*	-0.012**	-0.011**	0.053**	-0.008	0.002	0.025	0.000
	(-1.91)	(-1.88)	(-2.19)	(-1.97)	(2.02)	(-0.23)	(0.13)	(0.92)	(0.01)
Other Insurance Services (β_3)	-0.008	-0.008	-0.009*	-0.009*	0.036	-0.071*	-0.013*	-0.028	0.003
	(-1.54)	(-1.54)	(-1.80)	(-1.77)	(1.16)	(-1.66)	(-1.65)	(-1.53)	(0.07)
Loans Servicing (β_4)	0.005	0.003	0.004	0.003	-0.052	-0.006	0.010	-0.079	0.010
	(0.91)	(0.64)	(0.68)	(0.61)	(-1.50)	(-0.22)	(0.72)	(-1.16)	(0.19)
Annuity Sales (β_5)					-0.014	-0.202*		-0.031	0.325
					(-0.21)	(-1.74)		(-0.15)	(1.22)
Securities Brokerage (β_6)					-0.059	-0.004		0.045	-0.515***
					(-1.11)	(-0.05)		(0.33)	(-2.87)
Investment Banking (β_7)					-0.120	0.005		0.010	0.221
					(-1.00)	(0.03)		(0.05)	(0.50)
Unused Commitment (β_8)		-0.004**	-0.004**	-0.005***	-0.072***	-0.052***	0.002	-0.045**	-0.011
		(-2.42)	(-2.24)	(-2.71)	(-5.48)	(-3.46)	(0.66)	(-2.03)	(-0.66)
Loans Sale (β_9)		-0.003*	-0.002	-0.002	0.000	0.006	-0.004	0.013	0.007
		(-1.70)	(-1.40)	(-1.39)	(0.03)	(0.64)	(-0.74)	(0.54)	(0.55)
Loan Growth (β_{10})		-0.005***	-0.005***	-0.005***	-0.019***	-0.002	-0.008***	-0.009***	-0.007**
		(-8.02)	(-8.11)	(-7.75)	(-8.17)	(-0.64)	(-10.18)	(-3.86)	(-2.27)
Unsecured Loans (β_{11})		0.003**	0.003**	0.002*	0.002	-0.014***	0.006***	-0.004	-0.005
		(2.42)	(2.50)	(1.95)	(0.52)	(-2.80)	(3.20)	(-1.05)	(-0.92)
Capital (β_{12})			0.008**	0.008***	-0.058***	-0.218***	-0.001	-0.075***	-0.040
			(2.58)	(2.71)	(-3.02)	(-6.47)	(-0.08)	(-3.50)	(-1.33)
Spread (β_{13})			-0.002	0.004	-0.265***	-0.153**	-0.024	-0.221***	-0.225***
			(-0.11)	(0.25)	(-5.09)	(-2.51)	(-1.64)	(-3.84)	(-3.11)
Inefficiency (β_{14})			0.002***	0.003***	0.013***	0.005***	0.003***	0.005**	-0.000
			(3.18)	(4.34)	(8.48)	(2.69)	(3.87)	(2.42)	(-0.04)
Size (β_{15})				0.124***	0.102	-1.223***	0.011	-1.145***	-0.099
				(3.76)	(0.46)	(-3.35)	(0.13)	(-3.55)	(-0.24)
Log(Age) (β_{16})				0.123*	5.258***	4.697***	0.322***	6.128***	2.951**
				(1.81)	(8.37)	(6.54)	(2.95)	(5.61)	(2.55)
Interest Rate (β_{17})	0.048***	0.046***	0.045***	0.035***		5.887***	0.024***		3.160***
	(17.88)	(16.79)	(15.91)	(9.93)		(7.31)	(3.78)		(3.16)
Home Price Growth (β_{18})	-0.021***	-0.019***	-0.018***	-0.017***	-0.139***	0.016**	-0.035***	-0.057***	0.012
	(-7.23)	(-6.78)	(-6.46)	(-6.41)	(-12.29)	(2.44)	(-6.29)	(-3.74)	(1.49)
Income Growth (β_{19})	0.010***	0.010***	0.010***	0.010***	-0.065***	0.006	0.012***	-0.045***	-0.008
	(5.05)	(5.09)	(4.72)	(4.89)	(-9.79)	(0.43)	(3.24)	(-5.98)	(-0.50)
Constant (β_0)	0.100***	0.116***	0.122***	0.033	0.146	1.129***	0.031	-3.216***	-1.691***
	(7.77)	(8.50)	(8.36)	(1.24)	(1.07)	(5.63)	(0.33)	(-6.00)	(-2.74)
Observations	55,947	55,942	55,942	55,942	20,478	21,000	44,988	12,274	11,111
R-squared	0.093	0.098	0.100	0.102	0.206	0.070	0.022	0.071	0.015
Number of Banks	4,092	4,092	4,092	4,092	3,742	3,788	3,293	2,274	2,045

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Table III. Spread Model

This table reports estimations of the *Spread* model (Equation (2)) using quarterly data of 4,092 *Non-Micro Commercial Banks* and 3,293 *Micro Commercial Banks* during the pre, acute and post-crisis periods. *Non-Micro Commercial Banks* are defined as commercial banks with total assets above $100 million, whereas *Micro Commercial Banks* are banks with less than $100 million in total assets.

We use net interest spread defined as [(total interest income/average total earning assets) – (total interest expense/average total interest-bearing liabilities)] as the proxy and regress it on *Fiduciary Activities*, *Life Insurance*, *Other Insurance Services*, *Loan Servicing*, *Annuity Sales*, *Securities Brokerage* and *Investment Banking* which are scaled by total assets in lieu of total operating income, while controlling for *Unused Commitment*, loan portfolio characteristics (i.e. *Loan Asset Ratio*, *Unsecured Loans* and *Non-performing Loans*), capital and liabilities structures (i.e. *Core Deposits* and *Capital*), other bank-level heterogeneities (i.e. *Size* and *Log(Age)*) and finally macroeconomics, state-level and year fixed effect controls, i.e. *Interest Rate*, *Home Price Growth*, *Income Growth* and year dummies.

In columns (1) to (3), we study the relationship between *Spread* and our variables of interest using *Non-Micro Commercial Banks* sample in the pre, acute and post-crisis periods. Columns (4) to (6) display our analysis for *Micro Commercial Banks* during the same study periods. We exclude *Annuity Sales*, *Securities Brokerage* and *Investment Banking* from our pre-crisis period analysis due to lack of sufficient observations. Moreover, for the acute-crisis period, we keep out the *Interest Rate* from our model, due to its high correlation with *Income Growth*. We estimate our model using fixed effect technique.

All the right-hand-side variables are lagged for one quarter. Year dummies are included in the model, but not reported in the table. See Table A1 for variable definitions. Robust z-statistics are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

	Non-Micro Commercial Banks			Micro Commercial Banks		
	Pre-Crisis	Acute-Crisis	Post-Crisis	Pre-Crisis	Acute-Crisis	Post-Crisis
Variables	(1)	(3)	(5)	(2)	(4)	(6)
Fiduciary Activities (α_1)	-0.100	-0.120	-0.089	0.098	0.597**	0.157
	(-0.74)	(-0.44)	(-0.26)	(0.58)	(2.26)	(0.51)
Life Insurance (α_2)	-0.001	0.098	0.022	0.223	-0.009	-0.046
	(-0.01)	(0.56)	(0.14)	(1.32)	(-0.04)	(-0.32)
Other Insurance Services (α_3)	0.016	0.422**	0.078	0.755**	0.174	0.055
	(0.08)	(2.26)	(0.50)	(2.18)	(1.09)	(0.36)
Loans Servicing (α_4)	0.101	0.352	-0.332**	-0.117	-0.086	-0.238
	(0.75)	(1.11)	(-2.03)	(-0.63)	(-0.32)	(-0.74)
Annuity Sales (α_5)		0.763	0.288		-1.156	0.107
		(1.56)	(0.46)		(-0.71)	(0.10)
Securities Brokerage (α_6)		0.051	-0.636		0.241	-0.525
		(0.12)	(-0.89)		(0.28)	(-0.58)
Investment Banking (α_7)		0.313	2.705		2.431	-5.238*
		(0.43)	(1.33)		(1.08)	(-1.65)
Unused Commitment (α_8)	0.002	0.010***	-0.006*	0.002	0.005	0.002
	(1.03)	(3.56)	(-1.92)	(0.82)	(1.20)	(0.36)
Loan Asset Ratio (α_9)	0.018***	0.019***	0.022***	0.019***	0.018***	0.025***
	(14.38)	(13.00)	(15.09)	(12.41)	(9.94)	(12.37)
Unsecured Loans (α_{10})	0.002	-0.004*	0.001	-0.002	0.000	-0.003
	(1.01)	(-1.96)	(0.54)	(-1.43)	(0.10)	(-0.94)
Non-performing Loans (α_{11})	-0.005	-0.064***	-0.014***	-0.018***	-0.029***	-0.010***
	(-0.34)	(-14.80)	(-4.66)	(-3.57)	(-4.10)	(-2.79)
Core Deposits (α_{12})	0.006***	0.003**	0.004***	0.008***	0.005***	0.002
	(7.55)	(2.56)	(3.46)	(4.82)	(2.65)	(0.96)
Capital (α_{13})	0.035***	0.023***	0.004	0.019***	0.018**	0.006
	(7.88)	(4.37)	(0.76)	(3.69)	(2.13)	(0.63)
Size (α_{14})	-0.191***	-0.063	-0.444***	-0.421***	-0.192	-1.016***
	(-4.56)	(-0.64)	(-4.44)	(-5.84)	(-1.39)	(-4.19)
Log(Age) (α_{15})	0.648***	-1.124***	1.897***	0.442***	-0.904***	2.211***
	(8.46)	(-7.30)	(16.07)	(4.25)	(-3.12)	(10.59)
Interest Rate (α_{16})	-0.080***		3.040***	-0.035***		3.747***
	(-21.86)		(19.54)	(-7.87)		(15.13)
Home Price Growth (α_{17})	0.027***	0.009***	0.007***	0.025***	0.008*	0.011***
	(8.71)	(3.45)	(6.03)	(5.13)	(1.68)	(6.68)
Income Growth (α_{18})	-0.010***	-0.017***	-0.010***	-0.009***	-0.014***	-0.015***
	(-6.55)	(-8.68)	(-3.05)	(-5.30)	(-5.90)	(-2.86)
Constant (α_0)	-0.112***	-0.011	0.299***	-0.665***	0.248	-1.609***
	(-3.42)	(-0.17)	(5.14)	(-7.69)	(1.21)	(-4.97)
Observations	55,945	20,517	21,024	44,989	12,277	11,122
R-squared	0.219	0.123	0.271	0.168	0.093	0.242
Number of Banks	4,092	3,742	3,788	3,293	2,272	2,046

Table IV. Loan Composition Model

This table reports estimations of the *Loan Composition* model (Equation (3)) using quarterly data of 4,092 *Non-Micro Commercial Banks* and 3,294 *Micro Commercial Banks* during the pre, acute and post-crisis periods. *Non-Micro Commercial Banks* are defined as commercial banks with total assets above $100 million, whereas *Micro Commercial Banks* are banks with less than $100 million in total assets.

We use the share of loans not secured by real estate in total loans portfolio (*Unsecured Loans*) as the proxy and regress it on *Fiduciary Activities*, *Life Insurance*, *Other Insurance Services*, *Loan Servicing*, *Annuity Sales*, *Securities Brokerage* and *Investment Banking* scaled by total operating income, while controlling for capital and liabilities structures (i.e. *Core Deposits and Capital*), other bank-level heterogeneities (i.e. *Size and Log(Age)*) and finally macroeconomics, state-level and year fixed effect controls, i.e. *Interest Rate*, *Home Price Growth*, *Income Growth* and year dummies.

In columns (1) to (3), we study the relationship between *Unsecured Loans* and our variables of interest using *Non-Micro Commercial Banks* sample in the pre, acute and post-crisis periods. Columns (4) to (6) display our analysis for *Micro Commercial Banks* during the same study periods. We exclude *Annuity Sales*, *Securities Brokerage* and *Investment Banking* from our pre-crisis period analysis due to lack of sufficient observations. We also keep out the *Interest Rate* from our acute-crisis analysis, due to its high correlation with *Income Growth*. We estimate our model using fixed effect technique.

All the right-hand-side variables are lagged for one quarter. Year dummies are included in the model, but not reported in the table. See Table A1 for variable definitions. Robust z-statistics are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% respectively.

Variables	Non-Micro Commercial Banks			Micro Commercial Banks		
	Pre-Crisis	Acute-Crisis	Post-Crisis	Pre-Crisis	Acute-Crisis	Post-Crisis
	(1)	(2)	(3)	(4)	(5)	(6)
Fiduciary Activities (δ_1)	0.221**	-0.135*	-0.082	-0.012	0.045	-0.052
	(2.09)	(-1.94)	(-1.22)	(-0.11)	(0.26)	(-0.42)
Life Insurance (δ_2)	-0.009	-0.049	0.000	0.039	-0.051	-0.013
	(-0.13)	(-1.11)	(0.00)	(0.52)	(-0.86)	(-0.23)
Other Insurance Services (δ_3)	-0.041	-0.061	0.095**	0.122	-0.068	0.039
	(-0.59)	(-0.97)	(2.14)	(1.05)	(-0.87)	(0.56)
Loans Servicing (δ_4)	0.070	0.008	-0.037	-0.038	0.046	0.054
	(0.84)	(0.09)	(-0.62)	(-0.37)	(0.41)	(0.45)
Annuity Sales (δ_5)		0.182	0.267*		-0.437	-0.202
		(1.24)	(1.69)		(-1.54)	(-0.41)
Securities Brokerage (δ_6)		-0.082	-0.065		-0.063	-0.025
		(-0.72)	(-0.46)		(-0.35)	(-0.07)
Investment Banking (δ_7)		-0.164	0.383		-0.244	0.214
		(-0.45)	(0.56)		(-0.70)	(0.40)
Core Deposits (δ_8)	-0.013	0.014	-0.002	-0.002	-0.027***	-0.001
	(-1.05)	(1.29)	(-0.23)	(-0.24)	(-2.69)	(-0.07)
Capital (δ_9)	0.177***	0.060	0.077*	-0.089	-0.121	0.137**
	(2.60)	(1.58)	(1.66)	(-1.53)	(-0.93)	(2.00)
Size (δ_{10})	3.116***	1.156*	1.333**	-3.663***	-3.722**	1.293
	(4.90)	(1.94)	(2.51)	(-4.54)	(-2.04)	(1.25)
Log(Age) (δ_{11})	4.943***	4.367***	3.230***	2.023**	3.611***	3.546**
	(4.56)	(2.83)	(3.06)	(2.57)	(3.01)	(2.37)
Interest Rate (δ_{12})	-0.284***		-6.800***	0.463***		3.067
	(-6.10)		(-4.38)	(10.36)		(1.32)
Home Price Growth (δ_{13})	-0.008	0.038*	-0.016	-0.043	-0.000	0.029*
	(-0.21)	(1.73)	(-1.47)	(-1.07)	(-0.01)	(1.65)
Income Growth (δ_{14})	0.041*	0.052***	0.012	0.024	-0.035	0.051
	(1.90)	(3.23)	(0.27)	(1.33)	(-1.54)	(0.99)
Constant (δ_0)	-4.917***	-2.675***	-2.731***	-1.511	-1.513	4.894***
	(-10.39)	(-7.87)	(-8.81)	(-1.59)	(-0.68)	(3.83)
Observations	55,947	20,483	21,006	45,014	12,283	11,119
R-squared	0.030	0.010	0.009	0.026	0.019	0.006
Number of Banks	4,092	3,742	3,789	3,294	2,275	2,046

Table V. Cost Complementarities Analysis

This table reports Cost Complementarities analysis (Equation (4)), between the relationship expanding non-interest income activities and loans (secured and unsecured loans (Y1 & Y2)) for *Micro* and *Non-Micro Commercial Banks* across pre, acute and post-crisis periods. *Micro Commercial Banks* are defined as banks with less than $100 million in total assets. *Non-Micro Commercial Banks* are commercial banks with total assets above $100 million.

The first two columns present the analysis for the *Non-Micro Commercial Banks* and columns (3) and (4) exhibit the results for *Micro Commercial Banks*. Columns (1) and (3) display the necessary condition for the existence of cost complementarities between the non-interest income activities and secured or unsecured loans. In columns (2) and (4) the measure of cost complementarities are illustrated. See Table A1 for variable definitions.

		Non-Micro Commercial Banks		Micro Commercial Banks	
		NC_PCC(Yi, Y5)	PCC(Yi, Y5)	NC_PCC(Yi, Y5)	PCC(Yi, Y5)
		(1)	(2)	(3)	(4)
Pre-Crisis	Secured Loans (Y1)	-0.0043	0.0000	-0.0028	0.0000
	Unsecured Loans (Y2)	-0.0014	0.0000	-0.0010	0.0000
Acute-Crisis	Secured Loans (Y1)	-0.0087	0.0000	-0.0031	---*
	Unsecured Loans (Y2)	0.0008	0.0000	-0.0010	---*
Post-Crisis	Secured Loans (Y1)	-0.0229	0.0000	-0.0001	0.0000
	Unsecured Loans (Y2)	0.0005	0.0000	-0.0018	---*

* We do not report the measure of cost complementarity, since we obtain a negative elasticity of total costs to either loans or non-interest income activities.