

**THE RELATIONSHIP BETWEEN FEE INCOME AND NET INTEREST
MARGIN AMONG US BANKS**

by

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Abstract

This paper examines the relationship between fee income and net interest margins of banks. We use a sample of banks in the US over the period 1986-2012, and combine the Panel VAR with the GMM method. We find that changes in fee income have no impact on changes in net interest margins. However, a decrease in net interest margins is followed by an increase in fee income in the subsequent year. This result is more pronounced for large banks after the passage of the Gramm-Leach-Bliley Act in 1999, which increased banks' ability to generate fee income. We conclude that large banks can increase their fee income to offset the decrease in net interest margins.

Keywords: bank, fee income, net interest margins, Panel VAR, GMM

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1. Introduction

Banks have experienced a continuing decline in net interest margins and an increase in fee income for several decades. DeYoung and Rice (2004) found that, between 1980 and 2001, the ratio of fee income to total assets of US banks increased from 0.77% to 2.39%, and the ratio of fee income to total operating income increased from 20.31% to 42.20%.

Because net interest margin is traditionally the most important source of profit for banks, many researchers believe that banks offset the reduction of margins by generating more fee income. Allen and Santomero (2001) argue that banks are forced to change their way of absorbing risk in order to survive in the increasingly competitive environment. In order to have a buffer, banks develop new services and products.

Some researchers have different views; DeYoung and Rice (2004) first point out an interesting possibility, activities that generate fee income could co-exist with the traditional banking activities. They find that even though commercial banks in the US increasingly depend on fee income there is little relationship between fee income and deposit-taking or loan-making. Roger and Sinkey (1999) treat this phenomenon as a way of the changing nature in the banking industry. They argue that these changes provide banks with the opportunity to change the overall strategy, to count less on traditional activities and to absorb more risk. Ewijk and Arnold (2013) argue that this phenomenon is a result of the structural change from relationship-oriented model (ROM) to transaction-oriented model (TOM) in the banking industry.

Regarding the relationship between fee income and net interest margins of banks, we follow the work of William and Rajaguru (2013). They propose the following idea, stable long-term relationship between fee income and net interest margins means that the growing fee income is to offset the decrease in net interest margins. Alternatively, no such stable long-term relationship means that the growing fee income is not used to offset the decrease in net interest margins. This result could be seen as active self-transformation in the banking industry which could be a result of increasingly diverse needs from different consumer groups.

The empirical method of William and Rajaguru (2013) is as follows. First, they specify a multivariate Vector Autoregressive (VAR) model with fixed effects. Secondly, they take the first difference in order to eliminate the fixed effects. Finally, they estimate the resulting first-difference equations using the Generalized Method of Moments (GMM) method. To gain further insight, William and Rajaguru divide banks in their sample into three categories (big four, other domestic banks, and foreign banks) and several sub-periods (1988-1992, 1993-2010, 1998-2002, and 2003-2010).

William and Rajaguru find a negative relationship between the changes of net interest margins in the previous year ($\Delta\text{margins_lagged}$) and the changes of fee income in the current year (Δfees). They conclude that a decrease in margins in the previous year is followed by an increase in fee income in the current year. They also find that the decrease in margins is larger than the increase in fees. Finally, they find that banks tend to have higher fee income before the shrinking of margins.

Our paper differs from William and Rajaguru (2013) in several ways. One difference is that, while William and Rajaguru use a sample of Australian banks, we use a sample of US banks. Therefore, we

can compare our results with theirs. Another difference is that we divided the banks into two groups: small and large banks. Finally, we divided the whole sample period into two sub-periods based on the change of regulations in the US banking industry.

Using all the banks and over the full sample period 1986-2012, we could not find a stable long-term relationship between the changes of net interest margins and the changes of fee income. This result shows that the increase in fee income of US banks is likely due to the changing nature of the banking industry, rather than to offset the reduction of net interest margins. However, when we look at the sample of large banks over the period 2000-2012, we find a stable long-term relationship between the changes of net interest margins and the changes of fee income. This result shows that large banks generate more fee income to offset the decrease of net interest margins over this period.

The structure of this thesis is as follows: Section 2 gives a general introduction of ROM and TOM. Section 3 presents the sample and reports some descriptive statistics. Section 4 explains our empirical method. Section 5 presents the results. Section 5 concludes.

2. Literature Review

2.1 The Tendency under Transformation

Ho and Saunders (1981) develop a model in which banks are seen as risk adverse dealers in deposits and loans. The model shows that the bank needs a positive interest spread or fee income as the compensation for providing immediacy of service in the face of uncertainty. It also indicates that the

optimal mark-up for deposit and loan services are affected by (i) the level of risk aversion of the bank, (ii) the economic structure, (iii) the transaction size, and (iv) the volatility of interest rate.

Subsequent researchers develop new ideas based on Ho and Saunders' model. One idea is as follows. Competition causes a decline in the net interest margins, and banks in turn generate more fee income in order to offset the margin decline. As Allen and Santomero (2001) point out, banks that rely on margin income are more likely to fail when margin declines. Such banks are forced to expand their business scopes in order to survive. Albertazzi and Gambacorta (2009) argue that, with the changing market structures and the technology improvement in 1980s, competition has become more and more severe in the banking industry. As a result, net interest margins are reduced and banks are forced to diversify their sources of revenue. Lepetit et al. (2008) report empirical evidence consistent with this idea.

All these authors hold the opinion that with the declining deposit and loan activities during these years, banks passively shift their focus from borrowing and lending businesses to activities that generate fee income, and the importance of relationship oriented model (ROM) has been replaced by transaction oriented model (TOM).

2.2 Views towards ROM and TOM

Some people argue that banks' rising fee income is a result of their transformation from ROM to TOM. As Ewijk and Arnold (2013) point out: "The phenomena are often explained using causality that runs from increased competition in traditional segments to lower margins to new activities." Yet, some people have different views.

Boot and Thakor (2000) ask the following question, can relationship banking survive competition? They show that (1) there is more transaction lending at lower levels of interbank competition than at higher levels, and (2) increased interbank competition causes an increase in relationship lending, but each loan will have less marginal value for lenders. They conclude that in the market where banks are competitive, transaction oriented businesses will occur less while relationship oriented businesses will occur more.

Elsas (2005) finds that in highly concentrated markets, the likelihood of relationship lending increases as concentration increases, consistent with the idea that monopoly power can foster the establishment of lending relationships. This finding supports the idea of Boot and Thakor (2000).

Regarding the problem whether interbank competition and relationship banking are inimical or not, Degryse and Ongena (2007) find that banks that face more competitions are more likely to engage in traditional relationship-based lending. They also find that competition and relationships are not necessarily inimical.

Rogers and Sinkey (1999) examine the features of banks that heavily relied on non-traditional businesses. They conclude that, due to shrinking margins from traditional businesses, which results from fewer core deposits and more challenging interest rate conditions, banks need to find new ways to generate revenue and compete in the financial markets.

All these new ideas are centered on one question: which business model is more suitable for banks when they face changing market structure and technology enhancement, ROM or TOM?

2.3 Large Banks and Small Banks in Structural Transformation

When large banks face the problem of decreasing margins and the difficulty of attracting new customers, they tend to engage more in TOM. This is because large banks are more competitive in attracting investment funds and in using technologies, and they can make up the loss resulting from low margins by generating more fee income. Huang and Ratnovski (2011) point out that large banks could take valuable investment opportunities regardless of the total amount of the local deposit supply and could refinance unexpected retail withdrawals (also see Goodfriend and King, 1998). Although stepping into TOM means to move into a world where competition is even fiercer and the net interest margins could be even lower, large banks have the capacity to generate higher return on equity (ROE) compared with small banks (Ewijk and Arnold, 2013; DeYoung et al., 2004; DeYoung and Rice, 2004b).

In contrast, small banks cannot compete with large banks in TOM. Nevertheless, they are naturally linked with ROM because of their customer-oriented nature. The essence of relationship lending is based on information, and small banks have some advantages of acquiring information. For example:

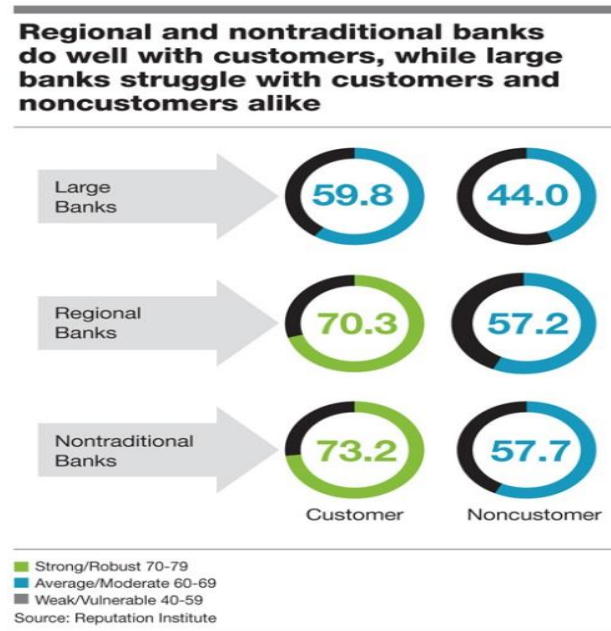
(1) Small banks have sound loan portfolios. They enjoy relative high reputation and customers' loyalty in the local community. The source of customers in small banks is stable. Most of the clients in small banks are local residents and give great preferences and trust to the local banks. As a result, the loan portfolios of small banks are less risky than the loan portfolios of large banks. Large banks

have a variety of funding sources and complicated business operations with other financial institutions which make their portfolios risky.

(2) Small banks provide outstanding and specific personalized services. They offer more personalized service and excellent customer service and give clients more personal attention. That leads to relatively high staff costs, which are not likely to be cut down in the future, to guarantee high-quality service especially in non-traditional service areas.

The picture below shows the survey result that both customers and non-customers give higher satisfaction towards the customer service of small banks (including regional and non-traditional banks) than large banks.

Figure 1: Satisfaction from customers of small and large banks



Berger and Udell (2002) argue that information about transactions-based lending technologies is easy to observe, verify and transmitted. Relationship lending, in contrast, allows small businesses without strong financial ratios, collateral, or credit scores to obtain bank financing, because small banks rely more on soft information and less on hard information.

The existing papers discussing net interest margins and fee income give us detailed information about how people think about ROM and TOM in these years. In early years, researchers think that, because of the declining margins, banks pay more attention on transaction-oriented activities. More recently, researchers think that small and large banks may have different competitive advantages in generating fee income and net interest margins.

2.4 The Relationship between Capital Requirements and Fee Income

During 1986-2012, with the establishments of Basel I and Basel II, the capital requirement has become an important factor to maintain the liquidity of a bank and reduce the operating risks. It could be a possible reason to affect banking performance on the weights of traditional and non-traditional businesses. Eysell and Arshadi (1990) find that in 1986 and 1987, assets in large banks cannot meet the requirement of Basel I. But small and medium sized banks could reach the minimum required ratio. Thus, in order to meet the minimum requirement, one of the solutions for banks is to change their capital structure.

Jones (2000) in his paper propose the idea that banks could decrease denominators in the capital ratios so as to reach the required amount. For example, off-balance sheet activities, like securitization and credit derivatives, provide a chance for banks to avoid the requirement and reduce the regulatory

risks. And eventually, they move away the risks from the balance sheet. By the way, Jones also point out that this method becomes widely used, especially by large banks.

Besides, Van den Heuvel (2007) develops a complicated model to demonstrate that banks, whether they have good liquidity conditions or not, will reduce lending to maintain the minimum capital requirement. This strategy may be used to prevent falling below the capital requirements in the future. The study proves that banks may put more efforts on non-traditional activities to avoid not meeting the capital requirements.

In the Juliusz Jablecki's paper (2009), they mention the novelty of Basel II—banks' capital requirements are decided on the estimates of the probabilities of default (PDs) and losses given default (LGDs) of their loans. In this case, when the economic situation declines, PDs and LGDs will rise. The capital requirements will increase accordingly. In the end, banks are likely to reduce lending activities.

2.5 The Work of William and Rajaguru (2013)

In regards to the relationship between net interest margins and fee income, William and Rajaguru (2013) argue that the increase in fee income is not only due to the decrease in net interest margins but also due to the change of banking business models.

Our paper follows the analysis of William and Rajaguru (2013). We want to find out the relationship between net interest margins and fee incomes among US commercial banks. Moreover, we wish to investigate the difference between small and large banks. If we could not find any relationship

between the changes in net interest margins and the changes of fee income, the results suggest that the rising fee income is a result of the changing business model from ROM to TOM. If we can find a significant relationship, we may conclude that banks are generating more fee income in order to offset the decrease in net interest margins.

3. Data

We obtain all the data from the WRDS database. The sample period is from 1986 to 2012, and there are 3,252 bank-year observations. We divide banks into two categories, small and large banks, according to a bank's total assets in 1986. A large bank has total assets of \$10 billion or more, and a small bank has total assets less than \$10 billion. Except for the main difference in size, large banks usually have more functionalities than small banks, especially in activities that generate fee income.

Table 1 reports the composition of our sample. Small banks account for 57.32% of total number of observations, which weights a bit more than large banks. Thus the influence of small banks will be more obvious in the whole sample period.

Table 2 to 4 report the descriptive statistics for all banks, large banks, and small banks, respectively. Following William and Rajaguru (2013), margins will be measured by $[(\text{interest income} - \text{interest expense}) / \text{total assets}]$, expressed as a percentage, and fees will be measured by $(\text{non-interest income} / \text{total assets})$, expressed as a percentage. Figure 2 to 4 present the changes of the margins and fees over time for all banks, large banks, and small banks, respectively.

Table 1: Sample Composition

	all banks	large banks	small banks
All years	3252	1388	1864
1986	254	52	202
1987	244	54	190
1988	233	50	183
1989	231	58	173
1990	222	65	157
1991	207	59	148
1992	188	59	129
1993	174	64	110
1994	156	65	91
1995	146	65	81
1996	132	63	69
1997	113	61	52
1998	93	56	37
1999	87	53	34
2000	81	53	28
2001	73	50	23
2002	72	52	20
2003	68	49	19
2004	61	45	16
2005	58	45	13
2006	57	43	14
2007	54	40	14
2008	52	39	13
2009	51	38	13
2010	49	37	12
2011	48	36	12
2012	48	37	11

Table 2: Descriptive Statistics for All banks

All banks	Mean	Standard deviation	Minimum	Maximum	Number of observations
Net interest margin /total assets (%)	3.474168	0.860842	0.119701	25.08268	3171
Non-interest income to total assets (%)	1.664153	2.096131	129521	106.7392	3171
Total assets (thousands)	4.16E+07	1.63E+08	131533	2.36E+09	3171
Interest income (thousands)	2212728	6661346	8919	8.93E+07	3171
1989					
Net interest margin /total assets (%)	3.486451	0.627912	1.285838	7.02318	215
Non-interest income to total assets (%)	1.388014	0.805232	0.300092	7.66463	215
Total assets (thousands)	1.16E+07	2.28E+07	406337	2.31E+08	215
Interest income (thousands)	1152226	2699740	64977	3.16E+07	215
1999					
Net interest margin /total assets (%)	3.450107	0.849226	0.59053	6.061039	86
Non-interest income to total assets (%)	2.029428	1.195711	0.469398	6.094628	86
Total assets (thousands)	5.25E+07	1.01E+08	549784	6.33E+08	86
Interest income (thousands)	3213888	6068046	35666	3.70E+07	86
2006					
Net interest margin /total assets (%)	2.957823	0.761971	1.037589	4.624675	55
Non-interest income to total assets (%)	2.136466	1.322276	0.625388	6.698082	55
Total assets (thousands)	1.16E+08	2.78E+08	3807143	1.46E+09	55
Interest income (thousands)	6005791	1.39E+07	208994	7.76E+07	55
2009					
Net interest margin /total assets (%)	2.963964	0.619989	1.219235	4.469097	47
Non-interest income to total assets (%)	1.950701	1.009734	0.220849	5.042891	47
Total assets (thousands)	1.68E+08	4.58E+08	3777368	2.23E+09	47
Interest income (thousands)	6280972	1.65E+07	166193	7.86E+07	47

Table 3: Descriptive Statistics for Large banks

Large banks	Mean	Standard deviation	Minimum	Maximum	Number of observations
Net interest margin /total assets (%)	3.233545	0.806612	0.119701	5.283884	1388
Non-interest income to total assets (%)	1.969198	0.991921	0.026628	7.000085	1388
Total assets (thousands)	8.96E+07	2.38E+08	1.00E+07	2.36E+09	1388
Interest income (thousands)	4663308	9522953	40878	8.93E+07	1388
1989					
Net interest margin /total assets (%)	3.284284	0.696081	1.285838	4.429072	58
Non-interest income to total assets (%)	1.631325	0.595525	0.879637	3.670358	58
Total assets (thousands)	3.39E+07	3.54E+07	1.01E+07	2.31E+08	58
Interest income (thousands)	3429400	4477084	900842	3.16E+07	58
1999					
Net interest margin /total assets (%)	3.196347	0.843381	0.59053	4.291285	53
Non-interest income to total assets (%)	2.427262	1.319918	0.469398	6.094628	53
Total assets (thousands)	8.15E+07	1.20E+08	1.01E+07	6.33E+08	53
Interest income (thousands)	4967684	7211311	623581	3.70E+07	53
2006					
Net interest margin /total assets (%)	2.951359	0.8166	1.037589	4.624675	43
Non-interest income to total assets (%)	2.301403	1.428629	0.625388	6.698082	43
Total assets (thousands)	1.47E+08	3.09E+08	1.02E+07	1.46E+09	43
Interest income (thousands)	7578674	1.53E+07	477431	7.76E+07	43
2009					
Net interest margin /total assets (%)	2.914382	0.582321	1.219235	3.956763	38
Non-interest income to total assets (%)	2.036046	1.090669	0.220849	5.042891	38
Total assets (thousands)	2.06E+08	5.03E+08	1.05E+07	2.23E+09	38
Interest income (thousands)	7696708	1.81E+07	356218	7.86E+07	38

Table 4: Descriptive Statistics for Small banks

small banks	Mean	Standard deviation	Minimum	Maximum	Number of observations
Net interest margin /total assets (%)	3.661484	0.855361	0.608015	25.08268	1783
Non-interest income to total assets (%)	1.426687	2.630847	0.012952	106.7392	1783
Total assets (thousands)	4.18E+06	2.49E+06	131533	9.99E+06	1783
Interest income (thousands)	305040.9	179644.2	8919	1.15E+06	1783
1989					
Net interest margin /total assets (%)	3.561137	0.585674	2.156919	7.02318	157
Non-interest income to total assets (%)	1.298128	0.854252	0.300092	7.66463	157
Total assets (thousands)	3.43E+06	2.10E+06	406337	9.98E+06	157
Interest income (thousands)	310977.2	185473.6	64977	9.59E+05	157
1999					
Net interest margin /total assets (%)	3.857661	0.694156	2.37082	6.061039	33
Non-interest income to total assets (%)	1.390482	0.53246	0.524765	2.887331	33
Total assets (thousands)	5.87E+06	2.11E+06	549784	9.72E+06	33
Interest income (thousands)	397186	159238.7	35666	8.26E+05	33
2006					
Net interest margin /total assets (%)	2.980984	0.550792	1.754611	3.799013	12
Non-interest income to total assets (%)	1.545443	0.550338	0.779683	2.86614	12
Total assets (thousands)	6.72E+06	1.84E+06	3807143	8.92E+06	12
Interest income (thousands)	369623.5	1.01E+05	208994	4.83E+05	12
2009					
Net interest margin /total assets (%)	3.173309	0.76218	1.995834	4.469097	9
Non-interest income to total assets (%)	1.590353	0.424376	0.876091	2.277368	9
Total assets (thousands)	6.76E+06	2.17E+06	3777368	9.53E+06	9
Interest income (thousands)	303419.6	1.06E+05	166193	4.42E+05	9

Figure 2: Average margins and fees for all banks

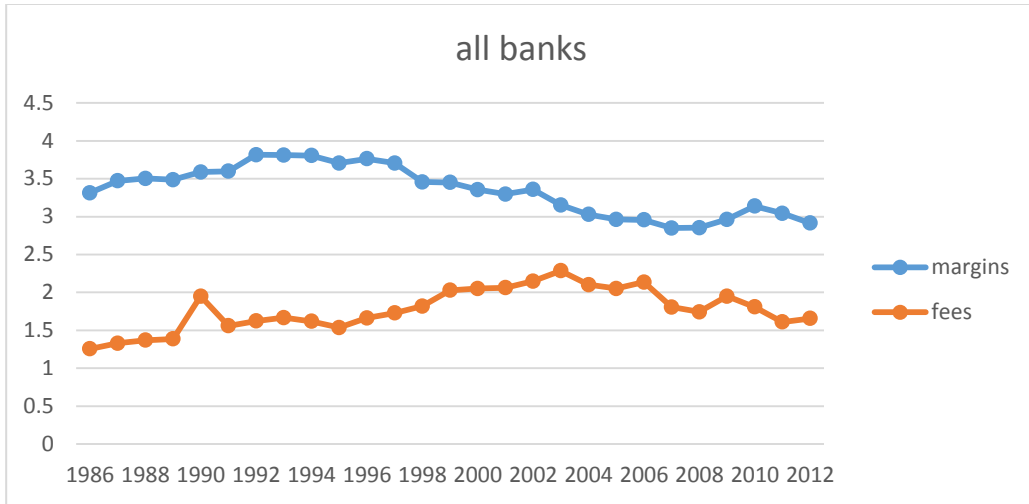


Figure 3: Average margins and fees for large banks

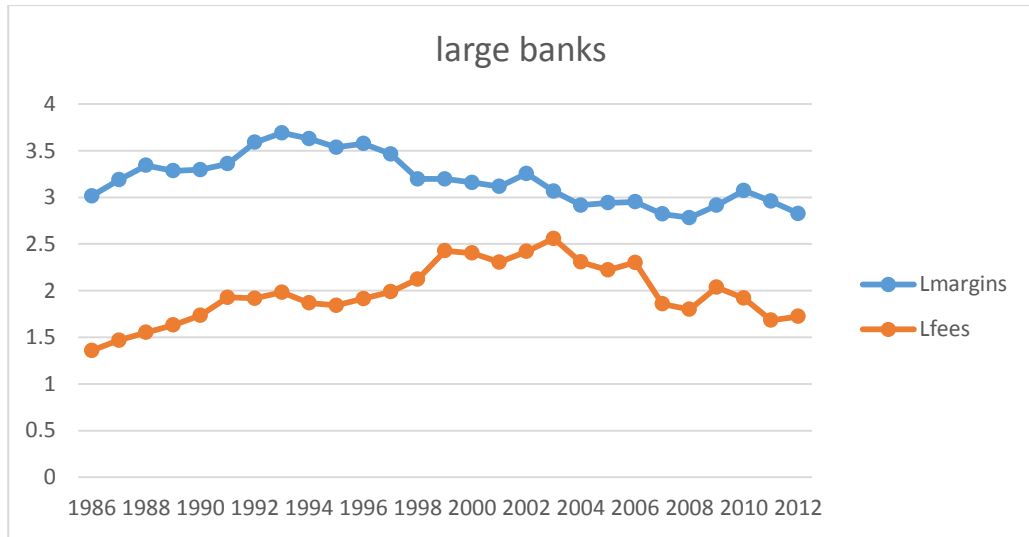
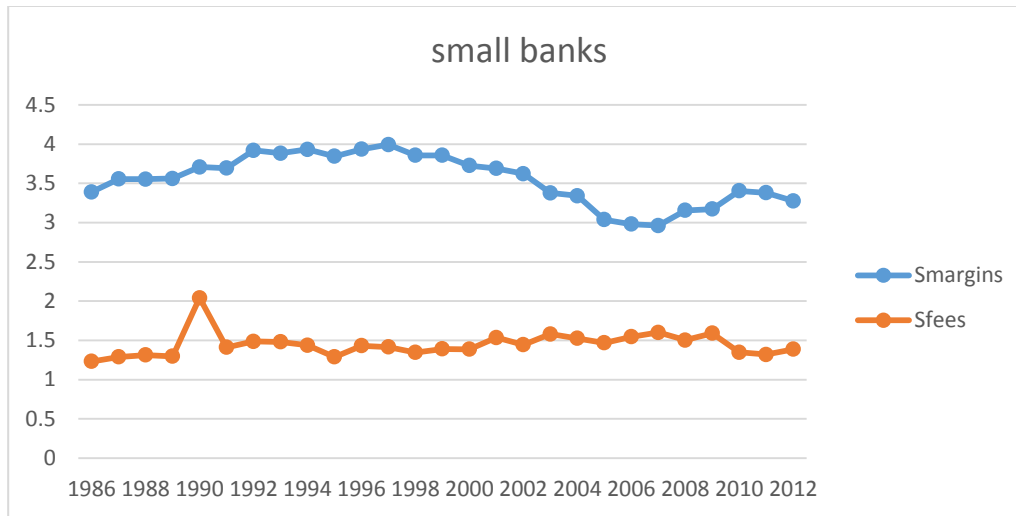


Figure 4: Average margins and fees for small banks



From the above figures we can see that for large banks, the margins fall from 1993, which is four years early than small banks. The margins of both small and banks have been decreasing all the way to 2008, which is the worst time of the financial crisis. After 2008, margins of both small and large banks show a trend of wave until 2012.

The fee income in large banks shows a steady increase from 1986 to 1999. After that, it shows an unstable trend. For small banks, there is nearly no changes through the whole sample period, except 1990, which is likely caused by the expansion of the FDIC insurance in 1989.

We find that the margin of small banks is higher than that of large banks, about 3.5% to 3%. However, large banks have a much higher fee income, ranging from 1.5% to 2.5%. For small banks, the fee income is always moving around 1.3%.

4. Method

This paper uses the panel Vector Autoregressive (VAR) model to study the time series relationship between Margins and Fees. Following Williams and Rajaguru (2013), the multivariate VAR(1) model with fixed effects take the form:

$$\begin{bmatrix} MARGIN_{i,t} \\ FEE_{i,t} \end{bmatrix} = \begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{bmatrix} \begin{bmatrix} MARGIN_{i,t-1} \\ FEE_{i,t-1} \end{bmatrix} + \begin{bmatrix} \eta_{1,i} \\ \eta_{2,i} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1,i,t} \\ \varepsilon_{2,i,t} \end{bmatrix} \quad (1)$$

Where $\eta_{1,i}$ is a bank-fixed effect and $\varepsilon_{1,i,t}$ is a multivariate normally distributed random disturbance.

The fixed effect can produce some bias in the estimation. Consequently, we take first difference on both sides of equation (1) to remove bank-fixed effect:

$$\begin{bmatrix} \Delta MARGIN_{i,t} \\ \Delta FEE_{i,t} \end{bmatrix} = \begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{bmatrix} \begin{bmatrix} \Delta MARGIN_{i,t-1} \\ \Delta FEE_{i,t-1} \end{bmatrix} + \begin{bmatrix} \Delta \varepsilon_{1,i,t} \\ \Delta \varepsilon_{2,i,t} \end{bmatrix} \quad (2)$$

Because the transformed lagged endogenous variables and the transformed error terms in equation (2) may be correlated, we follow Williams and Rajaguru (2013) and estimate equation (2) using the Generalized Method of Moments (GMM). Specifically, we use the `xtabond2` function in STATA to estimate equation (2).

5. Estimation and results

We divide the whole sample into two sub-periods: 1986-1999 and 2000-2012. We use year 1999 to divide the period because the Gramm-Leach-Bliley Act was enacted in that year. After the passage of

this Act, US banks have more flexibility to operate various banking businesses, which may contribute to different performance of margins and fees in the two sub-periods.

Table 5 to 7 report the estimation results. P-value indicates the level of significance. For each coefficient, the null hypothesis is that the value is equal to zero. Hence a small p-value means that we can reject the null hypothesis.

Table 5: Estimations for Large Banks

Large banks	Whole period		Sub-period 1		Sub-period 2	
	1986-2012		1986-1999		2000-2012	
VARIABLES	delta_margins	delta_fees	delta_margins	delta_fees	delta_margins	delta_fees
delta_margins_lagged	-0.225*** (0.055)	-0.074** (0.038)	-0.101** (0.044)	0.027 (0.043)	-0.311*** (0.059)	-0.141*** (0.052)
delta_fees_lagged	-0.013 (0.024)	-0.163*** (0.055)	-0.020 (0.045)	-0.290*** (0.066)	-0.021 (0.030)	-0.128** (0.059)
Constant	-0.029*** (0.007)	0.026*** (0.009)	0.002 (0.011)	0.080*** (0.011)	-0.082*** (0.010)	-0.019 (0.013)
Observations	1,266	1,266	650	650	616	616

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

Table 6: Estimations for Small Banks

Small banks	Whole period		Sub-period 1		Sub-period 2	
	1986-2012		1986-1999		2000-2012	
VARIABLES	delta_margins	delta_fees	delta_margins	delta_fees	delta_margins	delta_fees
delta_margins_lagged	-0.371***	-0.693	-0.413***	-0.802	-0.166	-0.082**
	(0.106)	(0.553)	(0.109)	(0.643)	(0.121)	(0.036)
delta_fees_lagged	0.006	-0.465***	0.008*	-0.461***	-0.128	-0.244***
	(0.005)	(0.021)	(0.005)	(0.024)	(0.092)	(0.059)
Constant	0.052**	0.085***	0.078***	0.106**	-0.068***	0.035***
	(0.020)	(0.026)	(0.024)	(0.042)	(0.015)	(0.011)
Observations	1,364	1,364	1,147	1,147	217	217

Note: Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Estimations for All Banks

All banks	Whole period		Sub-period 1		Sub-period 2	
	1986-2012		1986-1999		2000-2012	
VARIABLES	delta_margins	delta_fees	delta_margins	delta_fees	delta_margins	delta_fees
delta_margins_lagged	-0.313***	-0.438	-0.349***	-0.644	-0.280***	-0.130***
	(0.077)	(0.352)	(0.103)	(0.522)	(0.062)	(0.041)
delta_fees_lagged	0.004	-.473***	0.005	-.467***	-0.029	-0.139**
	(0.004)	(0.010)	(0.005)	(0.019)	(0.028)	(0.055)
Constant	0.009	0.051***	0.046***	0.099***	-0.078***	-0.007
	(0.010)	(0.008)	(0.015)	(0.025)	(0.009)	(0.010)
Observations	2,630	2,630	1,797	1,797	833	833

Note: Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5 reports the estimation results for large banks. Overall the whole period as well as the two sub-periods, we find that the changes of fees in the previous year have no significant impact on the changes of margins in the following year. A possible explanation is as follows. For large banks, their fee income is not only generated by card income and service charges but also by investment and brokerage services, investment banking income, trading account profits, and so on. The change in previous card income and service charges may have significant impact on the following year's margin, because these charges are based on traditional banking business. However, other sources of fee income listed above have little relationship with the traditional activities (i.e., taking deposits, providing loans), and such sources of fee income account for a considerably portion of the total fee income at large banks.

However, there is a significant relationship between the changes of margins in the previous year and the changes of fees in the following year. The coefficient is -0.074, which means that if the changes of margins in the previous year are negative, then the changes of fees will be positive and vice versa. It could be explained that if the traditional businesses did not perform well in the previous year, then in the following year large banks will make up by making more money from fee income. Therefore, fee income is used by large banks to offset the decrease in net interest margins.

Looking at the two sub-periods, we find that the result in the second sub-period is consistent with the whole sample period, while the relationship is insignificant in the first sub-period. This is probably due to the Glass-Steagall Act before 1999 so that there are separations between investment banks and depository banks. The separations are repealed by Gramm-Leach-Bliley Act in 1999. After that year large banks are better able to generate fee income in order to offset any decline in net interest margins,

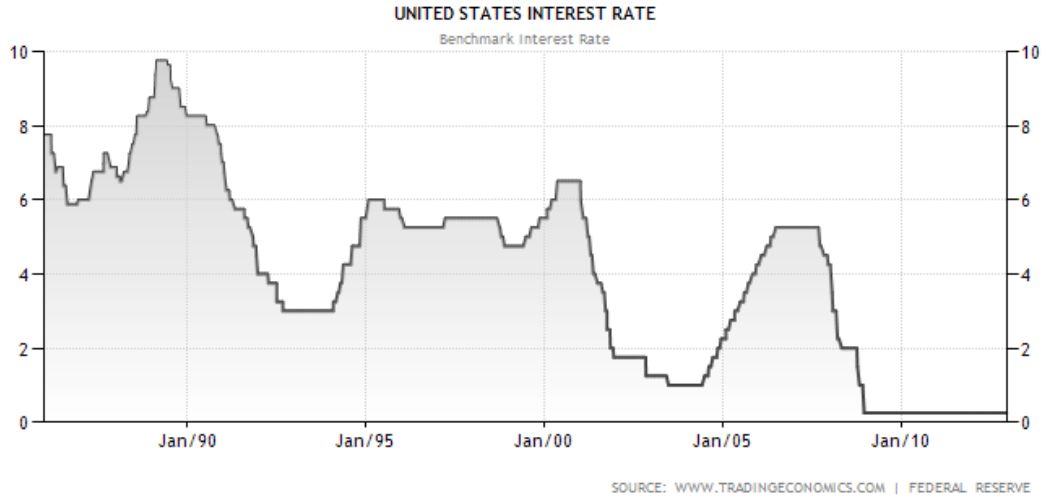
and the relationship the changes of margins in the previous year and the changes of fees in the following year becomes significant.

Table 6 reports the estimation results for small banks. For the whole period, the changes of margins are not affected by the changes of fees in the previous year. In the first sub-period, changes of margins have a negative relation with the lagged changes of fees. However, the coefficient, 0.008, is very small, which suggests that the influence is not very significant. In the second sub-period, the relationship between the two variables is not significant. We conclude that the changes of margins are not significantly affected by the changes of fees in the previous year.

To understand the reason behind our result, we note that the net interest margin is a function of capital structure, economic growth, inflation, interest level, interest risk, credit risk, operational costs and some other factors (van Ewijk and Arnold, 2013). Small banks have limited business scale, and usually do not have the capability to generate significant fee income. When the monetary policy of the Federal Reserve or the whole economic situation changes, the influence of macro economy is more powerful than that of the banks' own intention.

The graph below presents two major macro factors that affect the net interest margins of banks: the interest rate levels and the interest rate volatilities. As we can observe, the benchmark interest rate in the US during 1986-2012 has changed frequently. The interest rates of small banks, as a result, need to follow the base interest rate to reflect the market trend, which influences their margins accordingly.

Table 8: Interest Rate in US



The other two variables, changes of fees and changes of margins lagged, have a different relationship over different sample periods. For the whole period, the changes of fees are not affected by the changes of margins in the previous year. This result also holds for the first sub-period. Because small banks have limited service scale, they find it difficult to generate more fee income. The strategy of using traditional banking services to involve more participation in non-traditional banking services seems to be inefficient.

An interesting result in the second sub-period is that changes of fees have a negative response to the changes of margins lagged, suggesting that a decrease in net interest margin in the previous year is followed by an increase in fee income in the following year. This is probably due to the Gramm–Leach–Bliley Act (GLB), also known as the Financial Services Modernization Act of 1999. It repealed part of the Glass–Steagall Act of 1933, removing barriers in the market among banking companies, securities companies and insurance companies that prohibited any one institution from acting as any combination of an investment bank, a commercial bank, and an insurance company. It

was a good news for all the banks in the US. They had more space and flexibility to provide non-traditional business services which could improve their fee income. If a bank's net interest margin declines in one year due to economic conditions or competition, the bank can put more effort on its special non-traditional services to generate more fee income.

Table 7 reports the estimation results for all the banks. We find that the results for all banks are basically consistent with the results for large and small banks, especially with small banks. In particular, the changes of fees in the previous year have no influence on changes of margins. This is perhaps because of the following reason. On the one hand, margins are mainly affected by the levels and volatilities of interest rate, which are determined by the Federal Reserve and the macro economic conditions. So the impact of changes in fee here is little compared to the interest rates influenced by overall economy. On the other hand, a large portion of fee income is not from the traditional business services, but from services such as investment advice. So contribution to margins by traditional customer services is limited.

In regards to the relationship between the changes of margins in the previous year and the changes of fees in the following year, the results are different due to the bank size. Large banks show significant negative relationship between these two variables, while small banks show no such relationship. The relationship for the whole sample over the whole period is not significant. That is because there are more small banks in our sample.

Overall, the development of fee income is a passive changing process, which is affected by the changes in the traditional businesses. Before 1999, the non-significant relationship between changes

of margins in the previous year and changes of fees does not mean there is a change in the nature of the financial intermediation. During that period, policy controlled the economy and it is hard for banks to generate more fee income. After 1999, there is a strong relationship in large banks, compared with small banks.

6. Conclusion and further studies

This paper examines the relationship between fee income and net interest margins of US banks over the period 1986-2012. The GMM method is used in estimating the two variables for all banks, large banks and small banks separately with two sub-periods: 1986-1999 and 2000-2012. It is found that for large banks, in 1986-2012, changes of fees have a negative relationship with the changes of margins in the previous year. However, over the first sub-period, no such relationship exists. We argue that, after 1999, large banks are better able to offset a declining net interest margins by generating more fee income. Before 1999, business lines of banks are limited in many aspects, and fee income accounts for a small portion of a bank's total revenue. Thus, it is not easy for a bank to increase its fee income.

For small banks, the results are similar except that in the whole period there is no significant relationship between the changes of margins and the changes of fees. For all banks, the two variables have no significant relationships in the whole period. In the second sub-period, the relationship is significant. We believe this is due to the fact that there are more small banks in our sample.

Table 9 below summarizes our estimation results.

Table 9: Summary of results

		All banks		Large banks		Small banks	
		Δ margins	Δ fees	Δ margins	Δ fees	Δ margins	Δ fees
1986-2012	Δ margins lagged		0		1		0
	Δ fees lagged	0		0		0	
1986-1999	Δ margins lagged		0		0		0
	Δ fees lagged	0		0		1	
2000-2012	Δ margins lagged		1		1		1
	Δ fees lagged	0		0		0	

Note: In each cell, a value of 0 means the coefficient is not statistically significant, and a value of 1 means that the coefficient is statistically significant

A bank's net interest margins and fee income are two important factors in the contemporary banking industry. Nowadays, the competition in banking industry is so strong that banks, no matter large or small, have to devote efforts to develop new business and attract more clients. After the recent financial crisis, the Fed is very sensitive to interest rate control and banking regulation, which will put some limits on the existing bank business. It is important for a bank to observe and estimate the fluctuation of market interest rates and regulatory policy of the Fed.

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