*Non-interest Income and Systemic Risk : The Role of Concentration

Fariborz Moshirian[*], Sidharth Sahgal[†], and Bohui Zhang[‡]

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Abstract

This is the first paper to investigate the relationship between non-interest income and systemic risk while considering the concentration of the banking system in a country. Competition alters risk-taking behavior in banks and theory has conflicting predictions about whether or not competition improves the stability of the banking system. Rather than directly testing the effect of concentration on stability, we test whether competition affects the diversification of banks into non-interest generating activities. We find that banks in countries with low levels of concentration have much higher levels of non-interest income. As competition increases, so do levels of non-interest income. Diversification by banks into non-interest generating activities has been shown to decrease their stability in previous empirical and theoretical literature. We show that while non-interest income does increase systemic risk in highly competitive banking environments, it can decrease systemic risk in highly concentrated environments. Our results show that one cannot ignore the competitive landscape of the banking system when judging the effects of bank's non-interest generating activities on stability.

[*]Australian School of Business, University of New South Wales (f.moshirian@unsw.edu.au)
[†]**Contact Author**-Australian School of Business, University of New South Wales (s.sahgal@unsw.edu.au)
[‡]Australian School of Business, University of New South Wales (b.zhang@unsw.edu.au)

1 Introduction

The British government's 850 Billion pound rescue of the financial sector may end with the passage of legislation separating investment and retail banking.[1] Public outrage at the bail-outs prompted the formation of the Independent Commission on Banking, which recommended "ring-fencing" domestic retail banking from global wholesale and investment banking operations.[2]. The goal is to make it easier, and less costly for the resolution of banks that get into trouble, making U.K. banking more resilient. If the recommendation is passed into law in the UK, it would be reminiscent of the 1933 Glass-Steagall Act of the US. In reaction to the proposed law, Royal Bank of Scotland Group CEO Stephen Hester said that "I believe creating a ring-fence increases some of the systemic risks and decreases the ability of banks to withstand risks." Is regulation from the 1930's which separated retail and investment banking suitable for this day and age? Moreover, is the policy prescription in Britain, ostensibly to reduce systemic risk, suitable for banks in all countries? Banking executives have long argued about the benefits of diversifying into activities that are not considered to be at the core of their business. Can diversification actually reduce systemic risk?

In this paper, we tackle these questions by examining the effect of "non-core" banking (we call this non-interest income) on systemic risk . While there has been research on the role of non-interest income in banking stability (Stiroh [2004], De Jonghe [2009] and Demirguc-Kunt and Huizinga [2010]), we believe our analysis is unique because we consider the role of the competitive environment in the country. The banking environment in the US, with thousands of banks is, for example, very different from Australia with its "four pillars" policy. Figure 1 shows the disparity in non-interest income in countries with a low concentration of banks compared with countries that have highly concentrated banking systems. As concentration decreases, we find that banks increase their levels of non-interest income activity even after we control for the effect of regulations and interest rate spreads earned by banks. While non-interest income can increase the systemic risk of banks in countries with a highly competitive banking environment, it may actually decrease systemic risk in a highly concentrated banking environment. Our results demonstrate the importance of considering concentration in the analysis and show that there is a grain of truth to both sides of the argument

[1] The National Audit Office estimated the amount at about 842 Billion pounds in their 2009 report.

[2] Final Report Recommendations (Released on Sept 12, 2011) called for the legal, economic and operational separation of retail banking into separate subsidiaries, but fell short of calling for full separation.

in the regulation of non-interest income.

Two contentious theoretical debates underpin our empirical analysis. The first is the effect of concentration on banking system stability. While competition is generally believed to improve efficiency, the presence of deposit insurance makes banking different from other industries (Keeley [1990]). Banks can borrow at low rates (usually below risk free rates) by issuing insured deposits which are not subject to investor discipline. In the event of collapse, depositors are made whole while the downside to management is limited, thus exacerbating agency conflict (Jensen and Meckling [1976]) and maximizing the potential for moral hazard. Boyd and De Nicolo [2005] point out two possible solutions to this problem. One solution is the correct pricing of deposit insurance (Merton [1977]). The second would be to provide banks with franchise value, i.e. monopolistic rents, so that they will be incentivized to reduce risk taking. In an influential paper, Keeley [1990] provides a theoretical framework on the dangers of diminishing the ability of banks to earn monopoly rents, because of the potential for banks to increase both their leverage and the riskiness of their asset portfolios. Similarly, Hellmann et al. [2000] advocate the imposition of deposit rate controls to enable banks to maintain their franchise value, as liberalization in the 1990s increased competition and exacerbated moral hazard behavior. On the other hand, Boyd and De Nicolo [2005] demonstrate a channel by which competition could in fact increase stability. They focus on the lowering of interest rates by banks in a competitive loan market and show that lower rates could lead to a higher chance of a payoff by borrowers, which in turn could increase stability. The relationship between competition and stability is complex, and Allen and Gale [2004] show that the costs to society of reducing competition may outweigh the benefits of stability. The literature shows many potential avenues through which competition may alter risk taking behavior by banks. In this paper we are concerned with the effect of concentration on non-interest income. Can increased competition in the loan and deposit market drive banks to increase their non-interest income? We don't conflate non-interest income automatically with higher risk. Non-interest income can include volatile trading activity, but can also include low risk income streams like fees on bank accounts.

The second contentious area of debate is around the idea of diversification in banking. One of the central tenets of financial theory is the idea of diversification (for example: Markowitz [1952]), that is to not put all your eggs in one basket. An investor can improve the risk-reward ratio of his portfolio by investing in assets that are not perfectly correlated. Similarly, one would expect

that a financial firm could reduce the riskiness of its portfolio by diversifying its revenue streams. But, Wagner [2010] shows that while diversification may decrease the idiosyncratic risk of a bank, it can increase the likelihood of financial crisis. This effect is mechanical for as banks diversify, they will hold more and more similar portfolios. If banks hold fully diversified portfolios (the market portfolio in portfolio theory) then the collapse in one investment will lead to simultaneous weakness in all other banks holding the same portfolio. Similarly, Acharya [2009] and Ibragimov et al. [2010] develop models in which banks do not consider the negative externality that their actions impose on the stability of the rest of the banking system. The negative externality arises in Acharya [2009] due to the high level of correlation in the assets held by banks. In Ibragimov et al. [2010], however, the negative externality arises because of the interdependence induced by banks hedging their own risks by taking a position in another bank's risk portfolio. Our study is a test of whether diversification is in fact a negative for the stability of the banking system by the increase in individual systemic risk contributions of a bank.

We use a sample of 109 large listed banks in 20 developed countries over the time period 1996-2010 for our analysis. There are three key variables which we introduce here, but cover in more detail in the data section. The first, our proxy for systemic risk is based on the tail of equity returns (MES), introduced in Acharya et al. [2010] and measures the individual contribution to systemic risk by a bank within the country. This tail risk measure is a good predictor of equity losses in the 2007-2009 financial crisis. Since we are focused on individual contributions made by banks to the systemic risk of the entire banking system, we prefer to use MES rather than the commonly used zscore[3] which is beneficial to assess the individual stability of a bank. The second, our proxy for concentration is the asset Herfindahl Index (HHI) (Boyd et al. [2006]) which is calculated using the share of individual bank assets in the total assets of all private and publicly listed banks available in our database (Bankscope) for each country. Banks which are in countries with levels of concentration below the median are classified as "Low Concentration (LC)" and those above the median level of concentration are labeled "High Concentration (HC)". We split our sample into two, based on banks which are in the HC/LC group. Subsequently, we analyse the effects of non-interest income on MES within each sample. The third key variable is our proxy for bank diversification which is the net

[3]zscore is a measure for banking stability. Examples includeDemirguc-Kunt and Huizinga [2010], Berger et al. [2009] and several others. It is measured as $\frac{ROA+E/A}{SD(ROA)}$. In this paper, we calculate mean (ROA) and mean (E/A) and SD(ROA) over three years of data.

non-interest income earned by the bank which has been scaled by the gross interest income reported by the bank. Besides examining the effect of non-interest income on systemic risk, we also analyze its effect on ROA and the factors that may drive non-interest income itself.

Our analysis allows us to make three important contributions to the literature. First, we show that the effect of non-interest income on systemic risk is complex: consideration of the competitive environment in which banks operate is required to fully understand the effect of diversification by banks. Previous research has mostly concluded that non-interest income increases bank fragility. Demirguc-Kunt and Huizinga [2010] use a global sample to show that non-interest income increases the individual risk and return of a firm, and only provides diversification advantages at very low levels. Stiroh [2004] uses a US sample to show that non-interest income increases risk without a commensurate increase in return. Unlike the previous two papers, which use idiosyncratic risk measures(zscore), De Jonghe [2009] develops a proxy for systemic risk using the tail of equity returns called tail-β. De Jonghe [2009] uses this measure to show that revenue diversification increased systemic risk in European banks over the years 1992-2007. In contrast to these results, our results show that while non-interest income does increase systemic risk for banks in LC countries, it can have the opposite effect on banks in HC countries. Specifically, the net fees component of non-interest income can reduce the systemic risk of banks while the other components (trading income and other operating income) have no effect on systemic risk in HC countries. This result holds through several robustness checks, including removing the financial crisis period, excluding the US, and calculating non-interest income in alternative ways.

Second, we examine the impact of concentration on non-interest income. There is a large amount of empirical literature on bank concentration and stability and we mention only a few papers here[4]. This literature is mainly concerned with providing evidence in support of either the "competition-fragility" or "competition-stability" hypothesis using proxies for stability like loan quality, capitalization and zscore. In support of the "competition-fragility" hypothesis, Keeley (1990) shows that increased competition between banks in the US in late 1960's and 1970's may have caused erosion of franchise value which in turn led to increased risk taking (a lower capital-to-assets ratio and increasing rates on Certificates of Deposit) and a surge in failure in the 1980's. Beck et al. [2006] uses data on 69 countries from 1980 to 1997 to show that banking crises are less likely in economies

[4]See Boyd and De Nicolo [2005] for a an excellent overview.

with more concentrated banking systems using the actual occurrence of a crisis to measure banking system stability. Berger et al. [2009] use Lerner, HHI-deposit and HHI-loan indices as proxies for competition in a global sample of 30 developed countries and find that banks with a higher degree of market power bear significantly more loan portfolio risk. In support of the "competition-stability" hypothesis, Jayaratne and Strahan [1998] overturn the results in Keeley [1990] using a larger sample and show that loan losses decreased after competition increased in the US. And another study by Boyd et al. [2006] finds that bank's probability of failure (zscore) is positively and significantly related to concentration. Our study does not directly address the question of concentration and stability. Instead, we examine whether bank concentration plays a role in altering the business activities of a bank. We find that low levels of concentration and increasing competition correspond to higher levels of non-interest income. This change may indicate a propensity to increase risk taking, although it could also be seen as submitting to investor and competitive pressures (we do not test this explicitly). Given the significant role played by non-interest income in the total earnings of a bank and the recent focus on regulation of this supposedly systemically risky part of the banking business, we believe it is important to understand how competition impacts non-interest income.

Third, our analysis includes a global study of the determinants of systemic risk with a measure of systemic risk (MES) calculated using the tail of equity returns. De Jonghe [2009] shows that non-interest activities can increase the systemic risk of European firms. Similarly, in a contemporaneous paper, Brunnermeier et al. [2011] show that non-interest activities can increase systemic risk in American banks. To the best of our knowledge, we are the first to examine the determinants of systemic risk in a global context. The MES measure can be calculated using only one year of historical data. The tail-β measure in De Jonghe [2009] uses six years of data. Other papers which have looked at banking stability (Demirguc-Kunt and Huizinga [2010], Berger et al. [2009]) have been based on the zscore which has been calculated over several years with only one calculation for the entire sample. The recent financial crisis has shown that financial innovation can create and transmit distress at a rapid pace. A measure of banking weakness which can quickly reflect stresses in the market can be extremely handy for regulators. We perform a cross sectional test of the recent financial crisis using these three measures of banking stability (MES, zscore and tail-β) and find that MES is highly significant in regressions where the dependent variable is the equity losses suffered by banks in the crisis. We repeat this analysis for the Asian crisis and find that MES

is again significant in cross sectional regressions.

In summary, we attempt to link three strains of literature, one related to systemic risk, the second related to non-interest income and a third related to concentration. The banking literature has looked at completion and diversification separately. Our analysis shows that it is important to look at them together. In Section 2, we describe the data and the variables. In Section 3, we describe the results of our regression, and we conclude in Section 4.

2 Data

2.1 Sample

We use equity return data from DataStream and accounting data from Bankscope. We define banks as firms with the two digit SIC code of 60 and also the four digit SIC code of 6712 (bank holding companies). We pick banks with a market value of at least $5B USD in Datastream at any point between 1996 and 2010. There are a total of 259 banks in the sample which includes both developed and emerging countries. We use the MSCI classification for developing and emerging markets. Out of this sample, we find accounting information for 202 banks in Bankscope matching SEDOL number and manually correcting any erroneous links and delisted banks. We only include data from developed countries in our final analysis with 20 countries and 109 banks. This is because many of the banks in emerging markets are owned in varying degrees by the government and investor perceptions of systemic risk may be very different for these banks. We include data for the fiscal years 1996 through 2010. The data is winsorized at the 95% level. All numbers which are not ratios, are in (inflation adjusted) constant 2000 US Dollars. We use the World Bank Database for national accounts data. For country level banking regulations, we use the June 2008 version of the World Bank Banking And Supervision Database (see: Barth et al. [2008]).

2.2 Variables

Measurement of systemic risk:

Previous studies on the effect of non-interest income have used measures of individual stability like volatility and zscore (Stiroh [2004], Demirguc-Kunt and Huizinga [2010]), but in this paper we are interested in the systemic risk contribution of an individual firm. Several techniques have

been proposed after the 2007-2009 crisis to measure systemic risk. Acharya et al. [2010] define systemic risk as the capital shortfall of a financial institution when the banking system as a whole is under-capitalized (systemic expected shortfall (SES)). Using the equity losses during the 2007-2009 financial crisis as a proxy for SES, Acharya et al. [2010] find that the marginal expected shortfall (MES), which is calculated using tail of equity returns, is a significant predictor of SES. This calculation is in a similar vein to De Jonghe [2009] and Hartmann et al. [2005] who compute tail-β as the co-crash probabilities of banking stocks with the banking or market index.[5] Adrian and Brunnermeier [2009] use a measure called CoVar which is the value at risk of a financial institution conditional on other institutions being in distress. The marginal contribution by an institution to systemic risk is defined as the difference between CoVar and the financial system's Var. Huang et al. [2009] estimate credit losses in the midst of a crisis using credit default swaps (CDS) and time-varying correlations. In contrast to these approaches which use equity returns, Lehar [2005] uses contingent claim analysis with a modified Merton [1977] framework to measure systemic risk. We prefer to use equity returns as CDS data is not widely available for global institutions. We test both MES and tail-β in the recent financial crisis and the Asian financial crisis and find that MES is a strong predictor of equity losses in the downturn. Hence we use MES in our analysis. Similar to Acharya et al. [2010], we compute MES as the average return of the stock (R^i) when the market (R^m) is in its lowest 5% return quantile.

$$MES^i_{5\%} = \frac{\sum R^i_t I_{\{t \in D\}}}{\sum I_{\{t \in D\}}}$$

where I is an indicator variable which takes the value 1 the market is in its 5% return quantile$D = \{R^m_t$in 5% quantile$\}$ and 0 otherwise. We use USD returns for both the market and the individual stock. MES is calculated for each fiscal year from the July of the previous year till the June of next year. For example, MES for fiscal year 2009 will be calculated using data from July 1, 2008 to June 30, 2009.

Concentration:

We calculate total banking assets in a country as the sum of assets in all public and private Bank Holding Companies, Commercial Banks, Cooperative Banks and Savings Banks in Bankscope. We

[5]We thank Olivier De Jonghe for data on European Banks which we used to compare our calculations of tail-β

do not include Investment Banks in our sample as we are only interested in studying financial institutions which are typically subject to deposit insurance. The share of a bank in an economy is its total assets divided by the total banking assets in the country. The Herfindahl Index (HHI) is calculated as the sum of the share squared. This measure of concentration has been used in previous studies on concentration and stability like Boyd et al. [2006]. Other studies on concentration like Beck et al. [2006] use the share of the top 3 banks in an economy. Our results are robust to using this variable as well.

In order to examine the effect of non-interest income in different economies we break up the sample into two groups: low concentration (LC) and high concentration (HC). To get a similar number of banks in each group, we calculate the median HHI of all banks rather than calculating the median HHI by country. Banks which are below the median HHI are put in the LC group while banks which are above the median HHI are put in the HC bucket. Since the US has a large number of banks in our sample, this results in fewer countries in the LC group. But our results are robust to excluding the US. In further robustness tests, we have also used loans and deposits HHI and the results are quantitatively similar.

Non-interest Income:

Non-interest income is a ratio which is defined as (net non-interest income)/(gross interest income). Ideally, we would like to include only retail banking operations with income from loans and expenses due to deposits. But detailed information for loans and deposit income is only available in Bankscope from the year 2007 onwards for many banks in the sample. Hence we use gross interest income, which includes interest income from loans and securities and also dividend income. Our results are robust to using the non-interest income/net interest income ratio for the regressions on systemic risk. Net non-interest income typically includes three components: net trading income, net fees and other non-interest income. From the year 2007 onward, there is more detailed information and we have data on insurance income and change in face value of hedging/other securities, but we do not consider this in our analysis due to the limited length of the time series.

2.3 Control Variables

We include a slew of relevant control variables in our analysis. While checking for the determinants of systemic risk, we include variables for the profitability, quality and size of the loan book, and

the relative size of the bank in the economy. To ensure that systemic risk is not being driven by the unprofitability and weakness of the bank, we control for the Return on Assets (ROA). A high level of non-performing loans might motivate a bank to diversify into non-loan activity and so we control for this factor (NPL). A bank with 100 Billion Dollars of assets may be relatively small in the US, but it is large for a country like Australia, so we scale the assets of a bank by the GDP of the country. While checking for the determinants of non-interest income, we include variables for the interest rate spread and regulation in the country.

Regulation:

The World Bank Database for regulation by Barth et al. [2008] (June 2008 version) is based on questionnaires sent to financial supervisory authorities in each country. We use the section on Activities Restrictions to verify whether our results on non-interest income are being driven by country-specific regulation. There are four questions in Activities Restrictions that relate to the regulation of securities activities, real estate activities, insurance activities and non-financial activities. The four possible answers are "Unrestricted", "Permitted", "Restricted" and "Prohibited" which we denote with a numeric value of 1-4 with increasing levels being increasingly restrictive. We use two variables in our testing: 'Aggregate Regulation' which is a summation of all four variables; and 'Securities Regulation' which is only related to securities activities.

Interest Rate Spread:

If the interest rate spread for banks is being reduced (due to a flattening yield curve), we would expect banks to increase their non-interest income regardless of competition in the banking sector. So we control for the interest rate spreads, to determine if that rather than competition is driving an increase in non-interest income. We use interest income on average earning assets, minus the interest expense on average liabilities as the interest rate spread. This ratio helps us judge the profitability of the bank's core business . Again, this is an imprecise proxy because it may include the effect of securities other than those related to retail banking. But we do not have a long enough time series of data for interest income from loans and interest expense on deposits.

2.4 Summary Statistics

Table 1 shows a summary of the data for the whole sample and the entire time period (1996-2010) separated by concentration levels. Since we are looking at only large banks in this sample, the

asset size is large at about $85B for the LC sub sample and $122B for the HC sub sample. The non-interest income ratio is higher at 33.6% for HC than 25.6% for LC. The difference is clearly evident in Figure 1. MES, however, is similar in both samples as can been in Figure 2. Although it is not the primary focus of our study, the evidence leads us to believe that it is the idiosyncratic risk-taking of banks within their respective competitive environments which affects systemic risk rather than solely concentration.

To get more detail on countries that are in our sample we look at a snapshot of data by country for the year 2006 prior to the recent financial crisis (Table 2). The US has 23 banks in the sample given that it has a large number of listed banks relative to other countries. The median size (assets) of these listed banks is, however, smaller than some countries like Switzerland where the median size is $1.2 trillion because there are two large listed banks, UBS and Credit Suisse Group . Notably, banking systems which were in deep distress during the recent financial crisis such as the US, UK, Germany and France are in the LC sub-sample, while those in Australia and Canada, which were considered safer, are in the HC sub-sample.

3 Results

3.1 Determinants of Systemic Risk

This section examines if cross-sectional variation in MES can be explained by non-interest income after controlling for bank-specific and country-specific variables. We are interested in exploring whether non-interest income has distinct effects in countries with starkly different competitive environments. Hence, we break up the sample into a HC sub-sample and a LC sub-sample.

We run OLS regressions using robust standard errors with country and year fixed effects. The regressions are of the form:

$$MES_{bct} = \alpha + \beta NoninterestIncome_{bt} + \gamma_1 B_{bt} + \gamma_2 C_{ct} + \epsilon_{bct}$$

MES is calculated for each time period t and each bank b within each country c. B_{bt} are bank-specific control variables and C_{ct} are country-specific variables. Table 3 shows the results of our regression analysis. We always control for relative size, which we measure as Total Assets/GDP

(both in current USD). Regressions 1-3 are for systemic risk in countries with a low concentration of banks. Regression 1 includes only non-interest income and relative size, without any other control variables. Non-interest income is highly significant with a positive coefficient of .011 and a t-statistic of 10.13. This result indicates that for a 1% change in the non-interest income ratio, stock prices fall an additional 1.1% (relative to other banks in the sample on average) in times of market distress over our sample period. Non-interest income has a significant effect on the systemic risk of a bank in countries with low levels of concentration. Our results are similar to De Jonghe [2009] and Demirguc-Kunt and Huizinga [2010] who show that bank fragility increases with non-interest income. Relative size is also highly positively significant indicating that large banks are more susceptible to stresses in the market. The coefficient and the t-statistic of relative size remain significant in all regressions. Regression 2 includes bank-level control variables. The coefficient for leverage is highly significant, but surprisingly, it is negative. In the summary in Table 1, it is clear that leverage is lower for banks in LC countries. Berger et al. [2009] find that banks compensate for higher loan risk by holding extra capital. Our result shows that banks with higher levels of non-interest income also hold higher levels of capital to compensate for that risk and hence concern about capitalization does not seem to increase the systemic riskiness of the bank. The coefficient on leverage is actually very small, indicating that it may also be economically insignificant. The coefficient on non-deposit funding is positive, which agrees with Demirguc-Kunt and Huizinga [2010] who show that bank risk can decrease with non-deposit funding. However, the coefficient for non-deposit funding in our analysis is not significant. Non-performing loans indicate the riskiness of the loan portfolio held by the bank. The coefficient for non-performing loans is positive and is highly significant with a t-statistic of 5.83. For a 0.1% increase in non-performing loans, MES would increase 2.3% showing that a risky loan portfolio significantly increases the systemic riskiness of a bank. A profitable bank, on the other hand, can help reduce MES as the coefficient on ROA is negative and highly significant. Regression 3 includes country-level variables to determine if the economic environment is also responsible in increasing the systemic risk of banks. Inflation is the only country level variable that is significant and it is negative. Deflation would make it harder for borrowers to repay their loans which are in constant dollars.

Regression 4-6 are for banks in countries with a high level of concentration. The correlates of MES are significantly different in high concentration countries compared to low concentration countries.

In Regression 4, where only non-interest income and relative size are included, non-interest income is negative and insignificant. This result holds even when we add control variables in Regression 5 and Regression 6. Non-interest income does not seem to contribute to systemic risk in countries with a highly concentrated banking system. Size, however, remains positive and highly significant in all regressions. The coefficient for relative size is similar in magnitude for both low and high concentration, once country-level control variables are included (0.012 versus 0.013). Leverage is not significant in explaining MES and the magnitude remains very small. The ROA has the same sign and magnitude in the two sub-samples, showing that profitable banks have lower systemic risk no matter where the bank is located. The coefficient for non-performing loans is significant with a slightly smaller magnitude, without country-level control variables, as compared to the coefficient in the LC sub-sample. Once country-level variables are added, the coefficient on non-performing loans is not significant, indicating that for certain countries, the riskiness of the loan portfolio is not a major concern for the systemic risk of banks.

In Table 4 we break up non-interest income into its three components, trading income, fee income and other operating income for each of the two sub-samples. In Bankscope, trading income includes "income from marking to market of derivatives, on currency related transactions, interest-rate instruments, equities and other trading assets, including insurance-related trading income". We also combine income from revaluation of AFS (Available for Sale) securities in the trading income. Net fees include all fees and commissions which are not related to loans. Other operating income includes all income which is not a part of net fees and trading income. The advantage of breaking up the sample into two sub-samples is clearly visible in Table 4. In Regression 2, net fees is highly positively significant with a magnitude of 0.0910, while in Regression 4, the coefficient for net fees is highly negatively significant with a magnitude of -0.0128. This shows that income from non-core sources may actually decrease systemic risk. One drawback of our approach is that we do not know the break up of net fees. Banks in the low concentration countries could be earning their fees from investment banking while banks in the high concentration countries could be earning their fees from charging customers on their bank accounts. In Regression 1, trading income is significant at the 10% level and the magnitude is larger than the component for net fees indicating that it makes a greater contribution to systemic risk. This result is in line with results in (Stiroh [2006], Demirguc-Kunt and Huizinga [2010], Stiroh [2004]) who show that trading income has a disproportionate effect

in increasing banking fragility. Although the coefficient for trading income is not significant, it is negative in the LC countries and does not increase systemic risk. In both Table 3 and Table 4, the regressions have very high R-squareds of over 70%. This is driven mainly by the year fixed effects as systemic risk changes dramatically over time based on economic conditions.

Next we ensure that our results are not simply driven by the financial crisis. We separate the sample into three sub samples with the pre-crisis period 1996-2006 in one sub-sample, the crisis period 2007-2008 in the second sub-sample and the post-crisis period 2009-2010 in the third sub-sample. In Table 6, Regressions 1-4 are for countries with a low concentration banking environment. The result shows that coefficient for non interest income is positive, significant and remarkably similar over the three different time periods. The coefficients for non-interest income in the countries with a high concentration of banks fluctuate, but are never significant in any of the regressions.

3.2 Determinants of Non-interest Income

This section examines if cross sectional variation in non-interest income can be explained by concentration and change in concentration after controlling for bank-specific and country-specific variables. In this section, since we are interested in examining the correlation of concentration with non-interest income, we do not split the sample into two sub-samples. Again, we run OLS regressions using robust standard errors with country and year fixed effects. The regressions are of the form:

$$NI_{bct} = \alpha + \beta_1 Concentration_{ct} + \beta_2 \Delta Concentration_{ct} + \gamma_1 B_{bt} + \gamma_2 C_{ct} + \epsilon_{bct}$$

Concentration is calculated for each time period t and each country c. B_{bt} are bank-specific control variables and C_{ct} are country-specific variables. Table 6 shows the results of our regression analysis. In Regression 1, we include only the level of assets HHI. The ratio is highly significant and negative with a coefficient of -0.6, indicating that higher levels of non-interest income exist in countries with low levels of concentration. In Regression 2, the interest rate spread is highly significant with a coefficient of -0.0751. Banks, which earn a low interest rate margin, are more likely to have higher levels of non-interest income. In Regression 3, we use the change in concentration as an independent variable. Even though concentration is a slow moving variable, the annual change in concentration

is significant. This shows that small changes in concentration can affect the levels of non-interest income level. In Regression 4, we add bank level control variables. The level of concentration (assets HHI) and the the interest rate spread remain significant. But, the change in concentration goes slightly below the 10% significance level, although the sign continues to be negative. In Regression 5, when we add country-level control variables, both the level of concentration and the change in concentration are significant. This regression includes the regulations flag, details of which are included in the Variables section. We would expect the regulations flag to be negative, as lower levels of restrictiveness would allow a bank to enter business areas more freely. But the coefficient is positive and significant in Regression 5. There are a few possible reasons on the sign being different than we expected. First, we only have a snapshot of regulations in 2008 and they could have changed since our sample began in 1996. Second, it is possible that the regulations are not detailed enough to capture all the different types of activity. Lastly, it could be that the banks are subverting regulation and entering businesses without the express consent of the regulator. Overall, the results provide strong evidence that levels of concentration affect non-interest income. There is a slightly weaker effect on change in concentration, which is probably due to the fact that annual changes in concentration are small.

3.3 Determinants of ROA

As in the previous sections, we run OLS regressions using robust standard errors with country and year fixed effects where ROA is the dependent variable. We define ROA as the operating profit before taxes divided by the total assets of the bank. In Table 7, Regressions 1-3 are for banks in LC countries, while regressions 4-6 are for banks in HC countries. In Regression 1, non-interest income is positive and highly significant without any control variables (besides fixed effects). Once bank-level control variables are added in Regression 2, the coefficient becomes even more significant and its magnitude increases. Surprisingly, the size of the bank is not related to ROA in the LC sub-sample. Banks with more loans on their balance sheets (measured as loans/assets) are more likely to have higher ROA, so are banks with a higher level of capitalization (measured as equity/assets). This result shows that it is not necessary to take on higher leverage to gain a higher return on assets. As one would expect, banks with a high ratio of non-performing loans have lower levels of ROA. Banks which rely less on non-deposit funding are able to get a higher ROA. This indicates

that customer deposits are a cheaper source of financing for banks. In Regression 3, we add country-level variables. Non-interest income is still highly significant and the magnitude of the coefficient is similar to Regression 2. Inflation and GDP growth are positive and significant, showing that banks can earn higher ROA if the economy is growing faster. The results in Regressions 4-6 are very similar to the results in Regressions 1-3, with the only difference being larger banks in high concentration countries earn higher ROA's. In fact, even the magnitude of the coefficients for non-interest income in the two groups are very similar. Overall, the results show that non-interest income is strongly related to ROA for both types of competitive banking environments.

3.4 Effectiveness of systemic risk measures

This section examines if cross sectional variation in equity returns during the 2007-2009 financial crisis and the Asian financial crisis can be explained by systemic risk measures. We compare the measure we use in our study, MES to tail-β and the zscore to determine if these risk measures could predict equity losses in the financial crisis. We calculate tail-β as in De Jonghe [2009], where it "equals the probability of a sharp decline in a bank's stock price conditional on a crash in the banking index". We do not describe the details, but note that the methodology is based on using a modified Hill estimator [1975] to calculate the tail index and a semi-parametric estimation of the probability. One caveat with our calculation is that we use only one year of equity returns to calculate tail-β, whereas De Jonghe [2009] uses six years of equity returns. The reason for choosing a shorter time period was to provide both equity based measures with the same amount of information. In addition to these two equity based measures, we also calculate z-score as (ROA+E/A)/(SD(ROA)) where ROA and E/A in the numerator is the average over three years, while SD(ROA) is the standard deviation over three years. For the 2007-2009 financial crisis, the evaluation period is from July 2007 to December 2008 and one year of equity returns before this period are used to calculate MES and tail-β. For the Asian financial crisis, the evaluation period is from June 1997 to December 1997 and one year of equity returns before this period are used to calculate MES and tail-β. Table 8 presents the results for our historical tests. MES is significant for both periods. The coefficient for MES is -18.51 which is similar to -0.17 in Acharya et al. [2010] (we do not multiply MES by 100). Both tail-β and zscore are not significant in the regressions. These results give us the confidence to use MES as a measure of systemic risk in our tests.

4 Conclusion

In the aftermath of the 2007-2009 financial crisis, bank regulators have been tasked with studying and proposing new regulations to make the banking system more robust, and prevent a repeat of the bailouts that were orchestrated by central banks and treasury departments. One major focus of these new regulations is the diversification of banks into non-interest generating activities. In fact, legislators in the UK may pass a law "ring-fencing" retail banking from investment banking if they follow the recommendations of the Independent Commission of Banking. The importance of this issue from a regulation perspective directly motivates our empirical analysis.

The main contribution of this paper is the result that non-interest income can have contrasting effects on stability based on the competitive environment in the country. In low concentration countries, non-interest income can significantly increase systemic risk. While in high concentration countries, certain components of non-interest income can reduce systemic risk, improving bank stability. The results hold even when testing over varied time periods, using different proxies for non-interest income, and using different measures of concentration. We also find that banks in high concentration countries have lower levels of non-interest income activity. As competition increases, the level of non-interest income increases, even after controlling for regulations and the interest rate spreads being earned by the bank. Non-interest income increases ROA of banks in both sub-samples, but the increase is not high enough to reduce the systemic risk of banks in competitive banking environments.

Our study provide some evidence towards resolving conflicting theoretical predictions on the effect of concentration and non-interest income on stability. Traditional portfolio theory, for example, predicts that diversification can improve the risk reward ratio in a portfolio. But in the case of the banking system, while diversification may reduce the individual risk of a bank, it may increase its systemic risk. Our results show that without high levels of competition, banks do not increase their non-interest generating activities to such levels that they become systemically risky. When banks are in a competitive environment, their ability to earn monopoly rents is eroded and they are more likely to engage in risky behavior, such as increased levels of non-interest income which may lead to a decrease in bank stability. Regulators should be cognizant of the concentration of the banking environment before passing regulations controlling the diversification activities of banks.

5 Appendix

Appendix Table A
Variable Description

Variable	Description	Source
Trading income	Trading income/Gross interest income	Bankscope
Non-interest income	Non-interest income/Gross interest income	Bankscope
Net fees	Net fees/Gross interest income	Bankscope
Other operating income	Net fees/Gross interest income	Bankscope
Non-deposit funding	Non-deposit funding/(Deposits+Other short term funding)	Bankscope
NPL	Non performing loans/Gross loans	Bankscope
Deposit funding	Deposit funding/(Deposits+Other short term funding)	Bankscope
Loans	Loans/Total assets	Bankscope
Leverage	Assets/Total equity	Bankscope
ROA	Operating profit before taxes/Total assets	Bankscope
MES	The average return of a stock when the market is in its lowest 5%	Datastream
Assets HHI	Herfindahl index calculated using total assets	Bankscope
Assets	Total assets	Bankscope
Rel Size	Assets/GDP	Bankscope/World Bank
Beta	Coefficient in market model regression	Datastream
Vol	Annualized volatility of daily returns	Datastream

Figure 1
Differences in non-interest income

This graph shows the non-interest income from 1996-2010. The Low Concentration group includes banks which were in countries with levels of asset HHI below the median asset HHI for each year. The High Concentration group includes banks not in the Low Concentration group. Non-interest income is calculated as the ratio of net non-interest income/gross interest income. The values on the graph are the median non-interest income values for each year within each group.

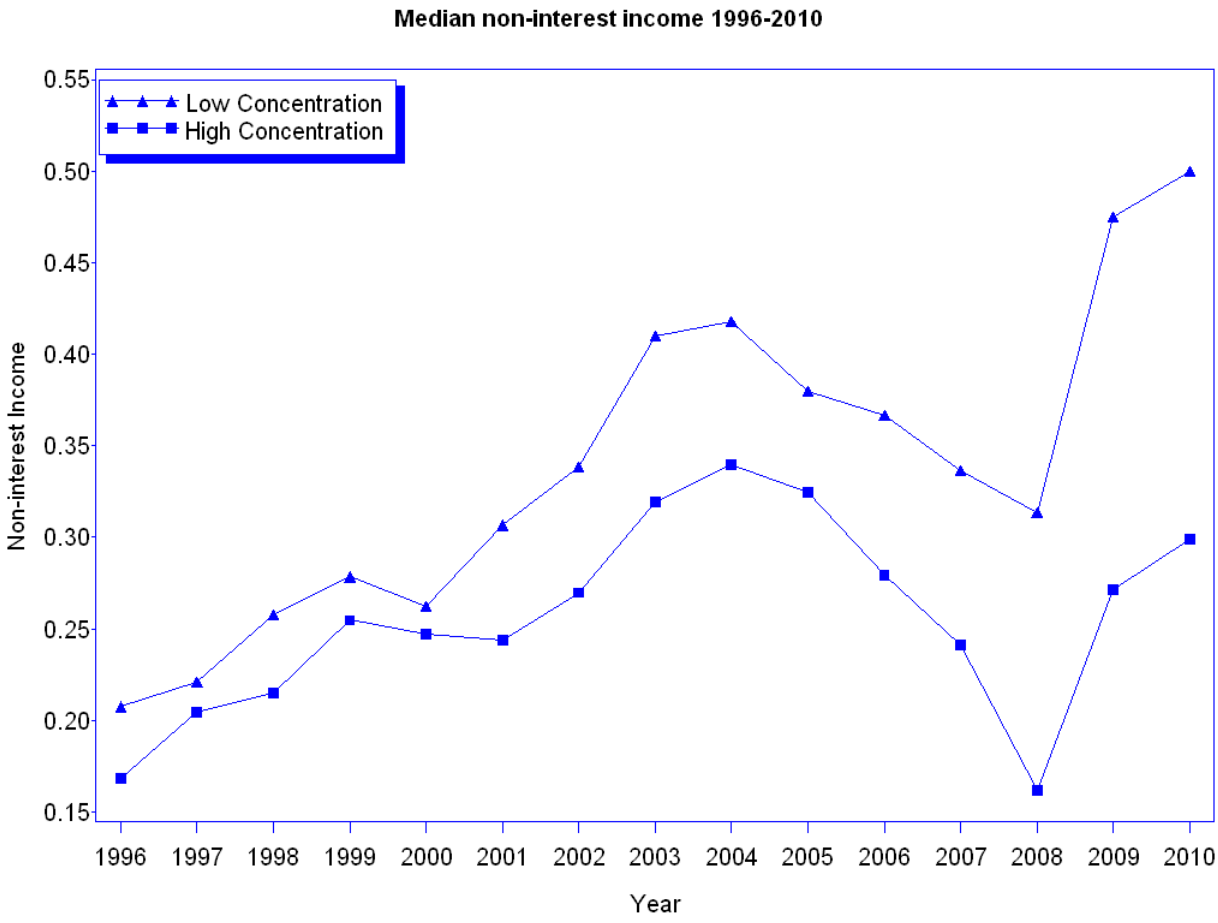

Figure 2
Differences in MES

This graph shows the MES from 1996-2010. The Low Concentration group includes banks which were in countries with levels of asset HHI below the median asset HHI for each year. The High Concentration group includes banks not in the Low Concentration group. MES is calulated as the average return of the stock on the worst 5 percentile returns days for the market. The values on the graph are the median MES values for each year within each group.

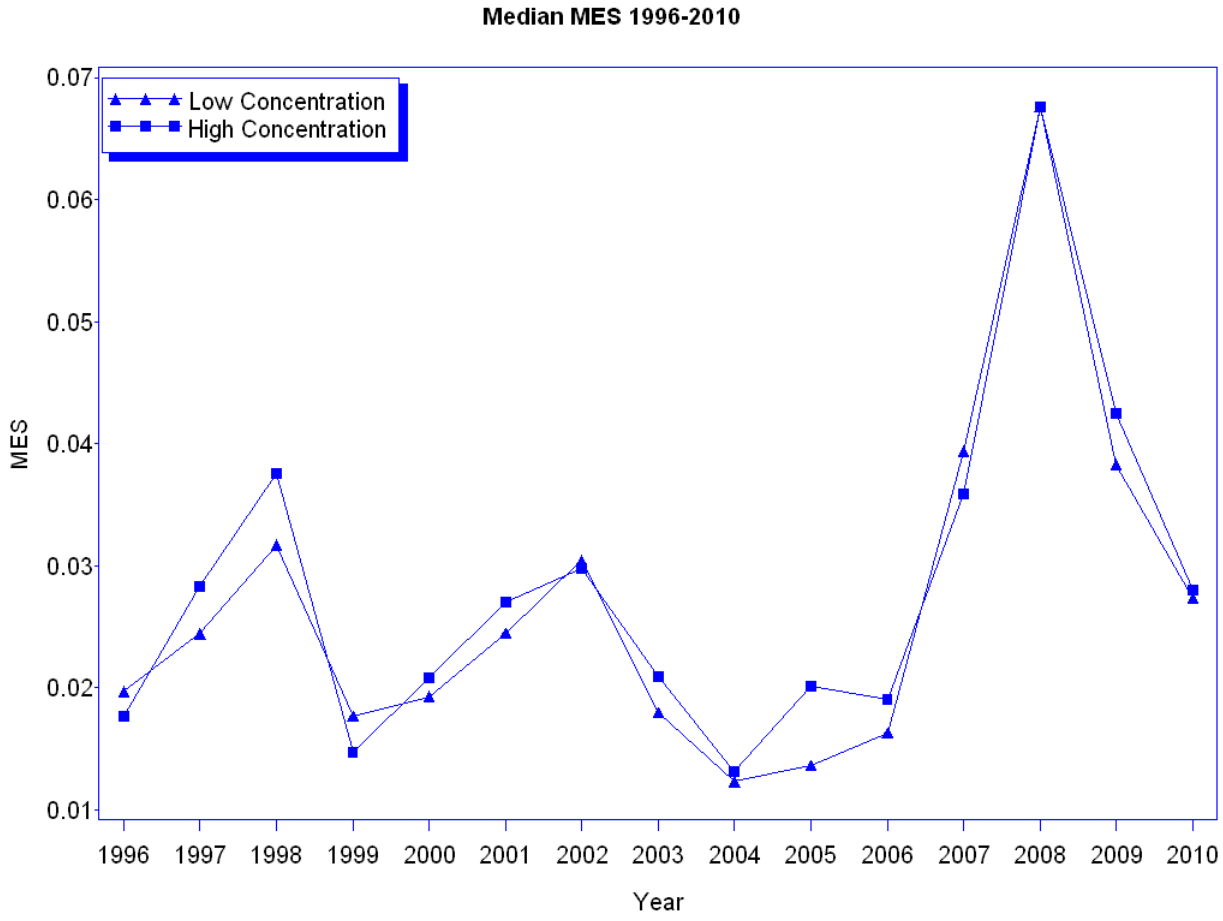

TABLE 1
Summary statistics (1996-2010)

This table shows the summary statistics of median values of the data from the period 1996-2010 within each group. The Low Concentration group includes banks which were in countries with levels of asset HHI below the median asset HHI for each year. The High Concentration group includes banks not in the Low Concentration group. Assets, desposits, gross interest income, net interest income and gross loans are in 2000 constant dollars. Asset HHI is calculated as the Herfindahl Index of the banking sector which includes all private and public banks listed in Bankcope. Non-interest income is calculated as the ratio of net non-interest income/gross interest income. MES is calulated as the average return of the stock on the worst 5 percentile returns days for the market. Vol is the annualized volatility based on daily returns. Zscore is (ROA+E/A)/(SD(ROA) where SD is calculated over three years. The interest rate spread is the interest income on average earning assets minus the interest expense on average liabilities. Leverage is Assets/Equity. NPL is non performing loans/total loans. Rel Size is the Total Assets/GDP. ROA is operating profit before taxes/assets. All accounting data is from Bankscope, equity data is from DataStream and national accounts data is from the World Bank.

	LOW CONCENTRATION			HIGH CONCENTRATION		
	median	mean	std dev	median	mean	std dev
Assets	85,035	113,627	65,128	122,741	145,240	61,637
Customer Deposits	54,572	63,000	33,774	61,540	62,841	20,138
Gross Interest Income	4,258	4,891	2,146	5,293	5,857	1,669
Net Interest Income	1,988	2,349	1,094	2,103	2,276	821
Gross Loans	59,882	68,989	36,585	82,624	89,829	32,345
Pretax Profit	870	1,041	444	1,197	1,235	417
Assets HHI	0.015	0.026	0.017	0.150	0.158	0.019
Asset Top3 conc	0.131	0.182	0.083	0.590	0.594	0.045
MES	0.023	0.026	0.014	0.027	0.029	0.014
Vol	0.296	0.321	0.120	0.310	0.306	0.115
Zscore	45.052	39.585	16.362	34.148	33.283	9.747
Noninterest Income/Net Int Income	0.7096	0.6922	0.0998	0.6307	0.6082	0.0857
Noninterest Income/Int Income	0.3363	0.3449	0.0963	0.2561	0.2550	0.0520
Trading income/Int Income	0.0147	0.0195	0.0151	0.0216	0.0234	0.0094
Interest Rate Spread	2.7400	2.5767	0.7560	1.9900	1.9833	0.2838
Leverage	13.7132	13.9288	1.0254	19.0483	19.4616	2.1522
Net Fees/Int Income	0.1981	0.1767	0.0634	0.1797	0.1746	0.0409
Noninterest expense/Int expense	1.1088	1.3725	0.6729	0.5752	0.6639	0.2024
NPL	0.0161	0.0162	0.0028	0.0176	0.0163	0.0047
Other Operating Income/Int Income	0.0970	0.0940	0.0292	0.0384	0.0382	0.0082
Rel Size	0.0157	0.0275	0.0239	0.3435	0.3702	0.0826
ROA	0.0151	0.0131	0.0049	0.0104	0.0100	0.0020
Curr Account	-3.2969	-3.3686	1.4052	0.1417	-0.0129	1.3433
GDP	9,060,996	8,224,107	2,431,080	441,462	411,497	111,073
GDP per cap	35,976	35,698	2,429	23,316	23,216	1,673
Inflation	2.7517	2.4764	1.0505	2.1409	2.1002	0.8743
NumBanks	59	59	59	50	50	50

TABLE 2
Country Summary in the year 2006

This table shows the summary statistics of median values of the data for the year 1996. The Low Concentration(LC) group includes banks which were in countries with levels of asset HHI below the median asset HHI for each year. The High Concentration(HC) group includes banks not in the Low Concentration group. Assets, desposits, gross interest income, net interest income and gross loans are in 2000 constant dollars. Asset HHI is calculated as the Herfindahl Index of the banking sector which includes all private and public banks listed in Bankcope. Non-interest income is calculated as the ratio of net non-interest income/gross interest income. MES is calulated as the average return of the stock on the worst 5 percentile returns days for the market. Vol is the annualized volatility based on daily returns. Zscore is (ROA+E/A)/(SD(ROA). The interest rate spread is the interest income on average earning assets minus the interest expense on average liabilities. Leverage is Assets/Equity. NPL is non performing loans/total loans. Rel Size is the Total Assets/GDP. ROA is operating profit before taxes/assets. All accounting data is from Bankscope, equity data is from DataStream and national accounts data is from the World Bank.

MARKET		Num Banks	Assets	MES	Rel Size	NI Inc/ Int Inc	Assets HHI	Int Spread	ROA	zscore	NPL	LVG	Net Fees/ Int Inc	Other Op/ Int Inc	Trad Inc/ Int Inc
Austria	LC	2	133,630	0.0235	0.4853	0.4152	0.0774	3.075	0.0171	60.1887	0.0286	14.4181	0.247	0.1139	0.0468
France	LC	4	1,247,240	0.0182	0.6473	0.3991	0.0674	0.44	0.0078	90.2547	0.028	30.867	0.1505	0.0268	0.175
Germany	LC	5	252,367	0.0165	0.1012	0.2458	0.081	0.51	0.0051	38.1234	0.019	39.7322	0.1518	0.0177	0.0356
Japan	LC	9	150,634	0.0259	0.0404	0.4857	0.0517	1.25	0.01	57.1127	0.0125	17.881	0.2968	0.0919	0.0205
United Kingdom	LC	5	992,345	0.0179	0.4753	0.4007	0.0689	0.9	0.0119	43.7872	0.0117	28.2179	0.1756	0.0525	0.1079
United States	LC	23	85,990	0.014	0.0075	0.3657	0.02	2.81	0.017	65.6924	0.0106	10.5003	0.2169	0.1814	0.0158
Australia	HC	6	202,611	0.0181	0.3166	0.2168	0.1713	1.88	0.0154	41.7003	0.0048	18.3497	0.0969	0.0931	0.0153
Belgium	HC	2	501,817	0.0192	1.0431	0.2364	0.1582	0.745	0.0101	63.4044	0.0108	25.7812	0.1089	0.0711	0.0274
Canada	HC	6	265,906	0.0102	0.2435	0.5262	0.1384	1.52	0.0112	49.3796	0.0086	23.4623	0.2794	0.2243	
Denmark	HC	1	413,314	0.0166	1.0431	0.1086	0.2466	0.54	0.0068	93.2523	0.0045	28.7833	0.0664	-0.0044	0.0633
Greece	HC	1	86,139	0.0285	0.3804	0.2815	0.151	3.53	0.0166	23.1915	0.0338	10.6232	0.1561	0.0853	0.0054
Hong Kong	HC	3	73,511	0.022	0.4531	0.1815	0.1965	1.94	0.0184	64.0993	0.0045	10.722	0.1143	0.0229	0.0407
Ireland	HC	1	167,713	0.0271	0.8825	0.1879	0.1799	1.35	0.0094	35.9019	0.0045	29.7146	0.1246	0.0583	0.005
Israel	HC	2	57,783	0.0297	0.4638	0.6199	0.1873	2.51	0.0177	30.6049	0.0477	15.8084	0.3816	0.1048	0.0858
Italy	HC	7	131,518	0.0149	0.0826	0.3052	0.132	2.185	0.0105	32.1076	0.0181	11.4018	0.237	-0.0013	0.0426
Portugal	HC	1	66,529	0.0107	0.3874	0.2858	0.1395	1.57	0.0097	60.8467	0.0243	14.0056	0.2128	0.0645	-0.0103
Singapore	HC	3	89,848	0.022	0.7238	0.2121	0.2178	1.95	0.0164	41.3023	0.0298	10.5637	0.1431	0.0311	0.0311
Spain	HC	5	118,513	0.0201	0.1124	0.2817	0.1225	1.61	0.0108	31.4172	0.0193	17.7147	0.2202	0.0466	0.0192
Sweden	HC	4	231,731	0.0254	0.6798	0.3092	0.2466	0.875	0.0094	48.9	0.0048	24.8344	0.2006	0.0345	0.0512
Switzerland	HC	2	1,260,782	0.0197	1.0431	0.5172	0.2466	0.655	0.0074	75.6843	0.0051	34.4654	0.3212	0.0184	0.1661

TABLE 3
Effect of noninterest income on MES

This table shows OLS regressions where MES is the dependent variable for the period 1996-2010. The Low Concentration(LC) group includes banks which were in countries with levels of asset HHI below the median asset HHI for each year. The High Concentration(HC) group includes banks not in the Low Concentration group. Asset HHI is calculated as the Herfindahl Index of the banking sector which includes all private and public banks listed in Bankcope. MES is calulated as the average return of the stock on the worst 5 percentile returns days for the market. Non-interest income is calculated as the ratio of net non-interest income/gross interest income. Rel Size is the Total Assets/GDP. Leverage is Assets/Equity. Nondeposit funding is the ratio of nondeposit funding/total short term funding. NPL is non performing loans/total loans. Loans is total loans/assets. ROA is operating profit before taxes/assets.

	LOW CONCENTRATION			HIGH CONCENTRATION		
	(1)	(2)	(3)	(4)	(5)	(6)
	mes	mes	mes	mes	mes	mes
Noninterest income	0.0118***	0.0115***	0.0111***	-0.00258	-0.00400	-0.00163
	(10.13)	(8.03)	(7.60)	(-1.07)	(-1.47)	(-0.57)
Rel Size	0.0117***	0.0105***	0.0120***	0.0130***	0.0131***	0.0135***
	(3.83)	(3.29)	(3.48)	(5.74)	(5.39)	(5.16)
LVG		-0.00000478***	-0.00000484***		-0.0000353	-0.0000227
		(-3.71)	(-3.59)		(-0.80)	(-0.51)
Nondep funding		0.00298	0.00473		0.00714	0.00347
		(0.86)	(1.37)		(1.49)	(0.69)
NPL		0.232***	0.227***		0.167***	0.0776
		(5.83)	(5.36)		(3.30)	(1.48)
ROA		-0.259***	-0.215***		-0.148	-0.210**
		(-3.82)	(-2.99)		(-1.43)	(-2.15)
Loans		0.00131	0.000372		0.00381	0.000134
		(0.48)	(0.13)		(0.76)	(0.03)
Curr Account			-0.000263			-0.0000269
			(-0.59)			(-0.12)
GDP Per Cap			0.000000886			-0.000000391
			(0.90)			(-0.94)
GDP Growth			-0.000710			0.000469
			(-1.00)			(1.30)
Inflation			-0.00242***			0.0000165
			(-2.65)			(0.03)
_cons	0.00775***	0.0197***	0.00580	0.0143***	0.0101**	0.0208**
	(4.07)	(4.25)	(0.34)	(9.33)	(2.08)	(2.13)
N	746	721	676	651	604	556
R-sq	0.700	0.741	0.756	0.680	0.709	0.738
adj. R-sq	0.690	0.731	0.744	0.662	0.690	0.717
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Std. Errors	Robust	Robust	Robust	Robust	Robust	Robust

TABLE 4
Components of noninterest income

This table shows OLS regressions where MES is the dependent variable for the period 1996-2010. The Low Concentration(LC) group includes banks which were in countries with levels of asset HHI below the median asset HHI for each year. The High Concentration(HC) group includes banks not in the Low Concentration group. Asset HHI is calculated as the Herfindahl Index of the banking sector which includes all private and public banks listed in Bankcope. MES is calulated as the average return of the stock on the worst 5 percentile returns days for the market. Trading Income is trading income/gross interest income. Net Fees is net fees/gross interest income. Other operating income/gross interest income. Rel Size is the Total Assets/GDP. Leverage is Assets/Equity. Nondeposit funding is the ratio of nondeposit funding/total short term funding. NPL is non performing loans/total loans. Loans is total loans/assets. ROA is operating profit before taxes/assets.

	LOW CONCENTRATION			HIGH CONCENTRATION		
	(1)	(2)	(3)	(4)	(5)	(6)
	mes	mes	mes	mes	mes	mes
Trading Income	0.0164*			-0.00106		
	(1.96)			(-0.07)		
Net Fees		0.00910***			-0.0128**	
		(3.70)			(-2.51)	
Other operating			0.0131***			0.00351
			(5.02)			(0.75)
Leverage	-0.00000558***	-0.00000515***	-0.00000498***	-0.0000289	-0.0000261	-0.0000227
	(-3.78)	(-3.59)	(-3.41)	(-0.64)	(-0.58)	(-0.50)
Non Dep Funding	0.00330	0.00436	0.00472	-0.00349	0.00130	0.00146
	(0.92)	(1.19)	(1.33)	(-0.58)	(0.24)	(0.29)
Rel Size	0.0101***	0.0112***	0.0101***	0.0150***	0.0131***	0.0140***
	(2.92)	(3.23)	(2.92)	(5.00)	(4.92)	(5.44)
LOANS	-0.00756**	-0.00667**	-0.00901***	0.000999	-0.000784	0.00275
	(-2.53)	(-2.49)	(-3.74)	(0.15)	(-0.14)	(0.54)
NPL	0.285***	0.260***	0.255***	0.0464	0.0885	0.0558
	(5.94)	(5.85)	(5.98)	(0.76)	(1.64)	(1.03)
ROA	-0.0932	-0.101	-0.128*	-0.338***	-0.196*	-0.252***
	(-1.26)	(-1.40)	(-1.78)	(-2.89)	(-1.96)	(-2.62)
Curr account	-0.000355	-0.000263	-0.000366	0.000365	0.0000961	0.000204
	(-0.81)	(-0.60)	(-0.83)	(0.97)	(0.39)	(0.84)
GDP Per Cap	0.00000103	0.00000114	0.000000952	-0.000000110	-0.000000425	-0.000000368
	(1.05)	(1.17)	(0.96)	(-0.17)	(-1.01)	(-0.86)
GDP growth	-0.000541	-0.000877	-0.000915	0.000230	0.000600	0.000412
	(-0.75)	(-1.24)	(-1.28)	(0.47)	(1.57)	(1.09)
Inflation	-0.00270***	-0.00279***	-0.00275***	-0.000866	0.000250	-0.000345
	(-2.85)	(-3.00)	(-2.94)	(-1.32)	(0.40)	(-0.54)
_cons	0.00833	0.00590	0.0123	0.0294*	0.0236**	0.0250**
	(0.49)	(0.35)	(0.73)	(1.82)	(2.38)	(2.42)
N	662	666	676	393	518	517
R-sq	0.735	0.742	0.743	0.770	0.739	0.751
adj. R-sq	0.723	0.730	0.731	0.743	0.717	0.729
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Std. Errors	Robust	Robust	Robust	Robust	Robust	Robust

TABLE 5
Effect of noninterest income on MES exluding the financial crisis

This table shows OLS regressions where MES is the dependent variable for a time period before the financial crisis, during the financial cris and post the financial crisis. The Low Concentration(LC) group includes banks which were in countries with levels of asset HHI below the median asset HHI for each year. The High Concentration(HC) group includes banks not in the Low Concentration group. Asset HHI is calculated as the Herfindahl Index of the banking sector which includes all private and public banks listed in Bankcope. MES is calulated as the average return of the stock on the worst 5 percentile returns days for the market. Non-interest income is calculated as the ratio of net non-interest income/gross interest income. Rel Size is the Total Assets/GDP. Leverage is Assets/Equity. Nondeposit funding is the ratio of nondeposit funding/total short term funding. NPL is non performing loans/total loans. Loans is total loans/assets. ROA is operating profit before taxes/assets.

	LOW CONCENTRATION				HIGH CONCENTRATION			
	1996-2006	2007-2008	2009-2010	1996-2010	1996-2006	2007-2008	2009-2010	1996-2010
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	mes	mes	mes	mes	mes	mes	mes	mes
Noninterest income	0.0103***	0.0122***	0.0115**	0.0111***	0.00207	0.00425	0.00864	-0.00163
	(7.44)	(3.14)	(2.53)	(7.60)	(0.73)	(0.59)	(1.55)	(-0.57)
Leverage	-0.0000681	-0.00000415***	0.0000246**	-0.00000484***	-0.000150*	-0.0000142	-0.0000768	-0.0000227
	(-1.36)	(-6.35)	(2.50)	(-3.59)	(-1.68)	(-0.48)	(-0.58)	(-0.51)
Non dep funding	0.0128***	-0.00460	-0.0121	0.00473	0.00262	-0.00375	-0.00244	0.00347
	(3.75)	(-0.52)	(-1.03)	(1.37)	(0.51)	(-0.29)	(-0.29)	(0.69)
Relative size	0.0107**	0.0134**	0.0104	0.0120***	0.0133***	0.0133**	0.0129***	0.0135***
	(2.47)	(2.34)	(1.48)	(3.48)	(4.55)	(2.63)	(4.03)	(5.16)
Loans	-0.00327	0.00741	0.00482	0.000372	0.0000906	0.00999	0.00459	0.000134
	(-1.15)	(0.93)	(0.60)	(0.13)	(0.02)	(0.66)	(0.38)	(0.03)
NPL	0.167***	0.292**	0.283***	0.227***	0.0466	-0.132	0.170	0.0776
	(3.33)	(2.13)	(4.01)	(5.36)	(0.86)	(-0.70)	(1.39)	(1.48)
ROA	-0.113	-0.127	-0.330***	-0.215***	-0.134	-0.425*	-0.485	-0.210**
	(-1.47)	(-0.57)	(-2.66)	(-2.99)	(-1.33)	(-1.80)	(-1.54)	(-2.15)
Current Account	-0.0000688	-0.00363		-0.000263	0.0000180	-0.000814*		-0.0000269
	(-0.16)	(-1.24)		(-0.59)	(0.07)	(-1.88)		(-0.12)
GDP Percapita	0.000000472	0.00000453		0.000000886	6.78e-08	-0.00000490		-0.000000391
	(0.44)	(0.35)		(0.90)	(0.17)	(-1.18)		(-0.94)
GDP Growth	0.000390	0.00206		-0.000710	0.000498	0.00231		0.000469
	(0.50)	(0.46)		(-1.00)	(1.33)	(1.67)		(1.30)
Inflation	0.000613	-0.0121**		-0.00242***	0.00161***	-0.00659***		0.0000165
	(0.51)	(-2.27)		(-2.65)	(2.62)	(-4.23)		(0.03)
_cons	0.0127	-0.0887	0.0133	0.00580	0.00739	0.201*	0.0248**	0.0208**
	(0.34)	(-0.18)	(1.33)	(0.34)	(0.78)	(2.00)	(2.09)	(2.13)
N	545	88	88	676	438	82	75	556
R-sq	0.583	0.813	0.662	0.756	0.569	0.885	0.900	0.738
adj. R-sq	0.562	0.767	0.598	0.744	0.528	0.833	0.857	0.717
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Std. Error	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust

TABLE 6
Determinants of noninterest income

This table shows OLS regressions where non-interest income is the dependent variable for the period 1996-2010. Asset HHI is calculated as the Herfindahl Index of the banking sector which includes all private and public banks listed in Bankcope. The interest rate spread is the interest income on average earning assets minus the interest expense on average liabilities. The Regulation flag is based on four questions in Activities Restrictions from the Regulation Database that relate to the regulation of securities activities, real estate activities, insurance activities and non-financial activities. The four possible answers are Unrestricted, Permitted, Restricted and Prohibited which we denote with a numeric value of 1-4. The Regulation flag is a summation of all four variables. Rel Size is the Total Assets/GDP. Leverage is Assets/Equity. Nondeposit funding is the ratio of nondeposit funding/total short term funding. NPL is non performing loans/total loans. Loans is total loans/assets. ROA is operating profit before taxes/assets.

	(1) Noninterest Income	(2) Noninterest Income	(3) Noninterest Income	(4) Noninterest Income	(5) Noninterest Income
Assets HHI	-0.600***			-0.742***	-0.690***
	(-3.26)			(-3.53)	(-2.97)
Interest Rate Spread		-0.0751***		-0.0779***	-0.0791***
		(-6.89)		(-6.82)	(-6.61)
Assets HHI Diff			-0.214**	-0.142	-0.183*
			(-2.26)	(-1.41)	(-1.80)
Regulation				0.0158***	0.0276***
				(2.79)	(4.50)
log (assets)				0.0341***	0.0356***
				(4.88)	(4.97)
Equity/Assets				0.892**	1.027**
				(2.33)	(2.51)
Asset growth				0.0000151	-0.0000377
				(0.06)	(-0.15)
GDP Growth					0.00128
					(0.23)
GDP percap					0.00000466
					(0.99)
Inflation					-0.0122
					(-1.47)
Current Account					0.00785**
					(2.31)
_cons	0.300***	0.395***	0.208***	-0.0602	-0.206
	(7.55)	(9.32)	(6.43)	(-0.54)	(-1.25)
N	1402	1359	1401	1307	1212
R-sq	0.251	0.322	0.249	0.341	0.333
adj. R-sq	0.232	0.305	0.230	0.321	0.310
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Std. Error	Robust	Robust	Robust	Robust	Robust

TABLE 7
Factors affecting ROA

This table shows OLS regressions where ROA is the dependent variable for the period 1996-2010. The Low Concentration(LC) group includes banks which were in countries with levels of asset HHI below the median asset HHI for each year. The High Concentration(HC) group includes banks not in the Low Concentration group. Asset HHI is calculated as the Herfindahl Index of the banking sector which includes all private and public banks listed in Bankcope. Rel Size is the Total Assets/GDP. Leverage is Assets/Equity. Nondeposit funding is the ratio of nondeposit funding/total short term funding. NPL is non performing loans/total loans. Loans is total loans/assets. ROA is operating profit before taxes/assets.

	LOW CONCENTRATION			**HIGH CONCENTRATION**		
	(1)	(2)	(3)	(4)	(5)	(6)
	ROA	ROA	ROA	ROA	ROA	ROA
Noninterest income	0.00231***	0.00534***	0.00597***	0.00489***	0.00657***	0.00628***
	(2.74)	(6.68)	(7.77)	(5.36)	(4.60)	(4.19)
Log(Assets)		0.0000183	-0.0000356		0.000498*	0.000530*
		(0.09)	(-0.17)		(1.82)	(1.88)
Loans		0.00721***	0.00782***		0.00451*	0.00494*
		(4.63)	(5.08)		(1.83)	(1.94)
Equiy/Assets		0.0421***	0.0459***		0.0738***	0.0903***
		(4.38)	(4.92)		(4.55)	(5.34)
NPL		-0.148***	-0.110***		-0.0952***	-0.0894***
		(-6.63)	(-4.75)		(-4.73)	(-3.97)
Nondep Funding		-0.00579***	-0.00589***		-0.00406**	-0.00383*
		(-3.07)	(-2.96)		(-2.01)	(-1.71)
Curr Account			-0.000250**			0.000116
			(-1.98)			(1.30)
GDP percap			-0.00000196***			-5.48e-09
			(-5.91)			(-0.03)
GDP growth			0.00116***			0.000289*
			(3.91)			(1.88)
Inflation			0.000962**			-0.000122
			(2.57)			(-0.58)
_cons	0.0151***	0.0154***	0.0334***	0.0137***	0.00270	0.000793
	(11.76)	(5.11)	(5.68)	(15.25)	(0.62)	(0.13)
N	746	721	676	656	609	556
R-sq	0.625	0.700	0.730	0.542	0.592	0.596
adj. R-sq	0.613	0.688	0.718	0.518	0.565	0.565
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Std. Error	Robust	Robust	Robust	Robust	Robust	Robust

TABLE 8
Performance of MES in 2007-2009 and Asian financial crises

This table shows OLS regressions where the dependent variables is the total equity return loss during the 2007-2009 and Asian financial crisis. MES is calulated as the average return of the stock on the worst 5 percentile returns days for the market. Zscore is (ROA+E/A)/(SD(ROA) where SD is calculated over three years. Tail Beta is calculate as in Dejonghe (2009) using a modified Hill estimator (1975) to calculate the tail index and a semi-parametric estimation of the probability of the crash in a stock given that the market is in distress.

	2007-2009 Financial Crisis			Asian Financial Crisis	
	(1)	(2)	(3)	(4)	(5)
	Cum Return	Cum Return	Cum Return	Cum Return	Cum Return
MES	-18.51***			-13.76*	
	(-2.77)			(-1.76)	
log (assets)	-0.106***	-0.109***	-0.111***	0.0533	0.0327
	(-3.54)	(-3.54)	(-3.75)	(0.91)	(0.56)
Leverage	-0.00217	-0.00167	-0.00128	0.0270	0.0299
	(-1.12)	(-0.94)	(-0.76)	(1.50)	(1.45)
Zscore		0.000443			
		(0.67)			
Tail-β			-0.119		-0.247
			(-0.69)		(-1.18)
_cons	1.114***	0.775**	0.861**	-0.723	-0.756
	(2.90)	(2.05)	(2.37)	(-0.92)	(-0.88)
N	92	91	92	78	78
R-sq	0.508	0.444	0.461	0.644	0.624
adj. R-sq	0.352	0.264	0.290	0.510	0.483
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Std. Errors	Robust	Robust	Robust	Robust	Robust

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