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BANK ACTIVITY AND FUNDING STRATEGIES: THE IMPACT ON RISK AND RETURN

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Bank Activity and Funding Strategies:
The Impact on Risk and Return

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Abstract: This paper examines the implications of bank activity and short-term funding strategies for bank risk and return using an international sample of 1334 banks in 101 countries leading up to the 2007 financial crisis. Expansion into non-interest income generating activities such as trading increases the rate of return on assets, and it may offer some risk diversification benefits at very low levels. Non-deposit, wholesale funding in contrast lowers the rate of return on assets, while it can offer some risk reduction at commonly observed low levels of non-deposit funding. A sizeable proportion of banks, however, attract most of their short-term funding in the form of non-deposits at a cost of enhanced bank fragility. Overall, banking strategies that rely prominently on generating non-interest income or attracting non-deposit funding are very risky, consistent with the demise of the U.S. investment banking sector.

Key words: non-interest income share, wholesale funding, diversification, universal banking, bank fragility, financial crisis

JEL classifications: G01, G21, G28

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1. Introduction

The recent financial crisis has important implications for feasibility of different banking models. On the funding side, the crisis has clearly exposed the dangers of a bank's excessive reliance on wholesale funding. Starting in August 2007, interbank money market rates in the U.S. rose dramatically reflecting perceptions of increased counter-party risk (see Taylor and Williams, 2008; Caprio, Demirguc-Kunt and Kane, 2008). By October 2008, interbank lending in the U.S. and in Europe had come to a virtual stand-still. To ward off a generalized bank liquidity crisis, authorities worldwide have taken unprecedented steps of providing extensive liquidity, giving assurances to bank depositors and creditors in the form of guarantees on interbank lending and in some cases blanket guarantees.

Similarly on the asset side, the crisis exposed weaknesses in different business models of banks. In trying to cope with the crisis, large U.S. investment banks have completely disappeared from the banking scene through bankruptcy (Lehman Brothers), takeovers (of Bear Stearns by JP Morgan Chase and of Merrill Lynch by Bank of America) and conversions into commercial banks (JP Morgan and Goldman Sachs). Indeed, after the crisis, the U.S. has now come full circle, from the separation of commercial and investment banking through the Glass-Steagall Act of 1933, to the re-introduction of universal banking by way of the Gramm-Leach-Bliley in 1999, and, finally, to the disappearance of large independent investment banks all together in 2008.

All over the world, perceived costs and benefits of combining bank activities of various kinds have given rise to a wide variation in allowed bank activities. [2] But after the crisis, the universal banking model, which allows banks to combine a wide range of financial activities, including

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[2] Universal banking model is common in Europe and in many other countries around the world. In the European Union, the Second Banking Directive of 1989 allows universal banking. A worldwide summary of restrictions on activities in securities markets, insurance, and real estate facing banks is contained in Barth et al. (2004).

commercial banking, investment banking and insurance, has emerged as a more desirable structure for a financial institution from the viewpoint of policymakers due to its resilience to adverse shocks.

In this paper, we examine the implications of a bank's activity mix and funding strategy for its risk and return. We represent a bank's activity mix by the share of non-interest income in the form of fees, commissions and trading income in total operating income. On the liability side, we distinguish between deposits and other non-deposit short-term funding in the form of money market instruments such as CDs and interbank loans. Our goal is to shed light on the risk-return trade-offs involved in the choice of different activity and funding strategies employed by banks.

Theory provides conflicting predictions about a bank's optimal asset or activity mix, its optimal financing, and the optimal match between bank assets and liabilities. Banks gain information on their customers in the provision of one financial service that may prove useful in the provision of other financial services to these same customers. This suggests that banks optimally combine activities of various kinds, for instance loan making with securities underwriting (Diamond, 1991; Rajan, 1992; Saunders and Walter, 1994; and Stein, 2002). Hence, combining different types of activities – non-interesting earning, as well as interest-earning assets – may increase return as well as diversify risks, therefore boosting performance. The extent of risk diversification benefits of combining income-generating activities of various kinds further depend on the co-movements of the risky incomes from these activities.

However, the optimal size and scope of the banking firm in addition reflect finance-specific technologies and potential agency problems that arise within the banking firm if it becomes too complex (Jensen, 1986; Jensen and Meckling, 1986). Hence, even if further diversification into different activities may not be optimal in terms of the overall risk-return trade-offs the institution faces, insiders may still support this diversification as long as it enhances their ability to extract

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private benefits which are sufficiently large. Another argument why differences in asset mix may impact an institution is that asset liquidity may enhance opportunities for bank managers to trade against the bank's interest (Myers and Rajan, 1998). Therefore, diversifying into more liquid non-traditional banking activities such as trading activities that generate non-interest income may end up increasing bank fragility and reduce overall performance.

On the funding side, information acquisition is equally important in determining the optimal mix of a bank's deposit and non-deposit funding. It is theoretically well-established that banks need to be partially equity-financed to provide bankers with appropriate incentives to monitor the projects they finance (Diamond,1984).[3] But a bank's composition of debt and its ability to fund itself in wholesale capital markets provides signals of bank creditworthiness that are relevant to potential depositors at the bank as well. For example, Calomiris (1999) discusses how holders of subordinated debt can perform the function of monitoring a bank if sub-debt is credibly excluded from deposit insurance. Hence, non-deposit funding in a bank's funding mix can actually reduce bank fragility through better monitoring.

But deposit and non-deposit funding tend to carry different risks in causing a potential liquidity crisis – through a bank run or a sudden halting of wholesale funding. For example, Huang and Ratnovski (2008) provide a model of the dark side of relying on wholesale funding in that wholesale financiers may have an incentive to withdraw funding on the basis of cheap and noisy signals of bank solvency, thereby causing solvent banks to fail. Deposit and non-deposit funding are also different in terms of the speed and size of changes in funding costs. The volume and price of wholesale funding, in particular, may adjust more quickly to reflect a bank's riskiness – not least because customer deposits tend to be covered by deposit insurance. Rajan (1992) juxtaposes

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[3] Making a distinction between bank equity and demandable debt, Calomiris and Kahn (1991) argue that demandable debt provides depositors with appropriate incentives to monitor banks and force liquidation of insolvent ones.

informed and arm's length debt to find that holders of informed debt –in this case wholesale financiers- may duly foreclose on a firm with negative present value projects, but at a cost of suddenly demanding a rather high interest rate if the project is continued.

Other models consider the simultaneous determination of bank activities and bank funding, - the asset-liability matching problem - and provide a rationale for why traditional lending and deposit taking services are likely to be observed within the same firm. One argument is that opaqueness of relationship lending enhances bank fragility since it makes it difficult for bank liability holders to assess bank solvency. Therefore, to reduce bank fragility, banks making relationship loans are financed relatively heavily by core deposits, which are unlikely to be withdrawn prematurely since they are held for their liquidity services (Song and Thakor, 2007)[4]. Another reason lending and deposit taking services can be provided within the same banking firm is because both financial services entail the provision of liquidity to bank customers, which in turn improves the institution's own liquidity management (Kashyap, Rajan and Stein, 2002). These models would predict a high correlation between reliance on activities that generate interest income and deposit funding.

The purpose of this paper is three-fold. First, we document trends in the relative importance of non-traditional banking activities and non-deposit funding in banks' asset and funding mix for a large sample of international banks over the 1995-2007 period. This is interesting as it illustrates the changes in asset and funding mix for different types of financial institutions prior to the latest crisis. Second, we present empirical evidence on the determinants of the fee income and non-deposit funding shares, by examining how these variables are related to a range of bank-level, macroeconomic and institutional indicators. Finally, we assess how different activity mixes and

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[4] Retail or core deposits tend to differ from other forms of bank funding in that they are primarily held for their liquidity services and in that they are covered by deposit insurance. Flannery (1982) argues that retail deposits can be seen as a quasi-fixed factor of production of a bank on account of their sluggish adjustment, and that this explains the tendency of banks to insulate deposit interest rates from changes in market interest rates. Billett, Garfinkel and O'Neall (1998) further find that banks tend to raise their use of insured deposits following increases in risk, as proxied empirically by Moody's downgrades.

funding patterns are associated with bank risk and return. We measure a bank's return by its return on assets. Our main measure of bank risk, in turn, is the distance to default or Z-score, defined as the number of standard deviations that a bank's return on assets has to fall for the bank to become insolvent.

On average, financial institutions are shown to substantially combine interest generating and other income generating activities, with a mean fee income share of 0.35. But this figure masks large differences across different types of institutions – while commercial banks, which make up the bulk of the sample, obtain around one third of their income from fee-generating activities, for investment banks this figure is over 75 percent. Moreover, fee income share has been rising for all institutions over the sample period, with particularly steep increases in 2007 for investment banks, non-bank credit institutions and other financial institutions such as real estate mortgage banks and savings banks.

Most banks, instead, attract only a small share of their short-term funding in the form of non-deposits, with a mean non-deposit funding share of 0.08. The distribution of the non-deposit funding share, however, has a fat tail of banks raising more than half of their short-term funding in the form of non-deposits. And again, reliance on non-deposit funding has been increasing significantly for investment banks, non-bank credit institutions and other financial institutions such as real estate mortgage banks and savings banks, and markedly so in 2007. Furthermore, we see that fee-income share and non-deposit funding share of institutions are indeed correlated, as suggested by asset-liability matching models, but the correlation is around 35 percent.

Controlling for institutional differences, we see that greater reliance on fee-income generating activities and non-deposit funding are associated with larger, fast-growing institutions. Reliance on non-deposit funding is also more common in developed countries, whereas developing country

banks rely significantly more on fee-generating activities. We find, among other things, that institutional factors that constrain banks' asset mix and reduce its reliance on fee-generating activities- for example through regulations on activity restrictions- are also associated with increases in non-deposit funding, suggesting that banks may be circumventing such restrictions on their asset composition by adjusting their funding mix to increase their risk-taking.

We find that both a bank's rate of return and its risk increase with its fee income share, suggesting trade-offs. However, estimated coefficients also suggest that increasing the fee income share can yield some risk diversification benefits albeit at very low levels. In contrast, non-deposit, wholesale funding lowers the rate of return on assets, while it can also offer some risk reduction benefits again at low levels.   In robustness tests we also consider two alternative indices of bank return and risk: stock return volatility, another measure of risk, and a measure of risk-adjusted rate of return, the Sharpe ratio. The Sharpe ratio is given by the mean value of the return on equity divided by the standard deviation of the return on equity.

Finally, we address potential endogeneity problems by presenting IV estimates that use information about banking type (as a proxy for bank-specific activity restrictions) to construct instruments for bank activity and funding mix. Based on these estimates, a higher fee income or non-deposit funding share continue to increase bank risk, and while we also find a positive impact of these variables on the rate of return, these findings are more subject to endogeneity concerns. At any rate, our IV estimates confirm that banking strategies that rely predominantly on generating non-interest income or attracting non-deposit funding are very risky.

Our paper fills a gap in the literature since to our knowledge no empirical studies have considered the implications of a bank's funding strategy for bank risk and return. However, several studies have examined the implications of mixing various bank activities for bank risk using mostly

U.S. data. Some of these studies consider how hypothetically combining banks with other types of financial or even non-financial firms would affect the variability of accounting measures of income or stock returns. [5] Other studies look at the risk implications of actual combinations of traditional banking and other financial activities.[6] Among these, the closes to our study is Stiroh (2004) which considers how the share of non-interest income of U.S. banks has affected their risk and return. Specifically, Stiroh (2004) finds that Z-scores are highest for U.S. banks with a non-interest income share close to zero so that even a small exposure to non-traditional banking activities increases risk. Our paper goes beyond Stiroh's (2004) analysis of the relationship between fee income on bank risk by considering an international data set, by providing estimation of the determinants of the fee income share, and by subjecting the relationship between bank risk and fee income to additional robustness tests.

Laeven and Levine (2008) use an international sample of 296 banks from 48 countries in 2001 to examine how bank-level risk, measured alternatively by the Z-score and stock return variability, is affected by bank-level corporate governance and national bank regulations. They show both factors affect bank risk. In this paper our focus is not on regulations but we include country fixed effects in our estimation that are meant to capture this and other time-invariant country traits. Controlling for time-invariant measures of bank regulation, we find that banks that rely on fee generating activities to a greater extent are subject to greater risk.

Risk and return should be reflected in bank stock prices and thus stock market valuations can provide information about whether banks can create value by mixing different activities. DeLong (2001) considers stock price reactions to announcements of U.S. bank mergers over the 1988-1995

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[5] See Boyd and Graham (1988), Boyd, Graham, and Hewitt (1993), Lown et al. (2000 and), and Saunders and Walter (1994) .
[6] See also DeYoung and Roland (2001), Geyfman (2005), Gayle (2001), Kwast (1989), Rosen et al. (1989), and Templeton and Severiens (1992).

period and finds that only mergers of banks that are similar in activity and geographical location create value. Similarity in activity is defined on the basis of co-movements of stock returns of the two merging banks.

Laeven and Levine (2007) instead estimate a relationship between the q-value of a banking firm and an income diversity variable that measures closeness of the non-interest income share to 0.5. In fact, by this measure firms with equal net interest and non-interest incomes are completely diversified. Using data for 43 countries over the 1998-2002 period, the authors find that banks with highly diversified income streams tend to have low q-values – relative to banks that produce the same income combination in separate, specialized firms. While the authors can not identify a single causal factor, they interpret their results as evidence of significant agency problems. Our results can be seen as consistent and complementary since we find diversification benefits accrue at relatively low levels of fee-income share, potentially providing an alternative explanation of why greater diversification may lead to a discount. In addition, the q-value measures the market value of a firm's assets relative to their replacement cost and as such summarizes market valuation of the banking firm's risky income stream. Our paper instead directly measures the impact of a bank's fee income share on its risk and return.[7]

Our paper is also related to Baele, De Jonghe and Vander Vennet (2007), who examine how a bank's share of non-interest income affects bank risk, as reflected in bank stock returns, for a sample of European banks over the period 1989-2004. Systematic risk, measured by the market beta, is found to increase with a bank's non-interest income share. Idiosyncratic risk, in turn, is found to be

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[7] Our paper thus can be seen to provide information on how a bank's risk and return are affected as some traditional bank intermediation (through loans and deposits) is replaced by other bank-assisted financial intermediation, rather than on the implications of re-organizing an existing pool of traditional and non-traditional bank activities in more specialized or less specialized institutions.

related to the non-interest income share in a non-linear way, with most banks beyond the point where idiosyncratic risk is minimized.

In summary, we contribute to the literature in this area by (i) documenting the trends of both activity and funding shares for an international sample of 1334 banks in 101 countries leading up to the 2007 financial crisis; (ii) investigating bank and country level determinants of these shares; and (iii) analyzing the relationship between activity and funding mix on bank risk and return. Our results have important policy implications for the debate on desirability of universal versus specialized banking models.

The remainder of this paper is organized as follows. Section 2 describes the data and documents the frequency distributions and time variation of the fee income and non-deposit funding shares. In addition, we take a first cursory look at the relationships between these two variables and bank risk and return through graphical analysis. Section 3 presents evidence on the determinants of the fee income and non-deposit funding shares. Section 4, in turn, presents evidence on the impact of the fee income and non-deposit funding shares on bank risk and return. Section 5 concludes by discussing the implication of our results for the viability of different models of the banking firm. Overall, we conclude that while universal banking can be beneficial in terms of diversifying risks and increasing returns, banking strategies that rely predominantly on generating non-interest income or attracting non-deposit funding are very risky.

2. The data

2.1 The fee income share and the non-deposit funding share

Bank-level data in this study are taken from Bankscope. Our international sample of banks is restricted to banks with a stock exchange listing to ensure a relatively high quality of data and enhance comparability across countries. The sample period is from 1995 to 2007. In their annual

statements, banks tend to report their net interest income and non-interest income in the form of fees, commissions and trading income. Using these data, we construct a bank's fee income share as the share of non-interest income in total operating income. We use this variable to proxy the overall relative importance of a bank's non-interest generating activities. Figure 1 plots the frequency distribution of the fee income share for the overall sample. To be precise, the figure reports the frequency of observations for this variable for each of the 20 intervals of size 0.05 between 0 and 1. Relatively few banks are seen to rely almost exclusively on fee income or net interest income. In fact, the distribution of the fee income share peaks for values of this variable between 0.25 and 0.30. The overall sample mean of the fee income share is 0.35.

Figure 2 shows that the average fee income share has increased over time. In fact, the average fee income share is seen to rise from 0.33 in 1999 to 0.38 in 2007. The time trend in the figure is limited to the years 1999-2007, as there are rather few observations in the years before 1999. Our overall sample includes banks of different types that by their charters may differ in their allowed activities and in their regulation and supervision. Although 85 percent of the sample is comprised of commercial bank observations, the data source enables us to distinguish four main categories of banks: (i) commercial banks (including bank holding companies), (ii) investment banks and securities houses, (iii) non-bank credit institutions and (iv) other banks (this is a broad category of banks comprising cooperative banks, Islamic banks, medium and long term credit banks, and real estate and mortgage banks). Figure 3 provides time trends of the average fee income shares for banks in each of these four categories. Not surprisingly, the fee income share of investment banks and securities houses is higher throughout the sample period than for any other bank category. For each bank category, the fee income share has risen between 1999 and 2007. Steep increases in the

fee income share in 2007 are seen for investment banks and securities houses, and for non-banking credit institutions, while the increase for commercial banks in this year is more modest.

On the liability side, a bank can fund itself through deposits or other short-term or long-term instruments. Other short-term instruments include interbank borrowings, certificates of deposit and short-term bonds. Investors may hold these latter categories of non-deposit funding either directly or indirectly through money market funds. Deposits tend to be instantly demandable, while non-deposits are considered term financing, even if the term may be very short as in the case of overnight inter-bank lending. In addition, customer deposits tend to be covered by deposit insurance up to some coverage limit, while non-deposits are generally excluded from explicit deposit insurance. For this reason, to the extent they are unsure they will be bailed out in the event of failure, providers of non-deposit funding have an incentive to monitor the bank and may withdraw their financing more readily than depositors if doubts about bank stability arise. We construct the share of non-deposit funding in total short-term funding as an index of a bank's funding strategy.

Figure 4 represents the distribution of the non-deposit funding share for the overall sample. Most banks are seen to have non-deposit funding shares of close to zero. In fact, 61.3 percent of banks have non-deposit funding shares of less than 0.05. Interestingly, however, there are a significant number of banks with rather high non-deposit funding shares. In fact, 6.0 percent of banks have a non-deposit funding share above 0.5. In Figure 5, we see that the overall trend in the non-deposit funding share has been downward over the 1999-2007 period.[8] This is surprising given the frequent allusion to non-deposit funding as a cause of bank instability in the recent financial crisis. The overall sample data, however, hide considerable variation in the time paths of the non-deposit funding shares for our four categories of banks, as seen in Figure 6. In fact, the non-deposit funding share has risen in three of our categories (investment banks and securities houses, non-bank

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[8] Short-term, non-deposit funding also declined as a share of total liabilities or assets.

credit institutions, and other banks) during the sample period, and markedly so in 2007. The non-deposit funding share has instead been on a downward trend for commercial banks. Thus, the downward trend of the non-deposit funding share in Figure 4 reflects the experience of commercial banks, which make up 85 percent of banking observations in our overall sample.

2.2   Bank risk and return variables

In this paper, a bank's return is proxied by the return on assets, computed as pre-tax profits divided by assets. Later in the paper we investigate how the return on assets is affected by a bank's income mix and funding pattern. Figure 7 provides a graphical representation of these relationships. Specifically, the figure plots the average return on assets for each of the 20 groups of bank observations, each containing 5 percent of total observations in increasing order. The highest return on assets is achieved by banks that rely primarily on fee income. Generally, the relationship between the bank rate of return on assets and the fee income share is seen to be U-shaped. Thus, banks that specialize in generating either interest income or fee income achieve a higher return on assets than banks that substantially mix the two income categories. Figure 7 in analogous fashion also plots the relationship between the bank rate of return and the non-deposit funding share. The figure reflects that about 30 percent of bank observations, corresponding to 6 groups, have a non-deposit funding share of zero. Interestingly, bank rate of return is seen to be highest for the banks that do not attract any non-deposit funding at all. The overall relationship between the bank rate of return and the non-deposit funding shares is again U-shaped so that substantial mixing of both deposit and non-deposit funding is associated with a relatively lower return on assets.

As a measure of bank risk, we use the Z-score which is the number of standard deviations that a bank's rate of return of assets has to fall for the bank to become insolvent. The Z-score is

constructed as the sum of the mean rate of return on assets and the mean equity-to-assets ratio divided by the standard deviation of the return on assets (Ray, 1952). A higher Z-score signals a lower probability of bank insolvency. We calculate a Z-score for a bank, if it can be based on annual accounting data for at least 4 years. Figure 8 displays relationships between the Z-score on the one hand and the income and funding shares on the other. The Z-score is shown to be lowest for banks that obtain almost exclusively fee income. Overall, the relationship between the Z-score and the fee income share appears to be an inverted U. This suggests that mixing interest-generating and fee-generating activities provides some risk diversification benefits. Specifically, bank risk appears to be lowest for banks with fee income shares between the 20th and 25th percentile of this variable's distribution.[9] Figure 8 also displays the relationship between the Z-score and the non-deposit funding share. Attracting some non-deposit funding is seen to increase the Z-score and thus it appears to reduce bank risk. The Z-score peaks for the group of banks between the 80th and 85th percentile of the distribution of the non-deposit funding share, after which is goes back down. Thus, the Z-score peaks for banks high up in the distribution of the non-deposit funding share variable, although even these banks have rather low non-deposit funding shares of less than 0.1 as evident from Figure 4.

Table 1 reports the correlation coefficients between a bank's fee income and non-deposit funding shares, and its risk and return outcomes. We note that the fee income and non-deposit funding shares have a positive and significant correlation coefficient of 0.30. Thus, banks that are non-traditional in having a high fee income share tend to be also non-traditional in having a relatively high non-deposit funding share. Rajan and Stein (2002) and Song and Thakor (2007) provide models of the co-existence of lending and deposit-taking within the same financial

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[9] This finding contrasts with the Stiroh (2004) who shows in his Figure 8 that the Z-score declines with the non-interest income share over its entire range.

institution which are consistent this finding. Next, the correlation between the rate of return on assets and the fee income share is 0.13 and statistically significant, while the correlation between the rate of return on assets and the non-deposit funding share is also positive but not statistically significant. Finally, the Z-score in turn has as negative and significant correlation with the fee income share of -0.27 and also a negative and significant correlation with the non-deposit funding share of -0.04.

2.3   Control variables

In the subsequent empirical analysis, we make use of a number of control variables. These controls are several bank characteristics and characteristics of the macroeconomic and institutional environment that can be expected to affect a bank's income and funding mixes as well as risk and return outcomes. Specifically, we use four bank-level controls. First, assets is the log of assets to proxy for bank size. Second, equity is the ratio of equity to assets to measure bank capitalization. Third, we construct asset growth as the growth rate of real bank assets to allow for the possibility that fast-growing banks have different income and funding strategies as well as risk and return outcomes. Fourth, the overhead variable is constructed as the ratio of overhead expenses to assets to represent a bank's cost structure. Next, there are three macroeconomic control variables. These are the rate of inflation, the growth rate of GDP, and GDP per capita. Specifically, we control for annual inflation rate since inflation can affect bank performance and may influence bank decisions to diversify into fee-income generating activities.   We control for the annual growth rate in the real Gross Domestic Product (GDP) per person to control for business cycle fluctuations and overall economic conditions. We include GDP per capita as an index of the overall level of economic development.

Finally, several regulatory and other institutional variables are included in some empirical specifications. The variable restrict is a composite index of regulatory restrictions on bank activities from Barth et al. (2004). It measures the degree to which banks face regulatory restrictions on their activities in securities markets, insurance, real estate, and owning shares in non-financial firms. The restrict variable ranges from 0 to 4, with higher values indicating greater restrictions. Next, capital is an index of regulatory oversight of bank capital, summarizing information about balance sheet items that can serve as bank capital as well as the magnitude of bank capital requirements. Official, in turn, is an index of the power of the commercial bank supervisory agency to undertake actions such as demand information, force a bank to change its organizational structure or oblige it to suspend dividend payments. Another regulatory variable is diversification, which represents the strictness of loan diversification guidelines imposed on banks.

Banks can also be affected by aspects of the legal system that apply to companies more broadly. Thus, rights is an index of the legal protection of shareholder rights from La Porta et al. (1998). It ranges from 0 to 6, with greater values indicating greater protection of shareholders rights. In addition, self-dealing is an indicator of anti-self-dealing regulations from Djankov et al. (2005). It measures the strength of minority shareholder protection against self-dealing by controlling shareholders. Finally, financial freedom is an index of financial market freedoms from the Heritage Foundation. It is scaled from 0 to 100, with higher values indicating greater financial freedoms. Table 2 provides summary statistics of the main variables used in this study.

As indicated, the GDP per capita variable can be seen as an overall index of a country's level of development. As such, we will use it as an independent variable to illustrate the variation in bank interest income shares, non-deposit funding shares, and bank risk and return. To get a feel for the impact of economic development, Table 3 provides averages of the main bank-level variables

separately for developing and developed countries. Banks in developed countries are shown to rely relatively less on fee income and to attract relatively more non-deposit funding. Further, banks in richer countries achieve relatively low returns on assets, while their average Z-scores tend to be higher.

3.   **The determinants of the interest income share and the funding pattern**

A bank's realized income stream reflects a bank' strategy, its capacities as well as the market environment in which it operates. The non-deposit funding share similarly reflects funding intentions as well as funding possibilities. This section presents the results of regressions that aim to explain variation in income and funding shares through a range of bank and bank-environment variables that can be expected to be relevant for a bank's activity and funding mix. To start, Table 4 presents the results of regressions that use individual bank-year observations. The regressions include country and year fixed effects, and clustering of the errors at the bank level. Regression 1 relates the fee income share to only bank-level variables. We see that investment banks tend to rely on fee income more than others. Similarly, larger, faster-growing financial firms tend to have higher fee income shares. On the whole, controlling for everything else fee-generating activities appear to be associated with greater equity. Further, banks with large overheads are estimated to have higher fee income shares, suggesting that fee-generating activities are relatively costly. Regression 2 in addition includes some macroeconomic controls. High inflation, and high GDP growth are seen to be associated with a higher fee income share. These results can reflect that the macroeconomic environment affects the share of bank resources allocated to fee-generating and interest-generating activities as well as their relative profitability.

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Regressions 3 and 4 in the table have the non-deposit funding share as the dependent variable, and are otherwise fully analogous to regressions 1 and 2. Interestingly, the same bank variables that tend to give rise to a higher fee income share also give rise to a higher non-deposit funding share, with few differences. Association with asset growth is much stronger, whereas equity is no longer significant. This suggests that fast-growing banks appear to be relatively heavily financed through non-deposits, increasing leverage. In addition to investment banks, non-bank credit institutions also rely more heavily on non-deposit financing. Regression 4 includes the macroeconomic controls, and shows that the non-deposit funding share has a weaker association with macroeconomic variables, with a lower non-deposit share in high inflation and high growth countries.

Next, Table 5 reports the results of regressions of the fee income and non-deposit funding shares that – in addition to the bank-level and macroeconomic variables of Table 4 – include one of several regulatory and other institutional variables at a time. Regressions of the fee income share and the non-deposit funding share are reported in Panels A and B, respectively. The institutional variables do not vary over time. Thus, we can only estimate the cross-sectional effect of these variables. To reflect this, we use mean values of all bank and macroeconomic variables in the regressions rather than yearly observations as in Table 4. Estimation is by OLS with clustering of the errors at the country level. In the table, we only report the estimated coefficients for the institutional variables for brevity.

The regressions in Panel A show that the fee income share is related to several institutional variables in a statistically significant way. To start, in regression 1 we see that the fee income share is negatively related to restrictions on bank activities. This is to be expected as restrictions tend to prevent fee-generating activities. In regression 2, the fee share is also negatively related to the protection of shareholder rights. This could reflect a conflict of interest between bank managers and

shareholders, if bank managers stand to benefit relatively more from expansion into non-interest income generating activities. Such activities tend to be supported by liquid assets, which provide bank managers with relatively straightforward opportunities for theft and self-dealing according to Myers and Rajan (1998). In regression 3, the fee income share is further negatively related to restrictions against self-dealing. Since self-dealing is likely to be a relatively important problem with fee-generating activities, restrictions on self-dealing can be expected to allow banks to expand their interest-generating activities. Finally, in regression 5, the fee income share is negatively associated with the index of official bank regulatory power. This could reflect that powerful bank regulators are relatively successful in curtailing a bank's perceived risky expansion into fee-generating activities.

An analogous set of regressions of the non-deposit funding share is reported in Panel B. Interestingly, institutional indices that are associated with a higher fee income share appear to give rise to a lower non-deposit funding share. Specifically, the non-deposit funding share is negatively and significantly related to the restrict, rights and official variables in regressions 1, 2 and 4 of Panel B, respectively. Thus, an interesting question is what can explain the apparent opposite impact of the institutional environment on the fee income and non-deposit funding shares. Remember from Table 1 that bank risk, proxied by the Z-score, is positively correlated with both the fee income share and the non-deposit funding share. This suggests that institutional factors that reduce the fee income share also reduce bank risk, thereby creating room for banks to take on additional risk by increasing their non-deposit funding share. The results of Tables 4 and 5 together provide suggestive evidence that the positive correlation between a bank's fee income share and its non-deposit funding share reported in Table 1 appears to result from variation in bank characteristics and not from cross-country variation in the institutional environment.

4. Evaluation of bank risk and return

4.1 Basic results

In this section, we examine the relationships between the fee income and non-deposit funding shares on the one hand and bank risk and return on the other. To start, Table 6 reports results of regressions that have the rate of return on assets as the dependent variable. The regressions include country and year fixed effects and have clustering of the errors at the bank level. Regression 1 includes the fee income share, in addition to a range of bank-level and macroeconomic controls. The fee income share obtains a positive coefficient of 0.017 that is statistically significant. Thus, firms with a focus on generating fee income tend to have a higher rate of return on assets. We further see that banks that are well-capitalized and grow fast tend to have a high return on assets. Banks in an inflationary environment and in countries with high GDP growth similarly tend to achieve a high rate of return on assets. Next, regression 2 relates the rate of return on assets to the non-deposit funding shares and controls as before. The non-deposit funding share is estimated to have a negative but insignificant impact on the bank rate of return. Among the controls, the assets variable now enters with a positive and significant coefficient to suggest that larger banks achieve higher rates of return. Regression 3 includes both the fee income and non-deposit funding shares in the regression. Consistent with the previous two regressions, the fee income share obtains a positive and significant coefficient, while the estimated coefficient for the non-deposit funding share is insignificant. From Figure 7, we see that the relationships between the bank rate of return on the one hand and the fee income and non-deposit funding shares on the other could well be non-linear. To allow for non-linearities in the estimation, regression 4 includes linear as well as quadratic terms in both the fee income and non-deposit funding shares. Now the linear fee income share variable obtains a negative coefficient of -0.021 that is significant at 10 percent, and a positive quadratic coefficient of 0.040

that is significant at 1 percent. These results provide evidence that the relationship between the rate of return and the fee income share is indeed non-linear. The estimated coefficients suggest that the rate of return is lowest for banks with a fee income share of 0.26.

We next consider how a bank's Z-score, as an index of bank risk, is related to the fee income and non-deposit funding shares. Table 7 presents regressions of the Z-score that are analogous to the rate of return regressions in Table 6. The table has two panels that use mean data for the entire sample period and data for the single year 2004, respectively. Specifically, in Panel A we relate an overall Z score (computed using data over the entire sample period) to mean values of right-hand-side variables. In Panel B, instead we compute a Z-score for 2004 (using 2004 data for the rate of return on assets and on the equity-to-assets ratio but multi-year data to construct the standard deviation of the rate of return on assets) to right-hand-side variables also for 2004. In both panels, errors are clustered at the country level. Starting with regression 1 in Panel A, we see that the Z-score is negatively and significantly related to the fee income share. This suggests that a higher fee income share reduces bank stability. Banks with high overheads are further estimated to be less stable, while banks operating in countries with high levels of GDP appear to be more stable. In regression 2 of Panel A, the non-deposit funding share is seen to enter the regression with a negative but statistically insignificant coefficient. Next, regression 3 of Panel A includes both the fee income and non-deposit funding shares, to yield a coefficient for the fee-income share that, as before, is estimated to be negative and statistically significant.

Finally, regression 4 of Panel A includes linear and quadratic terms in both the fee income and non-deposit funding shares. Both linear terms obtain positive coefficients, while both quadratic terms obtain negative coefficients. All four variables, apart from the linear fee income share, enter the regression significantly. Point estimates suggest that the Z-score peaks for fee income and non-

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deposit funding shares of 0.04 and 0.47, respectively.[10] Qualitatively, these results are consistent

with the inverted U-shaped relationships between the Z-score on the one hand and the fee income

and non-deposit funding shares on the other in Figure 8. Thus, there may only be a limited potential

to reduce bank risk by venturing into fee-generating activities, while bank risk is potentially reduced

by combining deposit and non-deposit funding.

The Z-score regressions with 2004 data reported in Panel B of Table 7 are very similar to those

reported in Panel B. Specifically, in regressions 1 and 3 the fee income share continues to obtain

negative and significant coefficients. In regression 4, the linear and quadratic terms in the fee income

share similarly continue to obtain negative and positive coefficients, respectively, but now both

coefficients fail to be statistically significant. This regression does not provide support for the

hypothesis that the relationship between the Z-score and the fee income share is non-linear.

Our fee income variable reflects non-interest income in the form of fees, commissions and

trading income. To conclude this section, it is interesting to break this variable down into a trading

income part and a non-trading, non-interest income part (with both variables defined as shares of

total operating income). Specifically, columns 1 to 3 of Table 8 report regressions of the bank rate of

return that include a trading income variable, a non-trading, non-interest income variable and these

two variables together, respectively. The trading income variable enters columns 1 and 3 with

positive and significant coefficients, while the non-trading income variable obtains insignificant

coefficients in columns 2 and 3. Trading income rather than non-trading, non-interest income

appears to increase a bank's rate of return. Analogously, columns 4 to 6 of Table 8 relate the Z score

to trading income, non-trading, non-interest income and both, respectively. Now we see that both

types of non-interest income (of the trading and non-trading type) reduce the Z-score significantly.

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[10] Note that these results suggest that for all but a few percent of banks a higher fee income share increases risk at the margin (unlike in Figure 8), while they confirm that for the great majority of banks a higher non-deposit funding share reduces risk (as in Figure 8).

Thus trading income appears to present banks with a trade-off between risk and return, while non-trading, non-interest income increases risk without a concomitant increase in return.[11]

4.2 Alternative measurement of bank risk

As robustness checks, we next consider how two alternative measures of bank risk and return are affected by the bank income mix and funding pattern. The first of these is the Sharpe ratio, defined as the mean return on equity (calculated as pre-tax profits relative to equity) divided by the standard deviation of the return on equity. The Sharpe ratio thus is a risk-adjusted rate of return and it is calculated only if bank data for at least 4 years are available. Second, to represent bank risk we also look at the variability of a bank's stock return. Specifically, we compute the standard deviation of the dividend-inclusive bank stock return on a yearly basis using weekly data.

Table 9 reports the results of regressions of the Sharpe ratio. This variable is related to mean values of right-hand-side variables, while errors are clustered at the country level. In regression 1, the fee income share is seen to obtain a coefficient that is negative and statistically significant. This result is consistent with the negative relationship between the fee income share and the rate of return on assets in the analogous regression 1 of Table. The Sharpe ratio is further estimated to be lower for banks with high overhead costs, but higher in countries with higher GDP per capita levels. In regression 2, the non-deposit funding share is estimated to obtain a positive but insignificant coefficient. Next, in regression 3 with the fee income and non-deposit funding share again enter with positive and negative coefficients, respectively, but now both coefficients are statistically significant. Finally, in regression 4 coefficients on the linear and quadratic terms for the fee income and non-funding shares suggests that the relationships between the Sharpe ratio and the two shares have

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[11] In his Table 5, Stiroh (2004) instead includes a trading income share defined as trading income relative to total non-interest income. This variable fails to have a significant impact on the bank mean rate of return on equity and the Z-score. Fiduciary income, however, is estimated to increase the Z-score, while fee income is estimated to reduce the Z-score.

inverted U-shapes, with the proviso that only the linear non-deposit funding variable and the quadratic fee income variable are estimated with significant coefficients. These regressions can be interpreted as combining the results of separate return and risk regressions of the previous tables. Hence, adjusted for risk, higher levels of fee income reduce returns, while the impact of non-deposit funding is not as significant.

Table 10 reports regressions of the variability of the bank stock returns. These regressions include country and year fixed effects, and errors are clustered at the bank level. In regression 1, the fee income share obtains a positive and significant coefficient. Thus, fee income appears to increase bank risk, consistent with the finding that fee income reduces the Z-score in the analogous regression 1 of Table 7. Bank size is seen to be negatively related to bank stock volatility, while banks with high overheads and in richer countries instead appear to have more volatile returns. In regression 2, we see that a higher non-deposit funding share also is positively and significantly related to bank stock return variability. In line with this, the fee income and non-deposit funding share variables both positive and significant coefficients in regression 3. In contrast, none of the linear or quadratic fee income and non-deposit funding shares are estimated with significant coefficients in regression 4. Overall, the result that fee income increases bank risk appears to be robust to a change in the risk measure. The non-deposit funding, is now found to increase bank stock volatility, even though there appears to be no significant effect on the Z-score in Table 7.

4.3 Endogeneity issues

Influences on a bank's risk and return may cause it to adjust its fee income share and its non-deposit funding share. In this section, we present approaches to deal with possible endogeneity of this kind. The first approach is to replace the fee income and non-deposit funding shares with lagged

values. We apply this approach to the estimation of the bank rate of return in Table 6 and to the estimation of the Z-score in Table 7. The results of rate of return regressions with lagged fee income and non-deposit funding shares are presented in Table 11. We see that the results in Tables 6 and 11 are very similar. In regression 1 of Table 11, the fee income share is again estimated to have a positive and significant impact on the bank rate of return, while in regression 2 the non-deposit funding share fails to be estimated with a significant coefficient. Table 12 displays the results of Z-score regressions with lagged fee income and non-deposit funding shares. In regression 1 of Table 12, the fee income share again has a negative and significant impact on the Z-score. In regression 2, however, the non-deposit funding share now has a negative and significant impact on the Z-score, while in the corresponding regression in Table 7 the estimated coefficient was insignificant. Regression 4 of Table 12, which includes quadratic fee income and non-deposit funding shares, again suggests that the relationship between the Z-score and the two shares have an inverted U-shaped, although only the quadratic fee income share is estimated with a significant coefficient.

Previously, we distinguished among 4 bank categories in Figures 3 and 6. Banks of different types are shown to differ materially in both their fee income share and their non-deposit funding share as shown in Table 4. This suggests that information about a bank's type can be used to instrument for the fee income and non-deposit funding shares. Banking type may affect a bank's fee income and non-deposit funding shares in several ways. Most obviously, a bank's type entails a specific charter that outlines allowed and disallowed bank activities. Investments banks, for instance, may be restricted form attracting retail deposits, which naturally increases their non-deposit funding share. Similarly, non-banking credit institutions may not be allowed to engage in investment banking activities, which limits their potential to generate fee income. Banking type may further affect the fee income and non-deposit funding shares through differences in bank regulation and supervision.

Investment banks, for instance, generally are exempt from minimum capital requirements. This suggests that banking type may indirectly affect bank return and risk through a bank's capitalization ratio as represented by the equity variable in our empirical specifications. Banks of different type may, of course, also differ in their access to the financial safety net in the form of, for instance, central bank loans. The rescue of Bear Stearns in March 2008 and the subsequent availability of central bank credit support to all U.S. investments, however, suggest that differences in financial safety net coverage across banks of different types may in practice not be very large.

With four bank categories, we can create three independent banking type dummy variables for each bank. Specifically we have dummy variables capturing whether a bank is an investment bank or security house, whether it is non-bank credit institution, and whether it falls into the other category. These three banking type dummies are used to instrument for the fee income share and the non-deposit funding shares in regressions of the bank rate of return on assets corresponding to regressions 1 and 2 in Table 6.[12] The resulting IV regressions are presented as column 1 in Panels A and B of Table 13, respectively. Both fee income share and non-deposit funding share have a positive and significant impact on the bank rate of return. Note that in the first-stage regressions banking type dummies are highly correlated with the asset and funding mix, as expected.

Our IV estimation assumes that banking type is exogenously given. Conceivably, banking type could react to banking strategy and performance and hence be endogenous. This is not very likely as none of our banks has changed banking type during the sample period.[13] All the same, in column 2 of Table 13, we present IV results where we take banking type dummies for 2001 to instrument for

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[12] We do not instrument for quadratic fee income and non-deposit funding variables to reflect that the instruments are dummy variables.
[13] The conversion of Goldman Sachs and JPMorgan from investment banks into commercial banks in September 2008, however, shows that a change in banking type can happen.

the fee income and non-deposit funding shares in the subsequent 2002-2007 period. The results are seen to be very similar to those in column 1.

For our instruments to be valid instruments, not only do they need to be correlated with variables in question but they should not enter the second stage regressions, thus satisfying the exclusion restrictions. Conceptually, it is plausible that the only effect banking type has on bank risk and return is through the impact it has on activity and funding mix. We report two tests of specification in the tables. The Hausman test has the null hypothesis that the IV and OLS estimators are not statistically different. The overid test is a joint test that the instruments are valid and the exclusion restriction holds. While the Hausman test cannot be rejected for any of the specifications (casting doubt on the need for IV in the first place), the overid test is rejected for all specifications except, column 2 of Panel A (casting doubt on the validity of the instruments).

Next, Table 14 presents IV regressions of the Z-score. Specifically, in Panel A we report 2 regressions relating the Z-score to the instrumented fee income share based on regression 1 of Table 7, Panel A, while in Panel B we report 2 regressions of the Z-score on the non-deposit funding share based on regression 2 of Table 7, Panel A. In Table 13, we see that the Z-score is negatively and significantly related to the fee income share in the 2 second-stage regressions. The estimated coefficient for the instrumented fee income share is -39.485 in column 1, which suggests that an increase of the fee income share from 0 to 0.5 reduces the Z-score of the mean bank from 30.740 to 10.998 to reflect significantly higher bank risk. In Panel B, the Z-score is in turn negatively and significantly related to the non-deposit funding share in the second-stage regressions. The instrumented non-deposit funding share obtains an estimated coefficient of -41.004 so that an increase of the non-deposit funding share from 0 to 0.5 is calculated to reduce the Z-score of the mean bank from 30.740 to 10.238. The specification tests for fee income share confirm the validity

of the instruments in both specifications. This is also true for the first specification with the non-deposit funding variable.

Overall, the results in this section confirm that higher fee income and non-deposit funding share increase bank risk. The impact on returns is subject to greater endogeneity concerns however, and suggest that the fee income and non-deposit funding shares are not fully exogenous to the rate of return.

5. Conclusion

The recent financial crisis has seen the demise of large investment banks in the U.S. This major change in the financial landscape has brought back to the fore the issue of the optimal banking model. In our view, the debate about banking models is ultimately an empirical one. In the recent crisis, banks that got into trouble most deeply generated substantial non-interest income through the trading of mortgage-backed securities or they relied heavily on the wholesale capital markets for their funding. These observations lead us to construct bank-level indices of the share of non-interest income in total income and of non-deposit funding in total short-term funding as proxies of a bank's asset and funding strategy or business model. We see substantial cross-bank variation in effective business models in our sample of international banks for the 1995-2007 period. This paper investigates in some detail the bank-level, macroeconomic and institutional determinants of banking strategies, as proxied by the non-interest income and the non-deposit funding shares. We find, in particular, that large and fast-growing banks tend to have higher non-interest income and non-deposit funding shares.

The main contribution of this paper is to provide evidence on what bank income and funding strategies perform well in terms of producing profitable and stable banks. In particular, we examine

how a bank's income and funding mixes affect the rate of return on its assets and Z-score or distance to default. Our basic regressions suggest that at low levels of non-interest income and non-deposit funding, there may be some risk diversification benefits of increasing these shares, although at higher levels of non-interest income and non-deposit funding shares further increases result in higher bank risk.

A bank's income and funding strategies and its return and risk outcomes may be determined simultaneously. Therefore, we instrument for bank income and funding mixes using information about banking type as a proxy for bank-specific banking powers and allowed activities. Our IV results qualify our basic findings and can be summarized as follows: a higher non-interest income or non-deposit funding share engenders a materially higher bank risk, but the impact of either variable on the rate of return on assets is difficult to establish due to endogeneity concerns.

The collapse of the U.S. investment banking sector shows that the market can weed out banks that have chosen an apparently unviable business model. All the same, there is an important role for policy as well, as bank collapses, such as in the U.S. investment banking case, can have important real side effects and impose high costs on the taxpayers through the financial safety net. The observed variation in policies regarding banking powers and restrictions over time and across countries, also suggests that policy makers are experimenting with different banking models, searching for an optimal model for banks. The evidence presented in paper suggests that traditional banks – with a heavy reliance on interest-income generating and deposit funding – are safer than banks that go very far in the direction of non-interest income generation and funding through the wholesale capital market. Our results provide a strong indication that banking strategies that rely preponderantly on non-interest income or non-deposit funding are indeed very risky.

However, our results do not suggest that banks with systemic importance should completely eschew non-interest income generating and non-deposit funding, suggesting that universal banking can be beneficial. Nevertheless, evidence of diversification benefits is weak. Hence, while universal banking model may be the best way to conduct investment banking business in a safe and sound manner, our results also suggest that there may limits to how far banks can steer away from the traditional model of interest income generation and deposit taking.

References

Baele, Lieven, Olivier De Jonghe and Rudi Vander Vennet, 2007, Does the stock market value bank diversification, Journal of Banking and Finance 31, 1999-2023.

Barth, James R., Gerard Caprio, and Ross Levine, 2004, Bank supervision and regulation: what works best?, Journal of Financial Intermediation 13, 205-48.

Billett, Matthew T., Jon A. Garfinkel, and Edward S. O'Neal, 1998, The cost of market versus regulatory discipline in banking, Journal of Financial Economics 48, 333-358.

Boyd, John H. and S.L. Graham, 1988, The profitability and risk effects of allowing bank holding companies to merge with other financial firms: a simulation study, Quarterly Review, Federal Reserve Bank of Minneapolis 28, 1-25.

Boyd, John H., Stanley L. Graham and R. Shawn Hewitt, 1993, Bank holding company mergers with nonbank financial firms, Journal of Banking and Finance 17, 43-63.

Calomiris, Charles W., 1999, Building an incentive-compatible safety net, Journal of Banking and Finance 23, 1499-1519.

Calomiris, Charles W. and Charles M. Kahn, 1991, The role of demandable debt in optimal banking arrangements, American Economic Review 81, 497-513.

Caprio, Gerard, Jr., Asli Demirgüç-Kunt and Edward J. Kane, 2008, The 2007 meltdown in structured securitization: Searching for lessons not scapegoats, World Bank Policy Research Working Paper, WPS4756.

Djankov, Simeon, La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer, The law and economics of self-dealing, Journal of Financial Economics 88, 430-465.

DeYoung, Robert and Karin P. Roland, 2001, Product mix and earnings volatility at commercial banks: evidence from a degree of total leverage model, Journal of Financial Intermediation 10, 54-84.

Flannery, M., 1982, Retail bank deposits as quasi-fixed factors of production, American Economic Review 72, 527-36.

Gayle L. DeLong, 2001, Stockholder gains from focusing versus diversifying bank mergers, Journal of Financial Economics 59, 221-252.

Geyfman, Victoria, 2005, Banks in the securities business: market-based risk implications of section 20 subsidiaries, Working paper 05-17, Federal Reserve Bank of Philadelphia.

Kashyap, Anil K., Raghuram Rajan, and Jeremy C. Stein, 2002, Banks as liquidity providers: an explanation for the coexistence of lending and deposit-taking, Journal of Finance 57, 33073.

Kwast, Myron L. 1989, The impact of underwriting and dealing on bank returns and risk, Journal of Banking and Finance 13, 101-125.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny, 1999, Law and finance, Journal of Political Economy 106, 1113-1155.

Huang, Rocco and Lev Ratnovski, 2008, The dark side of bank wholesale funding, mimeo, International Monetery Fund.

Laeven, Luc and Ross Levine, 2008, Bank governance, regulation, and bank risk taking, mimeo, forthcoming in Journal of Financial Economics.

Laeven, Luc and Ross Levine, 2007, Is there a diversification discount in financial conglomerates, Journal of Financial Economics 85, 331-367.

Lown, Cara S., Carol L. Osler, Phlip E. Strahan and Amir Sufi, 2000, The changing landscape of the financial services industry: what lies ahead?, Federal Reserve Bank of New York Economic Policy Review, October 2000.

Myers, Stewart C. and Raghuram G. Rajan, 1998, The paradox of liquidity, Journal of Finance 113, 733-771.

Rajan, Raghuram G., 1992, Insiders and ousiders: the choice between informed and arm's-length debt, Journal of Finance 47, 1367-1400.

Rosen, Richard J, Peter R. Lloyd-Davies, Myron L, Kwast and David B. Humphrey, 1989, Journal of Banking and Finance 13, 355-366.

Saunders, Anthony, and Ingo Walter, 1994, Universal banking in the United States: What could we gain? What could we lose? New York: Oxford University Press.

Roy, A.D., 1952, Safety first and the holding of assets, Econometrica 20, 431-449.

Song, Fenhua and Anjan V. Thakor, 2007, Relationship banking, fragility, and the asset-liability matching problem, The review of financial studies 20, 2129-2177.

Stein, Jeremy, 2002, Information production and capital allocation: decentralized versus hierarchical firms, Journal of Finance 57, 1891-1921.

Stiroh, Kevin J., 2004, Diversification in banking: is noninterest income the answer?, Journal of Money, Credit, and Banking 36, 853-882.

Taylor, John B. and John C. Williams, 2008, A black swan in the money market, NBER Working Paper 13943.

Templeton, William K., and Jacobus T. Severiens, 1992, The effects of nonbank diversification on bank holding company risk, Quarterly Journal of Business and Economics 31, 3-17.

Wagner Wolf, 2007, Financial development and the opacity of banks, Economics Letters 97, 6-10.

Table 1
Correlations of Fee Income and Non-deposit
Funding Shares with Bank Risk and Return

This table presents correlations among variables. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Return on assets* is the profit before tax as a percentage of total assets of a bank. *Z-score* is a measure of bank solvency defined as $\dfrac{ROA + CAR}{SROA}$, where ROA is the return on assets, CAR represents the capital assets ratio and SROA stands for the standard deviation of return on assets. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	Fee income	Non-deposit funding	Return on assets	Z-score
Fee income	1			
Non-deposit funding	0.3042***	1		
Return on assets	0.1271***	0.0022	1	
Z-score	-0.2713***	-0.0396***	0.0193	1

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Table 2
Summary Statistics on Bank, Macroeconomic and Institutional Variables

The table presents summary statistics of variables. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Fee income sq* and *non-deposit funding sq* are the squares of fee income and non-deposit funding, respectively. *Return on assets* is the profit before tax as a percentage of total assets of a bank. *Z-score* is a measure of bank solvency defined as $\dfrac{ROA + CAR}{SROA}$, where ROA is the return on assets, CAR represents the capital assets ratio and SROA stands for the standard deviation of return on assets. *Assets* is the natural logarithm of total assets in US $. *Equity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. *Investment bank dummy*, *Non-bank credit institution dummy* and *other dummy* are dummy variables that equal 1 for investment bank, non-bank credit institution and other banks, respectively, and 0 otherwise. All bank level variables are from Bankscope. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. The macroeconomic data are obtained from World Development Indicators (WDI) of World Bank. *Restrict* is the index of regulatory restrictions on bank activities from Barth et al. (2003). It takes value from 3 to 11 with higher values indicating more restrictiveness. *Rights* measures the legal protection of shareholders from La Porta et al. (1998), ranging from 0 to 5 with higher values indicating more protection of shareholders. *Self-dealing* is the anti-self-dealing index from Djankov et al. (2005), ranging from 0 to 1 with a higher value indicating more control of self-dealing. *Capital* is the index of regulatory oversight of bank capital from Barth et al. (2003). It ranges from 3 to 10 and higher values indicate greater stringency. *Official* is an index of power of commercial bank supervisory agency, from Barth et al. (2003). It measures the power of the supervisory authorities to take specific actions to prevent and correct problems, with higher values indicating greater power. *Diversification* is an index of diversification guidelines imposed on banks from Barth et al. (2003). It ranges from 0 to 2, with higher values indicating more diversification. *Financial freedom* is from the Economic Freedom Indicators of Heritage Foundation. It is scaled from 0 to 100 where 100 with higher values indicating greater freedom.

Variable	No. of observations	Mean	Standard Deviation	Minimum	Maximum
Bank variables					
Fee income	7266	0.353	0.218	0	1
Fee income sq	7266	0.172	0.22	0	1
Non-deposit funding	7212	0.081	0.151	0	1
Non-deposit funding sq	7212	0.03	0.108	0	1
Return on assets	7416	0.018	0.038	-0.805	0.416
Z-score	6554	30.740	26.863	0.068	147.055
Assets	7416	21.907	2.113	15.009	28.306
Equity	5988	0.119	0.127	0	1
Assets growth	5646	0.094	0.188	-3.103	0.996
Overhead	7403	0.043	0.083	0	3.415
Investment bank dummy	7416	0.073	0.260	0	1
Non-bank credit institution dummy	7416	0.030	0.172	0	1
Other dummy	7416	0.045	0.207	0	1
Macroeconomic variables					
Inflation	7069	0.045	0.169	-0.013	4.317
GDP growth	6932	-0.008	0.036	-0.290	0.120
GDP per capita	7136	24.788	14.647	0.129	54.178

Regulatory and institutional variables

Restrict	7225	7.604	1.338	3	11
Rights	6353	4.120	1.208	0	5
Self-dealing	6818	0.561	0.173	0.080	1
Capital	7048	6.112	1.189	3	10
Official	7177	12.002	1.844	4	14
Diversification	7228	1.748	0.455	0	2
Financial freedom	7364	67.045	21.648	10	90

Table 3
Main Bank Variables for Developing and Developed Countries

This table presents the mean and number of observations of main variables by country type and t-statistics for mean comparison. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Return on assets* is the profit before tax as a percentage of total assets of a bank. *Z-score* is a measure of bank solvency defined as $\dfrac{ROA + CAR}{SROA}$, where ROA is return on assets, CAR represents capital assets ratio and SROA stands for standard deviation of return on assets. The data for these bank level variables are from Bankscope.

Country		Fee income	Non-deposit funding share	Return on assets	Z-score
Developing countries	Mean	0.385	0.064	0.024	17.692
	N	1887	1862	1911	1687
Developed countries	Mean	0.342	0.088	0.016	35.263
	N	5379	5350	5505	4867
Total	Mean	0.353	0.081	0.018	30.740
	N	7266	7212	7416	6554
Mean comparison test	t-statistics	7.336	-5.954	8.030	-24.159

Table 4
The Fee Income and Non-deposit Funding Shares

The dependent variable in columns 1 and 2 is *Fee income*, and the dependent variable in columns 3 and 4 is *Non-deposit funding*. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Assets* is the natural logarithm of total assets in US $. *Equity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. *Investment bank dummy*, *Non-bank credit institution dummy* and *other dummy* are dummy variables that equal 1 for investment bank, non-bank credit institution and other banks, respectively, and 0 otherwise. The data for these bank level variables are obtained from Bankscope. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. All these macroeconomic variables are from World Development Indicators (WDI) of World Bank. We estimate all regressions using country and time fixed effects and clustering at bank level. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)
	Fee income	Fee income	Non-deposit funding	Non-deposit funding
Assets	0.034***	0.034***	0.029***	0.029***
	(0.003)	(0.003)	(0.003)	(0.003)
Equity	0.183***	0.169***	0.009	0.014
	(0.062)	(0.062)	(0.072)	(0.073)
Assets growth	0.036*	0.048**	0.046***	0.050***
	(0.019)	(0.019)	(0.014)	(0.016)
Overhead	1.424***	1.461***	0.346**	0.349**
	(0.213)	(0.218)	(0.147)	(0.150)
Investment bank dummy	0.291***	0.289***	0.184***	0.184***
	(0.025)	(0.025)	(0.038)	(0.038)
Non-bank credit institution dummy	-0.022	-0.021	0.273***	0.273***
	(0.043)	(0.043)	(0.052)	(0.052)
Other dummy	-0.039	-0.031	0.032	0.032
	(0.029)	(0.029)	(0.021)	(0.022)
Inflation		0.783***		-0.191*
		(0.212)		(0.111)
GDP growth		0.318*		-0.158*
		(0.168)		(0.087)
GDP per capita		-0.003		0.005
		(0.004)		(0.004)
N	5511	5412	5472	5371
R-sq	0.566	0.573	0.398	0.397
Country fixed effects	Y	Y	Y	Y
Time fixed effects	Y	Y	Y	Y
Clustering level	Bank	Bank	Bank	Bank

Table 5
The Fee Income and Non-deposit Funding Shares and Institutional Development

Panel A reports the relationship between *Fee income* and institutional variables. Panel B represents the relationship between *Non-deposit funding* and institutional variables. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Restrict* is the index of regulatory restrictions on bank activities from Barth et al. (2003). It takes value from 3 to 11 with higher values indicating more restrictiveness. *Rights* measures the legal protection of shareholders from La Porta et al. (1998), ranging from 0 to 5 with higher values indicating more protection of shareholders. *Self-dealing* is the anti-self-dealing index from Djankov et al. (2005), ranging from 0 to 1 with higher value indicating more control of self-dealing. *capital* is the index of regulatory oversight of bank capital from Barth et al. (2003). It ranges from 3 to 10 and higher values indicate greater stringency. *Official* is an index of power of commercial bank supervisory agency, from Barth et al. (2003). It measures the power of the supervisory authorities to take specific actions to prevent and correct problems, with higher values indicating greater power. *Diversification* is an index of diversification guidelines imposed on banks from Barth et al. (2003). It ranges from 0 to 2, with higher values indicating more diversification. *Financial freedom* is from the Economic Freedom Indicators of Heritage Foundation. It is scaled from 0 to 100 with higher values indicating greater freedom. Bank-level and macroeconomic variables included in regression 2 of Table 4 are included as well but they are not reported. We estimate all regressions with mean data and clustering at country level. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	Panel A: Fee income						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Restrict	-0.025***						
	(0.006)						
Rights		-0.020*					
		(0.010)					
Self-dealing			-0.118*				
			(0.060)				
Capital				-0.001			
				(0.008)			
Official					-0.014***		
					(0.004)		
Diversification						-0.005	
						(0.018)	
Financial freedom							0.000
							(0.000)
N	1165	1025	1126	1134	1154	1166	1190
R-sq	0.490	0.497	0.469	0.475	0.499	0.467	0.465

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Country fixed effects	N	N	N	N	N	N	N
Time fixed effects	N	N	N	N	N	N	N
Clustering level	Country	Country	Country	Country	Country	Country	Country

Panel B: Non-deposit funding

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Restrict	0.009**						
	(0.004)						
Rights		0.022***					
		(0.007)					
Self-dealing			0.027				
			(0.041)				
Capital				0.001			
				(0.008)			
Official					0.008**		
					(0.004)		
Diversification						0.024	
						(0.018)	
Financial freedom							0.000
							(0.000)
N	1153	1016	1115	1122	1142	1154	1179
R-sq	0.241	0.264	0.239	0.246	0.247	0.238	0.231
Country fixed effects	N	N	N	N	N	N	N
Time fixed effects	N	N	N	N	N	N	N
Clustering level	Country	Country	Country	Country	Country	Country	Country

Table 6
Determinants of the Return on Assets

The dependant variable is *Return on assets*, which is defined as profit before tax as a percentage of total assets of a bank. *Assets* is the natural logarithm of total assets in US $. *Equity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding is* the share of non-deposit short-term funding in total deposits & short-term funding. *Fee income sq* and *non-deposit funding sq* are the square of fee income and non-deposit funding, respectively. We get the data for these bank level variables from Bankscope. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. We obtain these macroeconomic variables from World Development Indicators (WDI) of World Bank. We estimate all regressions using country and time fixed effects and clustering at bank level. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)
Assets	0.000	0.002**	0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.001)
Equity	0.082***	0.110***	0.078***	0.073***
	(0.017)	(0.029)	(0.020)	(0.020)
Assets growth	0.011***	0.011***	0.008**	0.007*
	(0.004)	(0.004)	(0.004)	(0.004)
Overhead	-0.127	-0.020	-0.141	-0.152
	(0.084)	(0.065)	(0.095)	(0.096)
Fee income	0.017**		0.015**	-0.021*
	(0.008)		(0.007)	(0.011)
Non-deposit funding		-0.004	0.003	0.004
		(0.008)	(0.007)	(0.012)
Fee income sq				0.040***
				(0.015)
Non-deposit funding sq				-0.007
				(0.018)
Inflation	0.151***	0.126***	0.133***	0.128***
	(0.042)	(0.042)	(0.040)	(0.040)
GDP growth	0.122***	0.091***	0.102***	0.101***
	(0.035)	(0.034)	(0.033)	(0.032)

GDP per capita	-0.000	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
N	5412	5371	5303	5303
R-sq	0.270	0.289	0.284	0.290
Country fixed effects	Y	Y	Y	Y
Time fixed effects	Y	Y	Y	Y
Clustering level	Bank	Bank	Bank	Bank

Table 7
Determinants of the Z-Score

The dependant variable is *Z score* defined as $\dfrac{ROA + CAR}{SROA}$ where ROA is return on assets, CAR represents capital assets ratio and SROA stands for standard deviation of return on assets. *Assets* is the natural logarithm of total assets in US $. *Equity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding is* the share of non-deposit short-term funding in total deposits & short-term funding. *Fee income sq* and *non-deposit funding sq* are the square of fee income and non-deposit funding, respectively. We get the data for these bank level variables from Bankscope. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. We obtain these macroeconomic variables from World Development Indicators (WDI) of World Bank. We estimate all regressions with clustering at country level. For panel A, both the dependent and independent variables are mean value over years. For Panel B, the dependent and independent variables are for year 2004. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Panel A

	(1)	(2)	(3)	(4)
Assets	-1.369	-2.113**	-1.534	-2.020*
	(0.876)	(0.878)	(1.018)	(1.067)
Equity	16.769	9.402	20.678**	24.161***
	(10.098)	(13.618)	(9.824)	(8.307)
Assets growth	16.292*	13.940	15.545	15.702*
	(9.762)	(9.727)	(9.901)	(9.259)
Overhead	-62.909***	-95.542***	-80.516***	-68.815***
	(12.278)	(31.970)	(17.958)	(16.957)
Fee income	-27.171***		-29.537***	2.735
	(4.193)		(4.709)	(17.816)
Non-deposit funding		-2.846	11.091	53.564***
		(5.839)	(6.866)	(16.897)
Fee income sq				-34.575**
				(15.869)
Non-deposit funding sq				-56.499***
				(20.237)
Inflation	-16.008	-10.527	-5.169	2.926
	(28.718)	(31.389)	(29.521)	(28.427)

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GDP growth	-40.889	-42.347	-25.912	3.760
	(57.711)	(65.110)	(58.158)	(56.739)
GDP per capita	0.535***	0.603***	0.529***	0.537***
	(0.141)	(0.169)	(0.146)	(0.137)
N	919	918	905	905
R-sq	0.188	0.154	0.192	0.203
Country fixed effects	N	N	N	N
Time fixed effects	N	N	N	N
Clustering level	Country	Country	Country	Country
Panel B				
Assets	-2.328**	-3.085***	-2.426**	-2.807**
	(0.942)	(0.813)	(1.062)	(1.135)
Equity	27.109*	24.503	47.188**	46.403***
	(14.478)	(20.762)	(18.911)	(14.776)
Assets growth	-2.662	-1.953	-3.910	-3.095
	(7.217)	(7.578)	(6.675)	(7.286)
Overhead	-77.679***	-87.087*	-112.604***	-96.979***
	(14.675)	(48.429)	(24.499)	(25.768)
Fee income	-26.626***		-28.694***	-9.943
	(6.563)		(5.679)	(27.444)
Non-deposit funding		-2.428	10.593	53.377***
		(5.682)	(7.315)	(18.235)
Fee income sq				-20.880
				(25.883)
Non-deposit funding sq				-63.898***
				(22.447)
Inflation	-0.949	-4.279	8.760	6.661
	(65.905)	(70.101)	(66.347)	(66.448)
GDP growth	-52.199	-52.079	-49.458	-37.441
	(68.086)	(73.732)	(70.107)	(67.929)
GDP per capita	0.594***	0.648***	0.592***	0.599***
	(0.168)	(0.190)	(0.180)	(0.161)
N	835	828	818	818
R-sq	0.147	0.124	0.152	0.158
Country fixed effects	N	N	N	N
Time fixed effects	N	N	N	N
Clustering level	Country	Country	Country	Country

Table 8
Splitting fee income into trading income and other income

The dependent variable in columns 1 to 3 is *Return on assets* defined as profit before tax as a percentage of total assets of a bank. The dependent variable in columns 4 to 6 is *Z score* defined as $\dfrac{ROA + CAR}{SROA}$ where ROA is return on assets, CAR represents capital assets ratio and SROA stands for standard deviation of return on assets. *Assets* is the natural logarithm of total assets in US $. *Equity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. *Trading income* is the share of trading income in total operating income. *Non-trading, non-interest income* is defined as the share of non-trading, non-interest income in total operating income. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. We obtain bank level data from Bankscope and macroeconomic variables from World Development Indicators (WDI) of World Bank. We estimate all regressions with clustering at bank level. Standard errors are included in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Return on Assets	Return on Assets	Return on Assets	Z score	Z score	Z score
Assets	0.000	0.000	-0.000	-0.246	0.169	0.606
	(0.000)	(0.001)	(0.001)	(0.617)	(0.590)	(0.586)
Equity	0.054***	0.060***	0.052***	29.083**	28.913***	33.643***
	(0.018)	(0.018)	(0.018)	(11.353)	(10.199)	(10.323)
Assets growth	0.011**	0.012**	0.010**	-0.257	-0.491	0.288
	(0.005)	(0.005)	(0.005)	(3.769)	(3.731)	(3.759)
Overhead	-0.071	-0.081	-0.095	-105.775***	-75.211***	-61.957***
	(0.075)	(0.085)	(0.089)	(14.593)	(14.178)	(13.824)
Trading income	0.033**		0.038**	-24.656***		-32.982***
	(0.015)		(0.017)	(6.922)		(6.233)
Non-trading, non-interest income		0.008	0.014		-21.314***	-25.390***
		(0.009)	(0.010)		(6.455)	(6.249)
Inflation	0.152***	0.162***	0.141***	34.704**	37.282**	55.043***
	(0.049)	(0.051)	(0.051)	(16.957)	(14.802)	(17.590)
GDP growth	0.128***	0.132***	0.125***	17.526	16.737	23.194
	(0.039)	(0.042)	(0.040)	(15.523)	(13.666)	(15.122)
GDP per capita	-0.001	-0.001	-0.001	0.637	0.234	0.513

	(0.001)	(0.001)	(0.001)	(0.565)	(0.559)	(0.559)
N	3838	3838	3838	3527	3527	3527
R-sq	0.221	0.210	0.227	0.271	0.276	0.285
Country fixed effects	Y	Y	Y	Y	Y	Y
Time fixed effects	Y	Y	Y	Y	Y	Y
Clustering level	Bank	Bank	Bank	Bank	Bank	Bank

Table 9
Determinants of the Sharpe Ratio

The dependant variable is Sharpe ratio constructed as $\dfrac{ROE}{SROE}$ where ROE is return on equity and SROE represents standard deviation of return on equity. *Assets* is the natural logarithm of total assets in US $. e*quity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Fee income sq* and *non-deposit funding sq* are the squares of fee income and non-deposit funding, respectively. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. Both the dependent and independent variables are mean values over years. We obtain bank level data from Bankscope and macroeconomic data from the World Development Indicators (WDI) of World Bank. We estimate all regressions with mean data and clustering at country level. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)
Assets	-0.076	-0.219	-0.153	-0.218
	(0.122)	(0.164)	(0.145)	(0.166)
Equity	0.578	-0.943	0.344	1.150
	(1.245)	(1.265)	(1.162)	(0.977)
Assets growth	1.825	1.234	1.480	1.511
	(2.451)	(2.253)	(2.493)	(2.378)
Overhead	-5.221**	-8.047**	-7.624***	-5.703*
	(2.439)	(3.840)	(2.537)	(3.205)
Fee income	-3.267***		-4.140***	1.652
	(0.861)		(1.138)	(2.483)
Non-deposit funding		1.256	3.629**	8.886*
		(0.916)	(1.522)	(5.052)
Fee income sq				-6.338***
				(2.128)
Non-deposit funding sq				-6.652
				(5.736)
Inflation	-3.507	-1.668	-0.696	0.412
	(4.100)	(4.235)	(3.938)	(3.995)
GDP growth	-22.007**	-19.071**	-16.882**	-12.466*
	(9.544)	(9.334)	(8.063)	(7.404)
GDP per capita	0.056**	0.062**	0.052**	0.054**
	(0.023)	(0.024)	(0.023)	(0.024)
N	918	918	905	905
R-sq	0.099	0.072	0.110	0.120
Country fixed effects	N	N	N	N
Time fixed effects	N	N	N	N
Clustering level	Country	Country	Country	Country

Table 10
Determinants of the Stock Return Variability

The dependant variable is the *Stock return variability* representing the annualized standard deviation of weekly stock returns. *Assets* is the natural logarithm of total assets in US $. *Equity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Fee income sq* and *non-deposit funding sq* are the squares of fee income and non-deposit funding, respectively. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. We obtain bank level data from Bankscope and macroeconomic data from World Development Indicators (WDI) of World Bank. We estimate all regressions using country and time fixed effects and clustering at bank level. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)
Assets	-0.010***	-0.008***	-0.010***	-0.010***
	(0.003)	(0.002)	(0.003)	(0.003)
Equity	-0.123*	-0.089	-0.139**	-0.142**
	(0.072)	(0.062)	(0.067)	(0.068)
Assets growth	0.023	0.013	0.020	0.018
	(0.017)	(0.018)	(0.018)	(0.018)
Overhead	0.433***	0.476***	0.511***	0.493***
	(0.128)	(0.146)	(0.172)	(0.175)
Fee income	0.157***		0.111***	0.073
	(0.035)		(0.030)	(0.067)
Non-deposit funding		0.124***	0.071**	0.060
		(0.024)	(0.029)	(0.064)
Fee income sq				0.044
				(0.070)
Non-deposit funding sq				0.009
				(0.074)
Inflation	0.234	0.290	0.126	0.119
	(0.346)	(0.331)	(0.334)	(0.336)
GDP growth	0.313	0.357	0.247	0.246
	(0.313)	(0.284)	(0.289)	(0.289)
GDP per capita	0.015**	0.014**	0.014**	0.014**
	(0.007)	(0.006)	(0.006)	(0.006)
N	4343	4312	4256	4256
R-sq	0.313	0.315	0.331	0.331
Country fixed effects	Y	Y	Y	Y
Time fixed effects	Y	Y	Y	Y
Clustering level	Bank	Bank	Bank	Bank

Table 11
The Return on Assets with Lagged Fee Income and Non-deposit Funding Shares

The dependant variable is *Return on assets* defined as profit before tax as a percentage of total assets of a bank. *Assets* is the natural logarithm of total assets in US $. e*quity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Fee income sq* and *non-deposit funding sq* are the square of fee income and non-deposit funding, respectively. We take one year lag of fee income, non-deposit funding and their squares in our regressions. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. We obtain the bank level variables from Bankscope and macroeconomic variables from World Development Indicators (WDI) of World Bank. We estimate all regressions using country and time fixed effects and clustering at bank level. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)
Assets	0.000	0.001*	0.000	0.001
	(0.000)	(0.001)	(0.000)	(0.000)
Equity	0.080***	0.112***	0.084***	0.079***
	(0.017)	(0.027)	(0.021)	(0.020)
Assets growth	0.010***	0.011***	0.009**	0.008**
	(0.004)	(0.004)	(0.004)	(0.004)
Overhead	-0.157*	-0.023	-0.113	-0.122
	(0.088)	(0.061)	(0.092)	(0.092)
Fee income (one-year lag)	0.015**		0.007	-0.025**
	(0.008)		(0.006)	(0.011)
Non-deposit funding (one-year lag)		0.001	0.009	0.008
		(0.007)	(0.006)	(0.011)
Fee income sq (one-year lag)				0.037**
				(0.015)
Non-deposit funding sq (one-year lag)				-0.004
				(0.015)
Inflation	0.155***	0.128***	0.146***	0.142***
	(0.042)	(0.042)	(0.040)	(0.040)
GDP growth	0.121***	0.098***	0.114***	0.113***
	(0.035)	(0.034)	(0.033)	(0.033)
GDP per capita	-0.000	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
N	5410	5372	5304	5304
R-sq	0.274	0.296	0.284	0.288
Country fixed effects	Y	Y	Y	Y
Time fixed effects	Y	Y	Y	Y
Clustering level	Bank	Bank	Bank	Bank

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Table 12
The Z-score with Lagged Fee Income and Non-deposit Funding Shares

The dependant variable is Z score defined as $\dfrac{ROA + CAR}{SROA}$ where ROA is return on assets, CAR represents capital assets ratio and SROA stands for standard deviation of return on assets. *Assets* is the natural logarithm of total assets in US \$. e*quity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Fee income sq* and *non-deposit funding sq* are the square of fee income and non-deposit funding, respectively. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US\$. We take mean value of all the variables for period 2002-2007, except fee income, non-deposit funding and their squares, which take mean value for period 1995-2001. We obtain bank level data from Bankscope and macroeconomic data from World Development Indicators (WDI) of World Bank. We estimate all regressions with clustering at country level. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)
Assets	-1.343**	-2.134***	-1.410*	-1.925**
	(0.564)	(0.611)	(0.753)	(0.746)
Equity	23.322**	3.851	23.162**	27.375***
	(9.621)	(12.757)	(10.190)	(9.653)
Assets growth	23.120**	15.683	22.294**	24.729***
	(9.235)	(10.163)	(9.003)	(8.927)
Overhead	-57.868***	-65.862*	-68.477***	-61.727***
	(10.156)	(33.888)	(18.715)	(21.078)
Fee income	-31.464***		-33.336***	19.507
	(3.360)		(4.302)	(14.262)
Non-deposit funding		-11.158**	7.236	36.337
		(5.573)	(8.220)	(21.856)
Fee income sq				-56.347***
				(14.472)
Non-deposit funding sq				-32.323
				(26.227)
Inflation	-63.906	-55.436	-59.687	-58.445
	(56.038)	(56.494)	(55.748)	(53.300)
GDP growth	-130.403	-141.872	-124.794	-105.808
	(82.474)	(85.392)	(80.344)	(76.240)
GDP per capita	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
N	704	709	693	693
R-sq	0.185	0.137	0.185	0.197
Country fixed effects	N	N	N	N
Time fixed effects	N	N	N	N
Clustering level	Country	Country	Country	Country

Table 13
Determinants of the Return on Assets: IV Estimation

The dependent variable is *Return on assets. Return on assets* is defined as profit before tax as a percentage of total assets of a bank. *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Assets* is the natural logarithm of total assets in US $. *Equity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. the data for these bank level variables are obtained from Bankscope. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. All these macroeconomic variables are from World Development Indicators (WDI) of World Bank. The regressions in Panel A use instruments for the *Fee income* variable, and the regressions Panel B use instruments for the *Non-deposit funding* variable. The regressions in column 1 use as instruments dummy variables indicating whether the bank is an investment bank, a non-bank credit institution, or a bank in the other category. The regressions in column 2 use as instruments dummy variables indicating in 2001 whether the bank is an investment bank, a non-bank credit institution, or a bank in the other category. Other data are for 2002-2007. We estimate all regressions using country and time fixed effects. We also report the coefficient estimates for the instrumental variables of the first-stage regression, the p-value of the F-test of joint significance of identifying instruments, the p-value of the Hausman specification error test which compares the difference between the IV and OLS estimators, and the p-value of the Hansen J-test of overidentifying restrictions. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Panel A	(1)	(2)
	IV: Bank category	IV: Bank category 2001
Fee income share	0.035***	0.039***
	(0.005)	(0.006)
Assets	-0.000	-0.000
	(0.000)	(0.000)
Equity	0.076***	0.079***
	(0.004)	(0.005)
Assets growth	0.010***	0.010***
	(0.002)	(0.002)
Overhead	-0.159***	-0.200***
	(0.012)	(0.014)
Inflation	0.134***	0.123**
	(0.037)	(0.055)
GDP growth	0.114***	0.091**
	(0.030)	(0.046)
GDP per capita	0.000	0.000
	(0.001)	(0.001)
First-stage		
Instrumental variables		
Investment bank dummy	0.289***	0.284***
	(0.009)	(0.011)
Non-bank credit institution dummy	-0.021	-0.012
	(0.013)	(0.014)
Other dummy	-0.031***	-0.020
	(0.012)	(0.013)

N	5412	4279
R-sq	0.260	0.295
F-test of instruments (p-value)	0.000	0.000
Hausman test (p-value)	1.000	1.000
Hansen J-test of overidentifying restrictions (p-value)	0.023	0.103
Country fixed effects	Y	Y
Time fixed effects	Y	Y

Panel B	(1)	(2)
Non-deposit funding	0.018***	0.015**
	(0.006)	(0.007)
Assets	0.001***	0.001***
	(0.000)	(0.000)
Equity	0.107***	0.109***
	(0.004)	(0.005)
Assets growth	0.010***	0.010***
	(0.002)	(0.002)
Overhead	-0.031***	-0.047***
	(0.008)	(0.008)
Inflation	0.128***	0.117**
	(0.034)	(0.051)
GDP growth	0.093***	0.066
	(0.029)	(0.043)
GDP per capita	-0.002***	-0.002***
	(0.001)	(0.001)
First-stage		
Instrumental variables		
Investment bank dummy	0.184***	0.179***
	(0.008)	(0.009)
Non-bank credit institution dummy	0.273***	0.277***
	(0.011)	(0.011)
Other dummy	0.032***	0.031***
	(0.010)	(0.011)
N	5371	4241
R-sq	0.278	0.294
F-test of instruments (p-value)	0.000	0.000
Hausman test (p-value)	1.000	1.000
Hansen J -test of overidentifying restrictions (p-value)	0.000	0.000
Country fixed effects	Y	Y
Time fixed effects	Y	Y

Table 14
Determinants of the Z-score: IV Estimation

The dependent variable is the *Z score* defined as $\dfrac{ROA + CAR}{SROA}$ where ROA is return on assets, CAR represents capital assets ratio and SROA stands for standard deviation of return on assets *Fee income* is the share of non-interest income in total operating income. *Non-deposit funding* is the share of non-deposit short-term funding in total deposits & short-term funding. *Assets* is the natural logarithm of total assets in US $. *Equity* is the capital to asset ratio, which is defined as equity as a percentage of total assets. We used one period lag of equity in the regressions. *Assets growth* is the inflation-adjusted growth rate of bank assets. *Overhead* is defined as overheads as a percentage of total assets. The data for these bank level variables are obtained from Bankscope. *Inflation* is the inflation rate based on consumer prices. *GDP growth* is the inflation adjusted growth rate of GDP per capita of the country. *GDP per capita* is in thousands of 2000 constant US$. All these macroeconomic variables are from World Development Indicators (WDI) of World Bank. The regressions in Panel A use instruments for the *Fee income* variable, and the regressions Panel B use instruments for the *Non-deposit funding* variable. The regressions in column 1 use as instruments dummy variables indicating whether the bank is an investment bank, a non-bank credit institution, or a bank in the other category. The regressions in column 2 use as instruments dummy variables indicating in 2001 whether the bank is an investment bank, a non-bank credit institution, or a bank in the other category. Other data are for 2002-2007. We estimate all regressions with mean data and clustering at country level. We also report the coefficient estimates for the instrumental variables of the first-stage regression, the p-value of the F-test of joint significance of identifying instruments, the p-value of the Hausman specification error test which compares the difference between the IV and OLS estimators, and the p-value of the Hansen J-test of overidentifying restrictions. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)
	IV: Bank category	IV: Bank category 2001
Fee income share	-39.485***	-26.815***
	(13.872)	(5.030)
Assets	-0.940	-1.258***
	(0.661)	(0.487)
Equity	23.079**	19.417**
	(11.093)	(9.233)
Assets growth	17.607**	16.190**
	(7.161)	(6.691)
Overhead	-43.388	-62.585***
	(29.177)	(20.772)
Inflation	-18.800	-22.612
	(32.263)	(45.325)
GDP growth	-40.745	-53.638
	(45.269)	(50.358)
GDP per capita	0.510***	0.529***
	(0.072)	(0.073)
First-stage		
Instrumental variables		
Investment bank dummy	0.251***	0.274***
	(0.023)	(0.023)
Non-bank credit institution dummy	-0.042	-0.034
	(0.031)	(0.031)
Other dummy	0.035	0.042

	(0.028)	(0.028)
N	919	904
R-sq	0.183	0.182
F-test of instruments (p-value)	0.000	0.000
Hausman test (p-value)	0.999	0.977
Hansen J -test of overidentifying restrictions (p-value)	0.615	0.796
Country fixed effects	N	N
Time fixed effects	N	N

Panel B	(1)	(2)
Non-deposit funding	-41.004**	-39.635**
	(16.639)	(16.986)
Assets	-1.056	-1.031
	(0.659)	(0.667)
Equity	13.294	10.004
	(9.707)	(9.961)
Assets growth	16.741**	15.660**
	(7.397)	(7.080)
Overhead	-63.889**	-51.935**
	(25.261)	(20.717)
Inflation	-39.978	-50.142
	(35.678)	(48.896)
GDP growth	-92.731*	-101.761*
	(51.868)	(57.128)
GDP per capita	0.636***	0.608***
	(0.070)	(0.077)
First-stage	0.012	0.016
Instrumental variables	0.137	0.02
Investment bank dummy	0.164***	0.148***
	(0.019)	(0.019)
Non-bank credit institution dummy	0.226***	0.248***
	(0.025)	(0.025)
Other dummy	0.002	-0.004
	(0.025)	(0.025)
N	918	902
R-sq	0.115	0.109
F-test of instruments (p-value)	0.000	0.000
Hausman test (p-value)	0.645	0.703
Hansen J -test of overidentifying restrictions (p-value)	0.135	0.020
Country fixed effects	N	N
Time fixed effects	N	N

Appendix A. Variable definitions and data sources

Variable	Description	Sources
Fee income	Share of non-interest income in total operating income	Bankscope
Fee income sq	Square of fee income share	Bankscope
Non-deposit funding	Share of non-deposit short-term funding in total deposits & short-term funding.	Bankscope
Non-deposit funding sq	Square of non-deposit funding	Bankscope
Trading income	Share of trading income in total operating income	Bankscope
Non-trading, non-interest income	Share of non-interest, non-trading income in total operating income	Bankscope
Return on assets	Pre-tax profits divided by assets	Bankscope
Z-score	Index of bank solvency constructed as $\dfrac{ROA + CAR}{SROA}$ where ROA is return on assets, CAR represents capital assets ratio and SROA stands for standard deviation of return on assets.	Bankscope
Sharpe ratio	Risk-adjusted rate of return constructed as $\dfrac{ROE}{SROE}$ where ROE is return on equity and SROE represents standard deviation of return on equity.	Bankscope
Stock return variability	Annualized standard deviation of weekly dividend-inclusive bank stock returns	Bankscope
Assets	Log of assets in millions of US dollars	Bankscope
Equity	Lag of ratio of equity to assets	Bankscope
Assets growth	Real growth rate of bank assets computed using CPI	Bankscope and World Development Indicators (WDI)
Overhead	Overhead expenses divided by assets	Bankscope
Inflation	Consumer price inflation rate	WDI
GDP growth	Rate of real per capita GDP growth	WDI
GDP per capita	GDP per capita in thousands of 2000 constant U.S. dollars	WDI
Restrict	Index of regulatory restrictions on bank activities	Barth et al. (2004)
Rights	Index of legal protection of shareholders, ranging from 0 to 5 with higher values indicating more protection of shareholders	La Porta et al. (1998)

Self-dealing	Index of anti-self-dealing regulation, ranging from 0 to 1 with higher value indicating more control of self-dealing.	Djankov et al. (2008)
Capital	Index of regulatory oversight of bank, ranging from 3 to 10 with higher values indicate greater stringency	Barth et al. (2004)
Official	Index of power of commercial bank supervisory agency. It measures the power of the supervisory authorities to take specific actions to prevent and correct problems, with higher values indicating greater power.	Barth et al. (2004)
Diversification	Index of diversification guidelines imposed on banks, ranging from 0 to 2 with higher values indicating more diversification.	Barth et al. (2004)
Financial freedom	Index of financial freedom, scaled from 0 to 100 with higher values indicating greater freedom.	Heritage Foundation
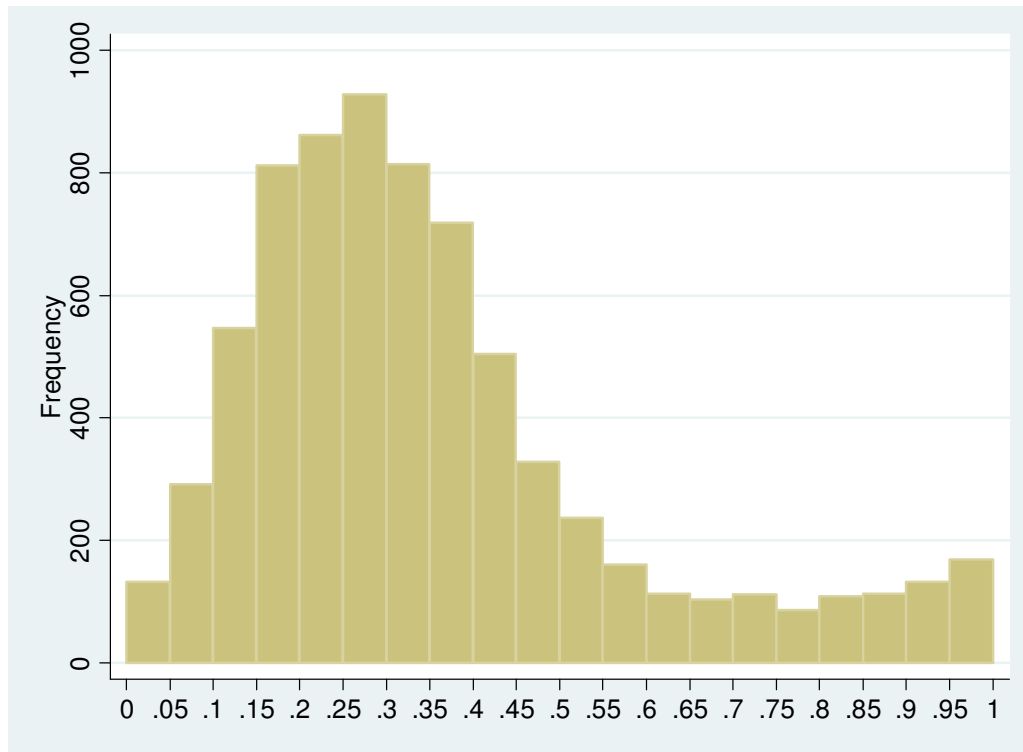
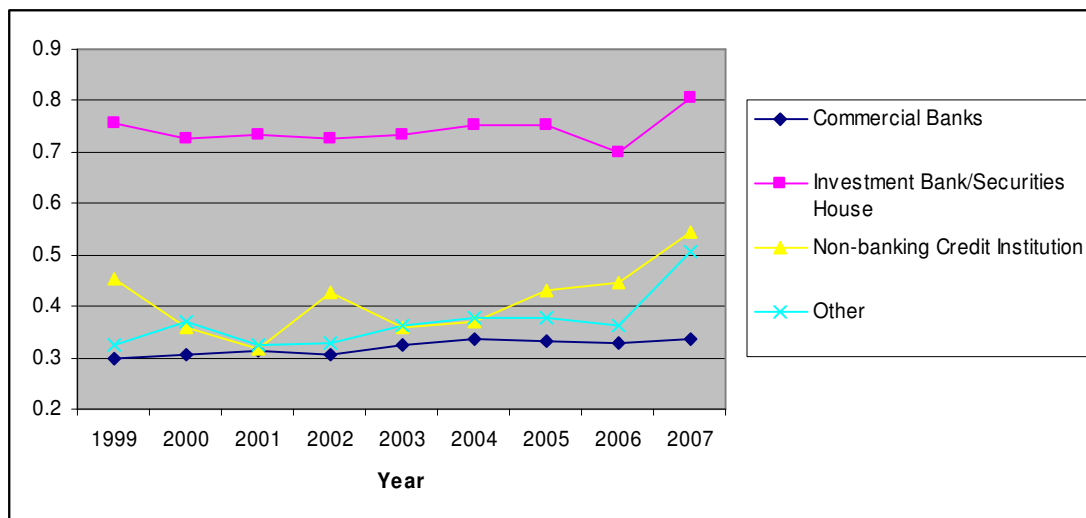**Figure 1. Distribution of the fee income share.**
The fee income share is the share of non-interest income in total operating income. The plot shows the frequency distribution of the fee income share in our dataset. The horizontal axis represents intervals of the fee-based income share. The data are obtained from Bankscope.
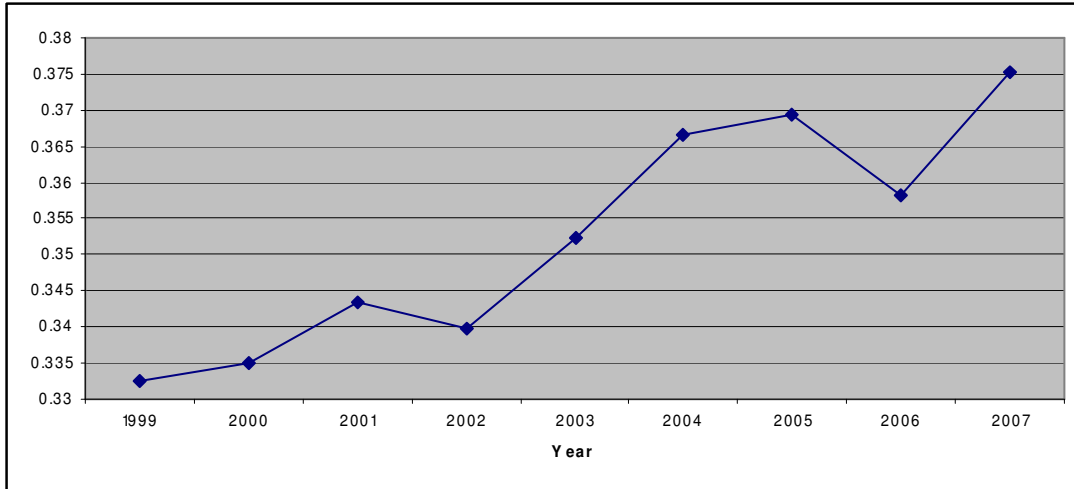
Figure 2. Trend of the fee income share.
The fee income share is the share of non-interest income in total operating income. This figure displays the trend of the fee income share from 1999 to 2007. The fee income share data are yearly averages. The data are from Bankscope.

Figure 3. Trend of the fee income share by categories of bank type.
The fee income share is the share of non-interest income in total operating income. This plot shows the trend of the fee income share by bank categories from 1999 to 2007. Bank categories are commercial banks, investment bank or securities house, non-banking credit institution and other. Subcategories of *commercial banks* are bank holdings and holding companies, and commercial banks. Subcategories of *other* are cooperative banks, Islamic banks, medium and long term credit banks, real estate mortgage banks and savings banks. The data are from Bankscope.
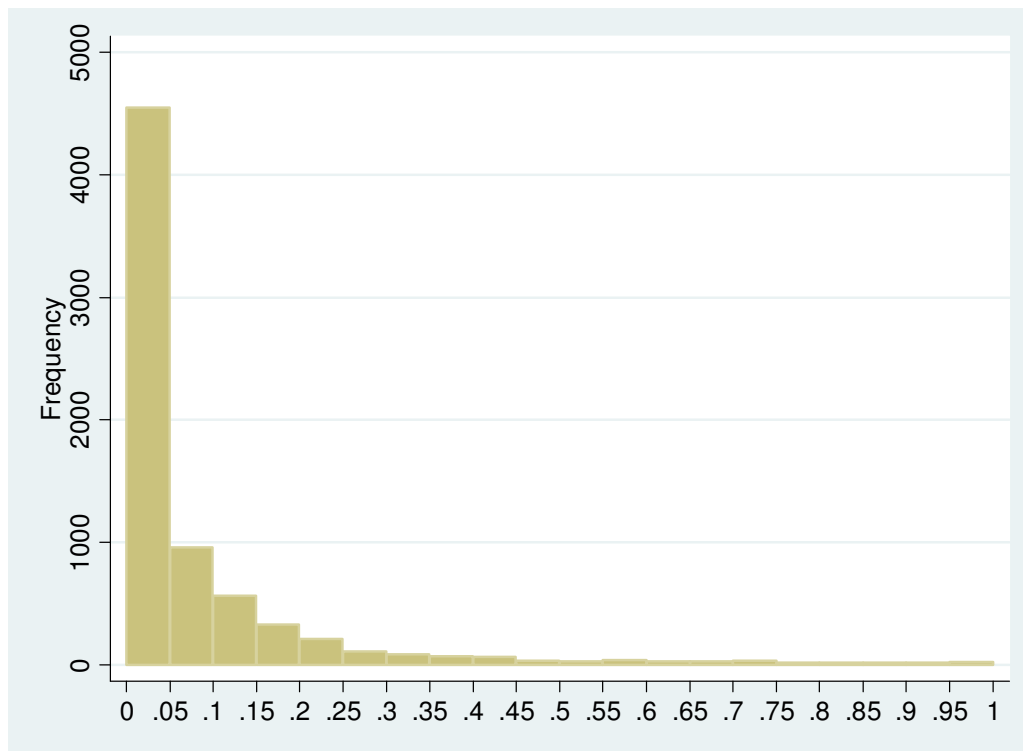
Figure 4. Distribution of the non-deposit funding share.
The non-deposit funding share is the share of non-deposit short-term funding in total deposits & short-term funding.
The plot shows the frequency distribution of the non-deposit funding share in our dataset. The horizontal axis
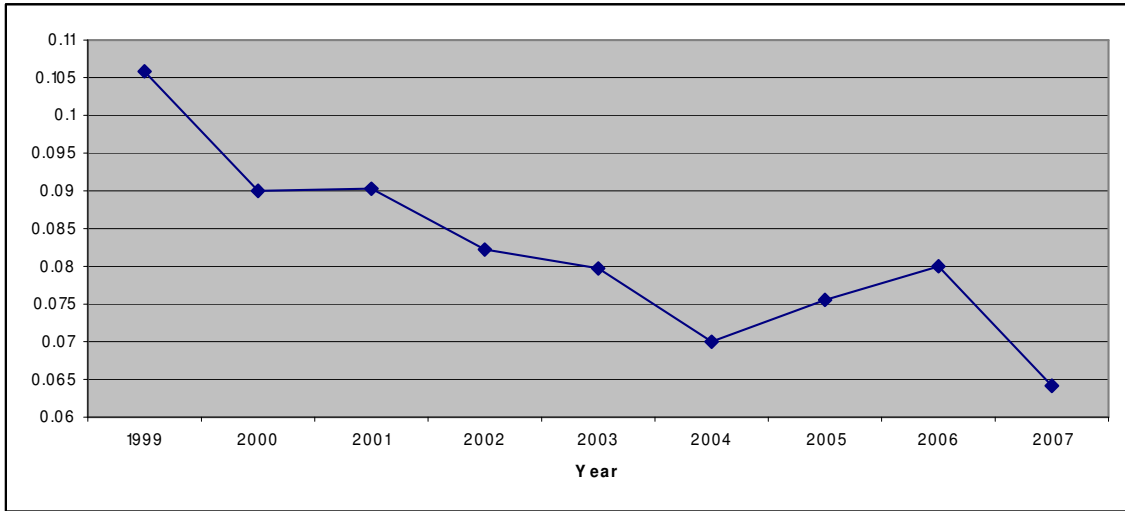represents intervals of the non-deposit funding share. Data are from Bankscope.

Figure 5. Trend of the non-deposit funding share.
The non-deposit funding share is the share of non-deposit short-term funding in total deposits & short-term funding.
This figure displays the trend of the non-deposit funding share from 1999 to 2007. The non-deposit funding share
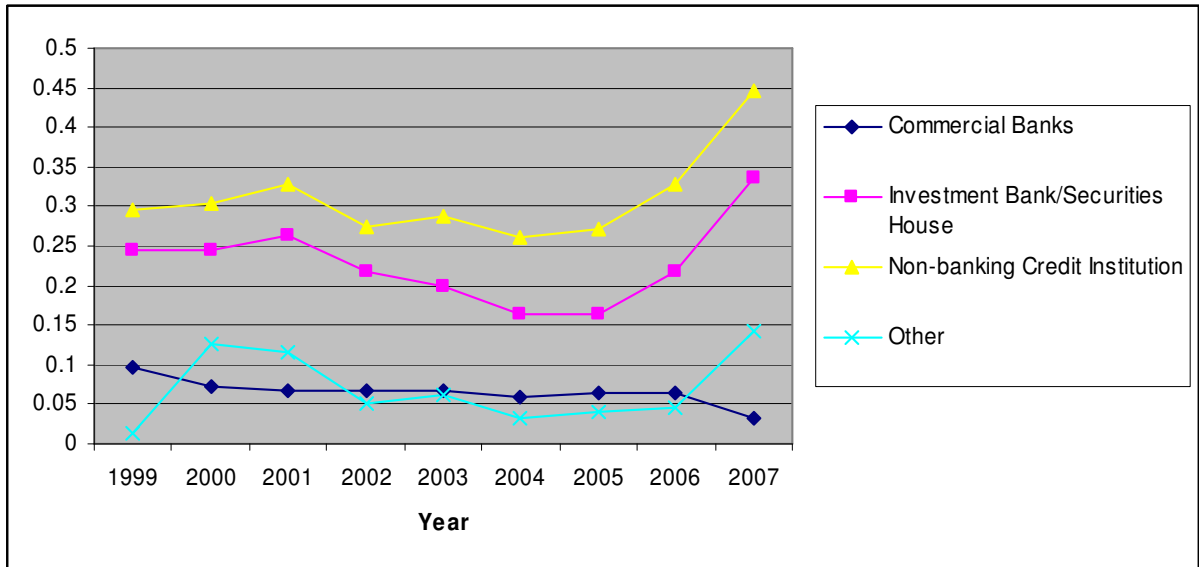data are yearly averages. Data are from Bankscope.

Figure 6. Trend of non-deposit funding share by categories of bank type.
This plot shows the trend of non-deposit funding share by bank categories from 1999 to 2007. Bank categories are commercial banks, investment banks or securities houses, non-banking credit institutions and other. Subcategories of *commercial banks* include bank holdings and holding companies, and commercial banks. Subcategories of *other* are cooperative banks, Islamic banks, medium and long term credit banks, real estate mortgage banks and savings banks. The data are from Bankscope.
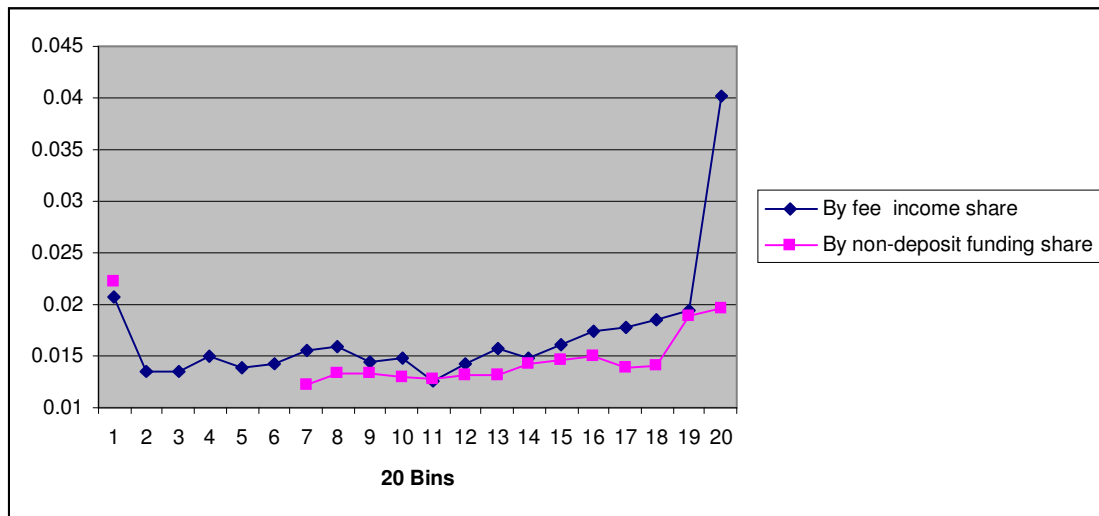
Figure 7. Return on assets by fee income and non-deposit funding share.
Return on assets is pre-tax profits divided by assets. The fee income share is the share of non-interest income in total operating income. The non-deposit funding share is the share of non-deposit short-term funding in total deposits & short-term funding. The plots display the rate of return on assets by fee income share and non-deposit funding share. The horizontal axis represents the 20 bins of the fee income share (the non-deposit funding share), with each bin containing 5 percent of observations of one of these two variables in increasing order. The vertical axis shows the return on assets. Data are from Bankscope.
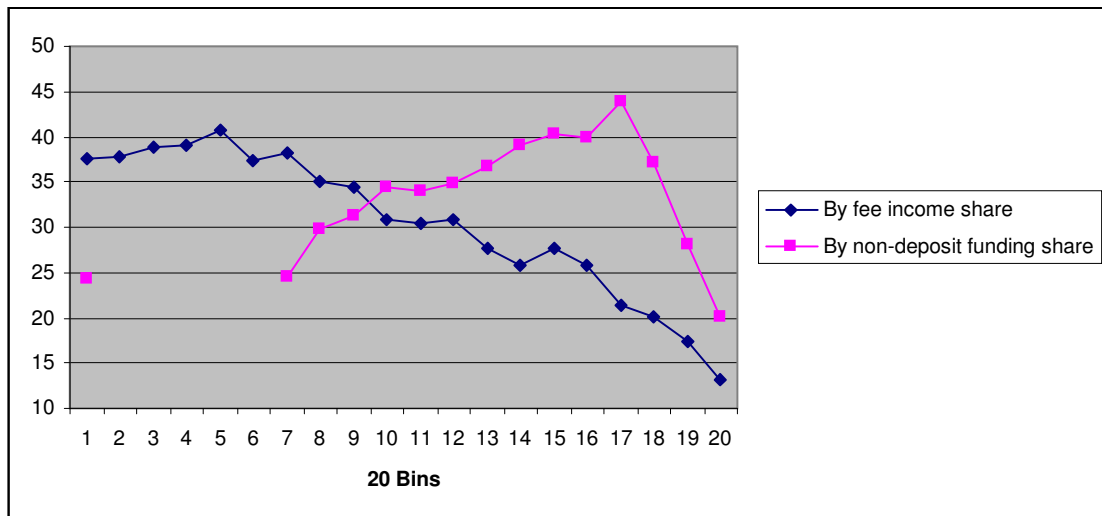
Figure 8. Z-score by fee income and non-deposit funding shares.

The Z score is defined as $\dfrac{ROA + CAR}{SROA}$ where ROA is return on assets, CAR represents capital assets ratio and SROA stands for standard deviation of return on assets. The fee income share is the share of non-interest income in total operating income. The non-deposit funding share is the share of non-deposit short-term funding in total deposits & short-term funding. This figure shows the Z-score by fee income and non-deposit funding shares. The horizontal axis represents the 20 bins of the fee income share (the non-deposit funding share), with each bin containing 5 percent of observations of one of these two variables in increasing order. The vertical axis shows the Z-score. Data are from Bankscope.