Asset Pricing and Cost of Equity for US Banking Sector By CAPM and TFPM from 1987 to 2011

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Abstract

Although Capital Asset Pricing Model (CAPM), one-factor model, has strong theoretical basis and is easy to use and understand, analysts also consider other alternative models, such as Three Factor Pricing Model (TFPM) developed by Fama and French (1993). Because some differences between actual return and estimated return could be explained by the effect of capital size and book-to-market ratio. The objective of using these two similar but complementary models is to estimate the cost of equity for the US banking sector. In order to do the estimation, we would conduct the estimation of parameters for both individual bank and the whole banking sector.

Keywords: Capital Asset Pricing Model (CAPM); Three Factor Pricing Model (TFPM); Cost of Equity; US banking sector

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1. Introduction

In the world of finance, we usually use the Capital Asset Pricing Model theory, introduced by Treynor (1961) and developed by Sharp (1964) and Lintner (1965), to estimate a suitable desired return rate for an asset, while the asset is located in a well-diversified portfolio. This model shows that the relation of an asset with non-diversifiable risk, systematic risk or market risk, which can analyze by beta β - the level of volatility, market premium, and a theoretical risk free rate. However, there are many patterns which one factor CAPM cannot explain. Therefore, there are many other studies proposing and identifying other alternative factors, also called anomaly, in average stock returns, including size effect (Banz 1981), earning price (Basu, 1983), leverage (Bhandari, 1988), past long-term returns (De Bondt and Thaler, 1985) and short-term returns (Jegadeesh and Titman, 1993), book-to-market ratio (Rosenberg et al., 1985; Chan et al., 1991; Fama and French, 1992) and short-term momentum strategy (Jegadeesh and Titman, 1993 and Carhart, 1997).

Among all these anomalies, size effect and book-to-market ratio are most significant (Fama and Fench, 1992). Fama and Fench expand the basic one-factor model (CAPM) to three-factor model (TFPM). The two new risk factors which Fama & Fench use are small minus big, SMB, and high minus low, HML. The reason for Fama & Fench to include these two variables in the model is that they believe small caps and stocks with a high book to market ratio are tended to outperform than the average market. Since TFPM has three different risk factors, it has four different coefficients – intercept, β_i, S_i and H_i, when CAPM only has two – intercept and β_i. As a result, TFPM can explain over 90% of diversified portfolios returns, which CAPM only can explain 70% of them.

Furthermore, firms obtain capital from other people to run and expand their business. There are two sources: lending from others and collecting from equity investors. We named these costs as the cost of capital. It can divide into two parts: cost of debt, lenders' perspective, and cost of equity, equity investors' perspective. The cost of equity

represents the theoretical rate of return a firm pays to its shareholders to cover the risk which causes by investing their capital. In finance, if the risk of a firm increases (decreases), its cost of equity will increase (decrease). It follows the human behavior and logic: provide funds and expect reward, e.g. interest. If the risk of an investment increases and the expected return decreases or remain unchanged, the investor will move their investment to other "good" company. The cost of equity is very useful for making many financial decisions. The most common method for estimating cost of equity is CAPM because of its theoretical accuracy and simplicity (Bruser et al, 1998). Since October 2005, the Federal Reserve System has used CAPM as the sole methodology (Barnes and Lopez, 2006). On the other hand, there is rarely to use TFPM to estimate the cost of equity since people think it is empirically inspired and lacks strong theoretical foundations. However, we are not talking about which model is right in this paper, thus we will use both CAPM and TFPM to do estimation for β_i, S_i and H_i, and cost of equity.

The purpose of this study is to estimate the cost of equity of the US banks uses both CAPM and TFPM. In order to do that, we first compare the average annually excess stock return and the excess market return to determine whether the banking sector tend to have higher return or not. Then, we estimate all CAPM and TFPM's coefficients for both individual firm and the whole banking sector. After that, we use these coefficients to estimate the historical cost of equity for both individual bank and the whole banking sector to see the trend and what makes the trend changes. Moreover, we estimate the 2011 December cost of equity for each bank and the whole banking sector to test whether the banking sector is less risky than average market or not.

2. Literature Review Section

There is rare study estimating the cost of equity for banks, because most financial studies believe that banks have different role of leverage, taxes and other factors since banking sector is highly regulated sector.

Zimmer and McCauley (1991) use the bank-level return on equity (ROE) to represent their estimations of the cost of equity for 34 international banks in six countries during the period 1984-1990. The ROE represents the ratios of the bank retain earning over its market capitalization, with inflation and accounting adjusted return. And then they take the averaged ROE over time period and across banks within one county to get the country level estimation. The backward looking method may be not a perfect way to calculate the cost of equity, but it is easy to observe. Zimmer's result shows that the banks in the US, Canada, and UK have higher ROE than those banks in Germany and Japan.

Except ROE, CAPM and TFPM, dividend discount model (DDM) is also used to estimate the cost of equity for banks in the study of Maccario et al(2002) with inflation adjusted return. Their samples include banks in 12 different countries over the period 1993 – 2001. The assumption is that the forecasts are the best estimate of next year's earnings, the growth rate is the same as that of the economy, and dividend paid out is a fixed ratio of earnings. One conclusion is that more profitable banks is with a higher cost of equity.

Although many methods can calculate the cost of equity, CAPM is still recommended to be the most suitable one for the Federal Reserve System in US market by Green (2003) and Barnes (2006). In methodology, they estimate the cost of equity by taking the average value until 2002, which is similar to the method used in Zimmer (1991). In comparison of these estimates, the average CAPM estimate by Green (2003) is 15 percent higher than the results from either Zimmer (1991) or Maccario (2002). Fed decided to review these methods in 2004. Fed's economists, Barnes and Lopez (2006),

test whether additional factors to the basic one-factor CAPM, eg. Fama-French TFPM and variations in calculation method will give different results. The conclusion shows that CAPM is better for estimating the cost of equity since Fama-French TFPM gives similar results but additional risk premiums (SMB and HML) are much harder to observe and mostly not significant.

King (2009) provides estimates of the banks' inflation adjusted cost of equity across six countries over 1990 – 2009. The study uses single factor CAPM for the cost of equity estimation. The result shows that the cost of equity declined over the period 1990 – 2005 for all countries and then rise from 2006 onwards. The theorical reasons for downward trend are risk free rate decreases over that period and the sensitivity of bank stock returns to market risk premium is declined. Also, the estimates vary across banks, which show the difficulty of estimating the expected return with CAPM.

In this paper, we estimate the cost of equity by using similar method as King. One difference is that we choose longer time period, 1987 – 2009, compared to the period 1990 – 2009 in King's study. Another one is that King's sample contains 89 different banks across six countries, but we select 11 largest banks in US market which continuously exist over period 1987-2011. Because of the different number of sample banks, the result in our study has higher volatility. The market risk premium calculated by King is 6.7% with 20% standard deviation, but it is 6.4% with 18% standard deviation in this paper since the studied period is different. Last but not the least, King only uses CAPM to do the estimation, but we use both CAPM and Fama-French TFPM.

3. The US banking system overview

After the rapid growth of economy, the productivity slowed in 1970s. In the late 1970s and early 1980s, as the government interfered, the banks, airlines, and some other sectors were deregulated and marginal tax rates were cut, helping US economy recover. The government spending relative to GDP was almost 20 percent in 1980. In early 1980s, this number firstly increased and then declined. After 2001, it began to rebound. During 1970-2007, the ratio of Federal Civilian Employment to Total Labor Force was decreasing, as a result of high government spending budget.

As table 1 show, since 1988, the first time Basel I published, banking regulation kept changing, and was updated by Basel II – 2004 and Basel III-2010. The banking sector's capital requirement and leverage ratio become more and more restrict. Federal Reserve System, created in 1913, is responsible to conduct monetary policy, monitor and regulate banking companies, etc. Federal Reserve System created more and more regulations to solve new issues. U.S. banking regulation focuses on confidentiality, announcement, anti-fraud, anti-money laundering, anti-terrorism, indiscrimination, and the assistance to lower-income populations. One of the major methods which Federal Reserve System uses to modify the monetary policy is to change the base borrowing rate. Because of the subprime mortgage crisis, Federal Reserve System reduced the base borrowing rate to 0%-0.25% since 2008 December 16 and keep it at such low level until now.

In December 2011, the five largest banks' capital equals to 56 percent of U.S. economy. Thus, in this study, we only choose several largest banks which are good representatives for the whole banking sector and good comparable samples to the whole market.

Table 1: Main Reforms in the monetary Sectors[1]

Year	Monetary Sector	Detail
1987	Competitive Equity Banking Act of 1987 (CEBA)	Authorizes $10.75 billion to Recapitalize Grants the FDIC bridge-bank Authority The First legislation which insured deposit banks
1988	Adopt the Basel Capital Accord, known as Basel I Accord	The central bank governors of the Group of Ten (G-10) countries adopt the Basel Capital Accord, known as Basel I Accord, which provides procedures for factoring on- and off-balance-sheet risks into the supervisory assessment of capital adequacy.
1989	Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA)	Creates two insurance funds: SAIF and BIF Gives the FDIC back-up supervisory authority over S&Ls Replaces the FHLBB with the OTS to regulate and supervise S&Ls
1990		The FDIC insurance premiums increase from 8.3¢ to 12¢ per $100 of deposit Iraq invades Kuwait, and the subsequent war between the U.S. and Iraq leads to higher oil prices, reduced consumption, and declining demand.
1991	Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991	Requires the FDIC to close banks in a manner that is least costly to the BIF Provides for a line-of-credit from the U.S. Treasury Requires banks to apply to the FDIC for deposit insurance independently
1992		RTC requests additional funds to continue resolving the S&L crisis. Congress does not approve the funding. The Bank Insurance Fund (BIF) ends the year with a deficit balance of $101 million. The Treaty of Maastricht is signed, which forms the European union.
1993	RTC Completion Act of 1993	Provides final funding of $18 billion for the RTC Provides for the closure of the RTC and the transfer of its workload and employees to the FDIC.
1994	Riegle Community Development and Regulatory Improvement Act of 1994	Contains provisions aimed at curbing non-bank lenders' practices of targeting low and moderate income homeowners, minorities, and the elderly for abusive lending practices Contains more than 50 provisions to reduce bank regulatory burden and paperwork requirements.
	Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994	Permits bank holding companies to acquire banks in any state Allows foreign banks to branch to the same extent as U.S. banks
1995		The FDIC lowers insurance premiums in on July 1. The FDIC launches its first public website in March.
1996	Economic Growth and Regulatory Paperwork Reduction Act of 1996 (EGRPRA)	Amends the FDIA to eliminate or revise various application, notice, and record keeping requirements to reduce regulatory burden Amends the Fair Credit Reporting Act to strengthen consumer protections relating to credit reporting agency practices Requires that one FDIC board member be a former bank regulator.
2000		In March, the dot-com bubble bursts.

[1] Federal Deposit Insurance Corporation. Retrieved Aug 03, 2012

Table 1: Continued

Year	Monetary Sector	Detail
2001	International Money Laundering Abatement and Financial Anti-Terrorism Act of 2001	Requires additional record keeping and reporting by financial institutions for foreign nationals Requires financial institutions to establish anti-money laundering programs Requires further cooperation between financial institutions and government agencies in fighting money laundering.
2002	Sarbanes-Oxley Act of 2002	Establishes the Public Company Oversight Board to regulate public accounting firms that audit publicly traded companies Prohibits accounting firms from providing both auditing and consulting services Requires that CEOs and CFOs certify the annual and quarterly reports of publicly traded companies.
2003	Fair and Accurate Credit Transactions (FACT) Act of 2003	Improves the accuracy and transparency of the national credit reporting system Enhances consumer rights in situations involving alleged identity theft.
2004	Adopt the new Basel Capital Accord, known as Basel II Accord	Both J.P. Morgan Chase and Bank of America report more than $1 trillion of bank and non-bank assets. Citigroup agrees to pay $2.65 billion to settle a lawsuit involving underwriting work of WorldCom. The FDIC consolidates into six regional offices.
2005		Meetings continue to be held on the Basel II Accord, which is scheduled to be implemented in the U.S. on January 1, 2008. The definition of capital is unchanged; however, Basel II allows the largest banks to use their own internal ratings systems to measure credit risk, as well as requires banks to measure and hold capital against operational risk.
2006	Subprime Mortgage Crisis Began	U.S. Home Construction Index is down over 40% as of mid-August 2006 compared to a year earlier. Commerzbank begins to stop building its massive subprime position AIG gets scared and stops selling credit protection against CDOs
2007	Subprime Mortgage Crisis Burst	S&P/Case-Shiller house price index records first year-over-year decline in nationwide house prices since 1991 Subprime industry collapse; several subprime lenders declaring bankruptcy, announcing significant losses, or putting themselves up for sale The value of USA subprime mortgages was estimated at $1.3 trillion as of March 2007
2008		Lehman Brothers files for bankruptcy protection The US Federal Reserve lends $85 billion to American International Group (AIG) to avoid bankruptcy. US Treasury changes tax law to allow a bank acquiring another to write off all of the acquired bank's losses for tax purposes
2010	Adopt the new Basel Capital Accord, known as Basel III Accord	Risk-based capital and leverage requirements credit exposure of a covered financial firm to a single counterparty as a percentage of the firm's regulatory capital. Credit exposure between the largest financial companies would be subject to a tighter limit Early remediation requirements

4. Data and Econometric Methodology

4.1 Data source and Portfolio Formation

We obtain monthly stock returns on the NYSE/NASDAQ/AMEX from WRDS website CRSP segment over period 1987-2011 and get the three risk factor ($R_m - R_f$), SMB, and HML on the NYSE/NASDAQ/AMEX from French database for the same period. The risk free rate for that period we use 3 month treasury rate which obtain from the Board of Governors of the Federal Reserve System website. Last but not least, we get the monthly expectation inflation ratios from the Federal Reserve Bank of Cleveland website. And we get the annualize value by taking average.

To form the banking sector portfolio, we searched today's first 30 largest banking companies in US market, but only 11 of them sustain during 1987 to 2011. These banks are M&T bank Corporation (MTB), Wells Fargo & Company (WFC), The Bank of New York Mellon Corporation (BK),, Northern Trust Corporation (NTRS), Bank of America Corporation (BAC), PNC Financial Services Group Inc. (PNC), KeyCorp (KEY), SunTrust Banks, Inc. (STI), Citigroup, Inc. (C), BB&T Corporation (BBT)and State Street Corporation (STT), which are equally weighted in the portfolio. All these stock returns are adjusted for stock split, right offerings and dividend payment.

4.2 The capital asset pricing model and three factor pricing model

- Methodology of estimating coefficients in the CAPM model

The CAPM model is used to describe the relation between the return of an asset (portfolio or stock) with the market as whole and to determine appropriate expected rate of return of the asset theoretically. The model takes into account the asset's sensitivity to market or systematic risk, represented by the quantity beta (β), as well as the expected return of the market and the

expected return of a risk-free asset. The CAPM pricing equation is:

$$E(R_i) = R_f + (E(R_m) - R_f)\beta_i \qquad i = 1,\dots n \qquad (1)$$

Where E(.) is the expectations operator, R_f is the riskfree rate of interest, R_m is the rate of return on the market portfolio, and β_i is the covariance of the return on asset (or portfolio) i with the return on the market portfolio divided by the variance of the return on the market portfolio. In this case, the expected return of asset i represents the cost of equity for bank i (i = 1,2,…,n). Monthly market excess return $R_{mt} - R_{ft}$ and monthly excess return of each bank $R_{it} - R_{ft}$ are used to estimate coefficient β_i and intercept α_i by simple regression as follows:

$$R_{it} - R_{ft} = \alpha_i + (R_{mt} - R_{ft})\beta_i \qquad i = 1,\dots n \text{ and } t = 1,\dots T \qquad (2)$$

- Methodology of estimating coefficients in the Fama-French three-factor model

The Fama and French three-factor model is an alternative to the CAPM. The model reflects the observation that two classes of stocks have tended to over perform the market as a whole: (a) small caps and (b) stocks with a high book-to-market ratio, so it adds two more factors to the CAPM to explain the sensitivity of expected return to market factors, (a) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB); and (b) the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks (HML).

$$E(R_i) = R_f + \big(E(R_m) - R_f\big)\beta_i + E(SMB)S_i + E(HML)H_i \qquad i = 1,\dots n \qquad (3)$$

Where $E(R_i)$ and $E(R_m) - R_f$ are expected premiums, and the factor sensitivities or loadings, S_i, H_i, and β_i are the slopes in the time-series regression.

$$R_{it} - R_{ft} = \alpha_i + \big(R_{mt} - R_{ft}\big)\beta_i + SMB_tS_i + HML_tH_i \qquad i = 1,\dots n \text{ and } t = 1,\dots T \qquad (4)$$

4.3 Estimates of Normal and Inflation Adjusted Cost of Equity in CAPM and TFPM

We estimated the cost of equity for each bank by using the estimated coefficients generated in CAPM and TFPM in equation (2) and (4). The cost of equity equals to the risk-free rate plus the premiums of each specific bank. For the whole banking sector, the cost of equity estimate equals to the average of each bank's cost of equity on equally weighted basis, the same method as the standard deviation of this estimate.

According to the CAPM pricing model,

$$E(R_i) = R_f + \overline{R_m - R_f}\widehat{\beta_i} \qquad \text{i} = 1,\dots \text{n} \qquad (5)$$

Where R_i is the cost of equity of bank i or the whole banking sector, depending the estimated coefficient $\widehat{\beta_i}$ whether is of individual bank i or the whole banking sector; $\overline{R_m - R_f}$ is the average market risk premium over the period studied.

According to the TFPM, adding two more variables into the estimated predictor,

$$E(R_i) = R_f + \overline{R_m - R_f}\widehat{\beta_i} + \overline{SMB}\widehat{S_i} + \overline{HML}\widehat{H_i} \qquad \text{i} = 1,\dots \text{n} \qquad (6)$$

Where $\overline{SMB}$ and $\overline{HML}$ are average annual SMB and HML premium over the period studied.

The expectation inflation-adjusted cost of equity equals to the normal cost of equity estimates calculated by (5) and (6) subtracting year-ahead inflation expectations[2].

[2] King, Michael R (2009), "The Cost of Equity for Global Banks: A CAPM Perspective from 1990 to 2009 "

5. Empirical Results

5.1 Excess Returns, Market Risk Premium, SMB and HML over the period

Table 2 illustrates the dependant variables of both CAPM and TFPM of 11 banks for the 25 years between Jan 1987 and Dec 2011, including the annually average excess returns for all the banks $R_i - R_f$, the annually excess market returns $R_m - R_f$, the difference between annual return on a portfolio of small stocks and on a portfolio of large stocks (SMB), the difference between annual return on a portfolio of high book-to-market stocks and on a portfolio of low book-to-market stocks (HML). Mean values, standard deviations, the number of negative data and t-statistic of these variables is shown at the last part of the table.

Because of the higher risk in equities investment compared to the risk-free investment, the premiums for market risk, small stocks and high book-to-market stocks are expected to be positive. According to the Table 2, although the mean value of market risk premium, SMB and HML are all positive in the equally weighted portfolio, 24% market risk premium $(R_m - R_f)$, 44% SMB and 40% HML are negative of the 25-year observations. For market risk premium, it is negative in 6 out of 25 years which is a moderate percentage, compared to Fama and French (1996) reporting that $R_m - R_f$ is negative in 10 of the 30 years. This moderate percentage also shows that the US market is sophisticated and steady market with low volatility during the period. On the other hand, 44% and 40% negative SMB and HML respectively are relatively high proportions, suggesting that the effect of size and book-to-market ratio is not perfect in NYSE/NASDAQ/AMEX.

Table 2 Annually CAPM and TFPM Explanatory Returns and annually Excess Returns over the Period 1987-2011 (%)

	$R_i - R_f$	SMB	HML	$R_m - R_f$
1987	-3.15	-8.64	-3.56	1.16
1988	18.10	5.13	12.23	10.53
1989	21.77	-10.26	-3.42	17.76
1990	-23.25	-14.99	-11.63	-12.28
1991	60.66	12.29	-10.73	24.91
1992	27.98	6.90	20.72	5.50
1993	5.53	5.45	16.46	8.34
1994	-9.11	-1.45	-0.96	-4.12
1995	44.27	-5.55	1.20	25.57
1996	30.09	-1.28	1.77	14.81
1997	49.68	-3.67	9.18	22.68
1998	12.52	-21.46	-8.83	18.08
1999	-4.13	13.47	-29.91	19.08
2000	33.08	0.63	35.76	-15.75
2001	-8.64	19.86	15.68	-13.54
2002	-11.50	4.52	12.15	-22.98
2003	26.90	20.37	3.28	28.53
2004	8.38	5.12	8.23	11.42
2005	2.47	-1.40	8.12	4.52
2006	13.89	1.01	12.26	10.62
2007	-18.39	-8.10	-11.93	2.99
2008	-44.61	7.44	2.23	-46.36
2009	18.61	7.62	0.02	30.11
2010	22.97	12.99	-2.07	18.22
2011	-24.57	-3.91	-7.00	0.41
Mean	9.98	1.68	2.77	6.41
SD	25.04	10.21	13.17	18.03
Num of Neg	9	11	10	6
% in the sample	36	44	40	24
T-statistic	0.08	0.03	0.04	0.07

In comparison of other comparable studies of US market (Table 3), the mean value of SMB and HML premiums are much lower than those showed in the Fama and French (1993) and Savis et al. (2000). It implies the decrease in the effect of size and book-to-market ratio over the period studied in this paper, compared to 1964-1993 and 1929-1997.

Table 3: Annual Mean Premiums from Comparable Studies (%)

	Country	Period	$R_m - R_f$	SMB	HML
Fama and French (1996)	USA	1964-1993	5.94	4.92	6.33
Davis et al.(2000)	USA	1929-1997	8.34	2.43	5.66

The standard deviation of market risk premium is 18.03%, the highest one among the three risk premiums. During the period 1900-2001, the standard deviation of market risk premium is 20%[3], which is quite close to 18.03% over the period 1987-2011, so the close but relatively high volatility shows that the true market risk premium contains substantial uncertainties and the US market keeps fluctuating within certain range. For the whole period from 1987 to 2011, all the premiums of CAPM and TFPM are not different from zero significantly, based on t-statistic in the Table 2. Therefore, the high percentage of negative annual premiums and their high volatility mean that these three premiums don't have ideal arbitrage opportunities.

5.2 Sensitivity to Risk Premiums or Coefficients

Table 4 illustrates the estimation of coefficients for the CAPM and TFPM, using the methodology presented in the Section 2. The mean value of beta for the banking sector is highly significant, which is 1.0378 for CAPM and 1.2351 for TFPM. The beta of whole banking sector is all greater than one, implying that banking industry is more risky than average market with more potential to gain higher return and higher volatility than other

[3] Source: Dimson et al (2002)

industries. One of the reasons for the high beta is because of US banking sector large volume of daily trade which makes the stock price fluctuate more than other sectors. The second reason is that large banks tend to have higher beta while small banks have lower beta in US banking sector, and all of our sampling banks are large capital banks. Last, but not least, US banking sector concentrates on risky investment with high return, utilizing derivatives and high leverage, thus they face more risks than other industries.

Table 4 Estimates and Predictors of CAPM and TFPM for each bank[4]

	CAPM		TFPM			
Bank	Intercept	$R_m - R_f$	Intercept	$R_m - R_f$	SMB	HML
MTB	0.7211**	0.7036***	0.4148	0.8701***	0.0229	0.9281***
	(0.3625)	(0.0772)	(0.3269)	(0.0730)	(0.1041)	(0.1104)
WFC	0.7659*	0.9324***	0.4149	1.1998***	-0.3478***	1.1133***
	(0.4261)	(0.0907)	(0.3657)	(0.0817)	(0.1165)	(0.1235)
BK	0.2182	1.1114***	0.0933	1.2621***	-0.3951***	0.4324***
	(0.4234)	(0.0902)	(0.4099)	(0.0916)	(0.1306)	(0.1385)
NTRS	0.4329	0.9730***	0.3629	1.0599***	-0.2331**	0.2441**
	(0.3427)	(0.0730)	(0.3389)	(0.0757)	(0.1079)	(0.1145)
BAC	-0.0711	1.3425***	-0.5067	1.6014***	-0.0759	1.3340***
	(0.5538)	(0.1179)	(0.5037)	(0.1125)	(0.1604)	(0.1701)
PNC	0.1945	0.9290***	-0.1373	1.1427***	-0.1380	1.0270***
	(0.4161)	(0.0886)	(0.3734)	(0.0834)	(0.1189)	(0.1261)
KEY	0.0507	0.7430***	-0.2028	0.9163***	-0.1544	0.7912***
	(0.4428)	(0.0943)	(0.4205)	(0.0939)	(0.1339)	(0.1420)
STI	0.0223	0.9226***	-0.3110	1.1496***	-0.1989	1.0396***
	(0.4409)	(0.0939)	(0.3979)	(0.0889)	(0.1267)	(0.1344)
C	-0.1554	1.7169***	-0.4683	1.9630***	-0.3479**	0.9974***
	(0.5214)	(0.1110)	(0.4843)	(0.1082)	(0.1542)	(0.1636)
BBT	0.4530	0.6828***	0.0910	0.9125***	-0.1343	1.1184**
	(0.4242)	(0.0903)	(0.3740)	(0.0836)	(0.1191)	(0.1263)
STT	0.4217	1.3592***	0.3250	1.5087***	-0.4658***	0.3562**
	(0.4326)	(0.0921)	(0.4194)	(0.0937)	(0.1336)	(0.1416)
Sector	0.2776**	1.0378***	0.0069	1.2351***	-0.2244***	0.8529***
	(0.1344)	(0.0286)	(0.1254)	(0.0280)	(0.0399)	(0.0423)

[4] Note: Figures given in parentheses are the estimated standard deviations of the estimates.
***, **, and * indicate significance levels at 1, 5, and 10%, respectively.

Both CAPM and TFPM have similar specification on beta (coefficient of market risk premium), but there are some slight differences. Mostly because in TFPM created by Fama and French, two more risk factors are added into the basic CAPM. One is small minus big (SMB) which has a negative coefficient on the sector. For individual bank, most observed banks get negative and relative low coefficient on SMB, which means most the banks in the banking system are big firms among all the companies listed on the NYSE/NASDAQ. Banks with high negative coefficients are large-cap banks, such as WFC, BK, NTRS, C and STT, which are less exposed to risk than other smaller companies in the NYSE/NASDAQ. Only MTB has positive sign for the coefficient of SMB, but not statistically significant. For the other added factor HML, the coefficients are positive and range from 0.2441 to 1.3340. For banks with a positive sign, this signifies that they are experiencing financial difficulties.

From the sector-level perspective, the main factor for the change in banking sector risk premium $(R_m - R_f)\beta$ is the movement of coefficient or the sensitivity of banking sector to those risk premiums. In general, banking sector's beta trends to downward over the time period 1987 to 2008 and jumps to a high level after the Global Financial Crisis (GFC) erupted from 2009 to 2011. As the Table 5 illustrates, β in CAPM was 1.0579 over 1987-2000 and decreased to 0.6785 during 2006-2008, but it rise to 1.5426 in the latest three years; in TFPM, although the value of beta is different, the trend of it is similar to CAPM. Generally, lower beta represents lower sensitivity of banking sector returns to market movements. Therefore, if the market risk premium keeps constant, the lower beta results in a decline in the banking sector risk premium, leading to a fall in cost of equity.

Table 5 Estimates of CAPM and TFPM for Banking Sector[5]

	CAPM		TFPM			
	Intercept	$R_m - R_f$	Intercept	$R_m - R_f$	SMB	HML
1987-2000	0.7135*	1.0579***	0.2259	1.4331***	-0.2223**	0.9045***
	(0.3693)	(0.0819)	(0.2836)	(0.0719)	(0.0861)	(0.1096)
2001-2005	0.1996	0.7092***	0.0148	0.8480***	-0.1257	0.3388***
	(0.3518)	(0.0794)	(0.3597)	(0.0871)	(0.1165)	(0.1206)
2006-2008	-0.7468	0.6785***	-0.9220	0.6415***	-0.3464	2.0376***
	(1.0648)	(0.2240)	(0.8203)	(0.1822)	(0.3880)	(0.4021)
2009-2011	-1.6160	1.5426***	-0.5357	1.0786***	-0.2030	1.4239***
	(1.0180)	(0.1756)	(0.8358)	(0.1935)	(0.3556)	(0.3014)

5.3 Cost of Equity US banking industry

Graph 1 show the annual estimates of the inflation adjusted cost of equity for banking sectors in the US market from 1987 to 2011. The data used in the graph is the estimates based on the CAPM and TFPM, using the data in Table 2 and Table 10. The difference between two graphs displays that cost of equity estimates are sensitive to the methodology employed. The inflation adjusted cost of equity equals to 7.55% in CAPM and 10.8% in TFPM (Table 11) over the period 1987-2011.

According to the five-year moving average line, the trend of both the estimated cost of equity based on the CAPM and TFPM has a downward direction for most of the past 25 years. According to previous studies, the bank real cost of equity was 11.9% during the period 1984-1990[6] and 8.8% during the period 1993-2001[7], so cost of equity in US banking keep decreasing in the past 30 years. Although the general trend is downward, obvious cyclical tracks still exist, including huge increases in cost of equity around 1994,

[5] Note: Figures given in parentheses are the estimated standard deviations of the estimates.
***, **, and * indicate significance levels at 1, 5, and 10%, respectively.

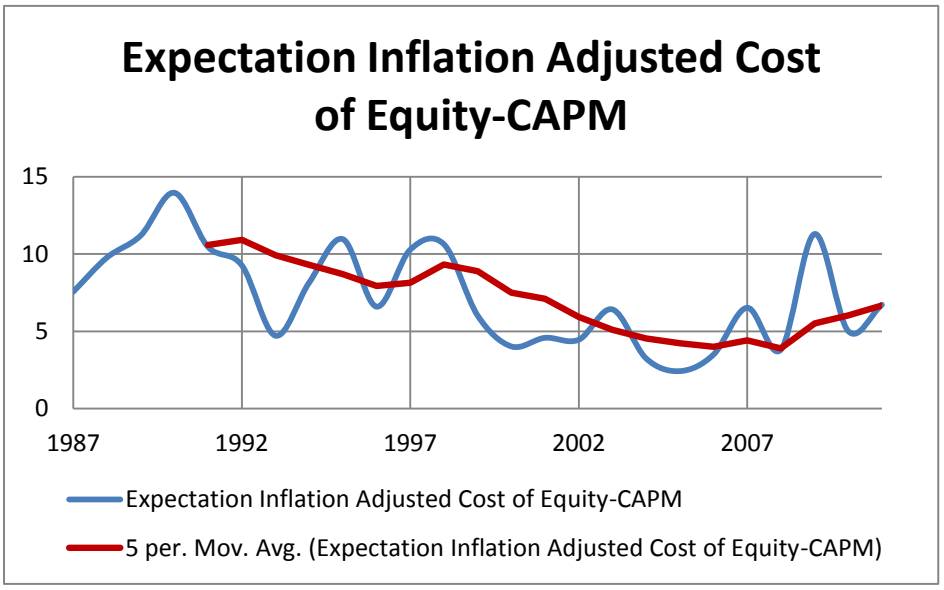
[6] Zimmer and MaCauley (1991) measure the inflation adjusted cost of equity using the bank-level return on equity (ROE).

[7] Maccario et al (2002) measure the inflation adjusted cost of equity using a dividend discount model (DDM).

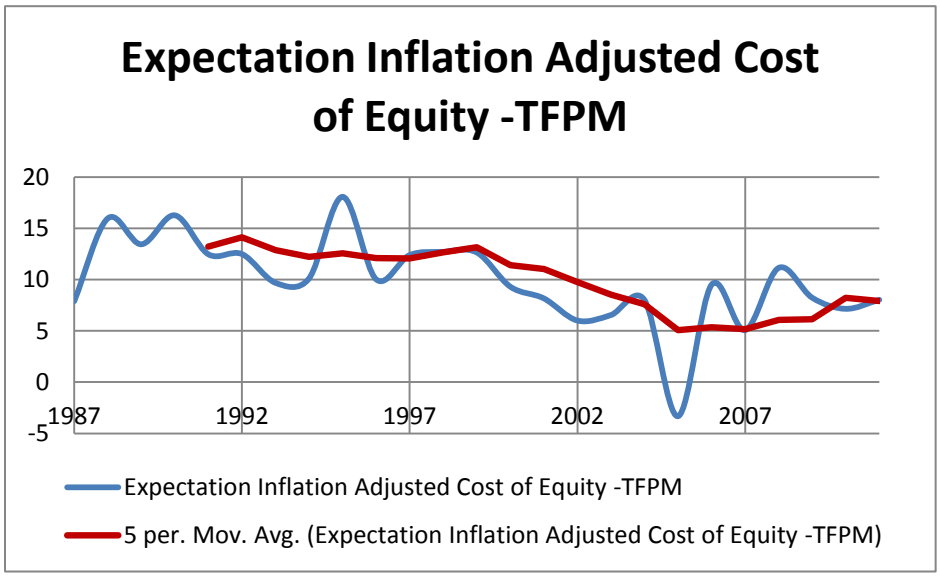
collapse from 1999 to 2002 and increases during 2006 to 2007. Analyzing the reasons of turning point needs to consider events at the specific time point.

During 1989 to 1991, US banking system suffered Savings & Loan crisis, which make the annual cost of equity estimates reach a low. Over the period 1999 to 2002, US market experienced the collapse in equities values, because of the stock market bubble. Before the housing bubble burst, US banks have rises in cost of equity between 2005 and 2007, which can be explained by upsurge of the subprime mortgage. In September 2008, when Lehman Brothers declared bankruptcy, the cost of equity in US banks suffered a slump, worsening the Global Financial Crisis. In recent two years from 2010 to 2011, the cost of equity keeps decreasing mostly because of the weak global economy, especially the ongoing Europe sovereign debt crisis.

Graph 1 Cost of Equity with annual estimates based on CAPM and TFPM



Graph 1: Continued



In Table 6, we estimate the cost of equity for each 11 bank and the whole sector for 30 Dec 2011, annual risk-free rate R_f is 0.04% of 2011. Except higher beta, higher cost of equity also can represent higher risk and volatility. As observe, CAPM and TFPM models give different costs of equity, 6.77% and 10.01% respectively. Subtracting risk-free rate from cost of equity, the result is similar to the excess return of banking sector, which is 6.73% in CAPM and 9.97% in TFPM. It means that banking industry is risky than the market as whole, while the market risk premium only 6.40%. For individual bank, the cost of equity in CAPM is around the whole sector average value and range from 4.4946 (BBT) to 11.1223(C). From the TFPM, the range of cost of equity is relatively large, from 7.1962 (NTRS) to 14.8763 (C). One interesting thing is Citigroup (C) has highest cost of equity in both CAPM and TFPM while it also has the highest beta over all 11 banks. C's beta is 1.9630, close to 2, which means it has twice volatility than the average market and is more sensitive to market risk.

The differences of the cost of equity for both CAPM and TFPM are most likely because of the coefficients of SMB and HML. Also, the estimation errors of TFPM

coefficients lead part of distinguish. However, uncertainty about the three different risk factors is more important than risk loadings (Fama and French, 1997). Therefore, choice different pricing model, CAPM and TFPM, will generate a large difference on the valuation.

Table 6 Estimated and Predicted Cost of Equity under CAPM and TFPM for Each Bank on 30 Dec 2011

Bank	CAPM		TFPM			
	β_i	Cost of equity(%)	β_i	S_i	H_i	Cost of equity(%)
MTB	0.7036	4.6288	0.8701	0.0229	0.9281	8.3050
WFC	0.9324	6.0950	1.1998	-0.3478	1.1133	10.3068
BK	1.1114	7.2424	1.2621	-0.3951	0.4324	8.7408
NTRS	0.9730	6.3554	1.0599	-0.2331	0.2441	7.1962
BAC	1.3425	8.7231	1.6014	-0.0759	1.3340	13.9499
PNC	0.9290	6.0732	1.1427	-0.1380	1.0270	10.0552
KEY	0.7430	4.8817	0.9163	-0.1544	0.7912	7.9240
STI	0.9226	6.0326	1.1496	-0.1989	1.0396	10.0321
C	1.7169	11.1223	1.9630	-0.3479	0.9974	14.8763
BBT	0.6828	4.4946	0.9125	-0.1343	1.1184	8.8392
STT	1.3592	8.8306	1.5087	-0.4658	0.3562	9.9909
Sector	1.0378	6.7709	1.2351	-0.2244	0.8529	10.0197

6. Conclusions

This study utilizes CAPM and TFPM to evaluate US banking sector, generating estimates of cost of equity over the period 1987–2011 and analyzing the main reasons for changes in cost of equity in the sector. The period considered for this study is from the time just before Basel I and the time just after Basel III, in order to track the improvement of the whole financial system while the regulations are updating.

For both CAPM and TFPM, empirical results show that US banks are more exposed to market risk than the average companies on the NASDAQ/NYSE/AMEX since average β_s (CAPM) and β_s (TFPM) are greater than one, but the exposure has been decreasing over the time period even though β_s and β_s increased significantly after Global Financial Crisis. Except sensitivity to risk premiums, risk-free rate represents about one third of the cost of equity but its influence keep decreasing; on the other hand, risk premiums (market risk premium, SMB and HML), especially market risk premium represent increasingly percentage of the cost of equity. Combining all the three factors, the trend of cost of equity decreased from 1987 to 2011 generally, with several turning points and moderate volatility. Although the general trend is downward, obvious cyclical tracks still exist, including huge increases in cost of equity around 1994, collapse from 1999 to 2002 and rebound at 2007 and 2009.

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Appendix

Table 7 Inflation Adjusted Estimates in CAPM for each bank (%)

	MTB	WFC	BK	NTRS	BAC	PNC	KEY	STI	C	BBT	STT
1987	8.89	7.18	6.35	6.15	7.64	6.20	7.16	5.87	9.70	6.52	11.42
1988	7.58	9.18	5.50	10.60	12.04	8.36	3.57	13.44	16.78	4.99	15.36
1989	7.65	8.73	12.78	11.42	16.49	13.42	10.53	10.49	13.39	5.07	13.06
1990	8.77	17.15	17.66	10.78	15.92	13.94	10.96	12.42	16.48	9.97	19.46
1991	8.52	13.39	18.07	6.24	14.36	8.62	10.62	10.01	15.94	1.29	7.88
1992	8.76	8.02	4.79	7.60	6.09	3.99	14.26	10.67	16.52	8.97	12.28
1993	-2.09	4.00	2.47	7.41	3.98	4.68	9.02	-2.12	12.24	7.48	4.71
1994	1.07	9.93	12.81	3.93	12.20	8.11	8.34	7.02	12.81	7.67	5.62
1995	5.49	17.23	20.15	-0.64	12.91	7.78	15.61	11.00	17.93	3.91	9.13
1996	2.33	6.84	7.31	2.12	3.79	7.66	9.06	7.42	9.67	8.83	7.40
1997	4.60	9.84	10.03	12.33	10.24	8.49	9.02	10.82	12.44	6.81	18.33
1998	9.76	9.34	11.33	12.08	10.19	9.46	10.58	10.76	11.96	10.10	11.31
1999	5.42	4.81	8.68	9.21	8.68	0.69	-1.60	5.64	11.49	3.07	10.07
2000	4.71	2.33	5.23	4.94	7.73	3.17	1.35	2.24	6.28	0.99	5.20
2001	2.36	1.62	7.58	7.25	4.18	4.31	1.33	1.98	9.43	2.34	7.89
2002	1.71	0.65	7.80	6.47	3.79	5.73	2.22	1.16	10.64	2.33	6.37
2003	3.89	3.10	13.95	9.55	2.51	3.88	8.29	5.16	5.22	5.91	9.02
2004	-0.08	0.25	3.87	10.18	0.78	5.53	1.73	1.30	3.98	-1.69	9.77
2005	1.39	1.74	8.04	3.91	1.36	2.20	2.96	1.37	-0.26	2.02	1.84
2006	2.14	0.45	4.50	4.78	0.67	3.36	6.47	2.11	2.49	1.58	9.76
2007	4.39	6.23	5.13	6.02	5.73	5.35	2.03	6.36	14.42	6.18	9.82
2008	1.53	1.17	0.76	9.45	6.47	3.63	1.90	2.97	8.53	0.80	4.60
2009	8.31	17.25	3.31	-0.61	25.09	12.15	0.43	11.01	26.48	11.37	9.37
2010	-0.99	7.33	4.32	3.54	5.63	4.85	4.24	7.87	6.55	4.86	6.86
2011	4.19	2.51	7.25	6.26	9.84	4.29	8.28	6.08	11.52	4.20	9.36

Table 8 Inflation Adjusted Estimates in Fama-Fench (TFPM) for each bank (%)

	MTB	WFC	BK	NTRS	BAC	PNC	KEY	STI	C	BBT	STT
1987	10.06	11.41	6.92	9.80	11.98	3.10	5.95	3.08	6.76	9.31	8.44
1988	11.73	14.44	14.92	18.85	19.43	18.69	7.64	24.14	25.62	2.92	17.29
1989	13.74	18.47	18.84	10.51	18.17	13.20	15.44	17.08	3.05	9.24	10.18
1990	7.11	11.09	23.39	16.21	22.07	22.94	2.06	20.48	7.52	29.76	16.40
1991	17.99	15.06	26.51	8.49	13.15	8.65	14.36	6.91	13.16	1.60	11.30
1992	16.71	10.26	7.02	11.29	10.76	7.34	17.99	13.07	17.60	12.41	12.99
1993	2.55	11.60	2.79	14.88	8.86	6.99	12.80	-0.17	21.79	13.37	11.06
1994	0.20	14.33	8.03	11.00	13.48	13.69	16.98	3.97	9.93	10.07	9.54
1995	5.61	27.25	35.51	3.02	21.11	23.20	19.68	15.69	23.31	12.56	11.97
1996	6.07	4.12	15.85	7.54	6.70	13.02	8.68	11.18	8.96	9.38	18.83
1997	19.25	4.81	9.55	6.80	15.49	13.14	10.03	12.24	8.97	15.46	20.54
1998	10.85	7.93	9.60	6.99	18.36	12.86	14.77	11.62	20.40	10.71	15.66
1999	17.56	19.42	15.88	9.67	10.29	7.04	8.45	14.59	14.66	12.91	8.68
2000	22.14	13.34	-1.61	3.59	16.46	6.08	8.95	20.33	10.49	8.93	-6.29
2001	7.04	6.53	14.81	11.60	4.27	9.51	7.39	4.30	6.90	5.98	11.49
2002	3.88	2.28	9.38	9.46	5.91	11.92	5.02	3.63	6.99	3.09	4.45
2003	2.66	4.52	11.81	8.97	-0.06	5.32	8.83	7.31	2.74	8.50	11.36
2004	10.11	2.06	8.48	18.45	3.73	10.93	7.62	5.70	6.29	4.82	9.86
2005	-3.01	-3.72	0.41	-4.99	-2.32	-4.07	0.79	-1.56	-1.02	-7.12	-10.11
2006	4.78	9.15	4.24	16.57	7.97	6.77	9.44	8.90	8.96	8.99	18.70
2007	2.17	4.56	1.96	3.07	3.06	2.58	3.32	9.32	15.25	4.07	6.39
2008	11.01	10.88	0.86	11.41	20.15	10.57	8.37	10.93	19.87	12.64	5.89
2009	6.11	15.39	2.87	0.73	23.09	8.58	-3.37	4.91	16.54	7.99	7.66
2010	2.06	9.12	5.64	4.38	9.03	7.49	7.58	11.20	8.15	7.40	6.57
2011	5.31	7.41	8.09	6.08	14.12	5.87	11.20	6.53	9.68	7.50	6.56

Table 9 Components of Cost of Equity Estimates in CAPM and TFPM (%)

	CAPM						TFPM									
	Cost of Equity		Rf	(Rm-**Rf**)*β	Percentage		Cost of Equity		Rf	(Rm-**Rf**)*βi	SMB*Si	HML*Hi	Percentage			
	Mean	SD			Rf	(Rm-**Rf**)*β	Mean	SD					Rf	(Rm-**Rf**)*β	SMB*Si	HML*Hi
1987	11.45	1.76	5.34	6.11	46.63	53.37	11.79	3.03	5.34	6.28	-0.06	0.23	45.29	53.29	-0.53	1.95
1988	13.81	4.32	6.18	7.63	44.74	55.26	20.02	6.71	6.18	9.47	0.43	3.95	30.87	47.28	2.14	19.71
1989	15.14	3.18	8.07	7.07	53.31	46.69	17.40	4.89	8.07	8.01	1.05	0.27	46.38	46.06	6.02	1.54
1990	17.90	3.59	7.57	10.33	42.29	57.71	20.22	8.47	7.57	10.07	1.45	1.14	37.44	49.79	7.15	5.62
1991	14.19	4.77	5.46	8.73	38.48	61.52	16.21	6.48	5.46	9.05	0.84	0.86	33.68	55.85	5.15	5.32
1992	12.71	3.89	3.45	9.26	27.15	72.85	15.94	3.75	3.45	10.93	-0.08	1.63	21.65	68.61	-0.51	10.25
1993	7.72	4.35	2.86	4.86	37.06	62.94	12.70	6.37	2.86	6.93	0.58	2.33	22.53	54.57	4.55	18.35
1994	11.59	3.73	3.84	7.75	33.14	66.86	13.56	4.80	3.84	8.03	-0.66	2.35	28.32	59.22	-4.88	17.35
1995	14.24	6.52	5.46	8.78	38.36	61.64	21.36	9.53	5.46	12.24	-0.30	3.97	25.56	57.29	-1.42	18.57
1996	9.74	2.64	5.08	4.66	52.17	47.83	13.18	4.39	5.08	7.04	-0.59	1.66	38.53	53.40	-4.50	12.57
1997	13.47	3.51	5.13	8.34	38.09	61.91	15.59	4.97	5.13	9.62	-0.78	1.62	32.91	61.72	-5.02	10.39
1998	13.43	0.96	4.75	8.68	35.37	64.63	15.51	4.22	4.75	10.91	-1.36	1.20	30.63	70.36	-8.76	7.77
1999	8.95	4.10	4.59	4.36	51.27	48.73	15.59	4.09	4.59	9.35	-1.19	2.85	29.45	59.96	-7.66	18.26
2000	7.15	2.15	5.73	1.42	80.11	19.89	12.45	8.72	5.73	5.94	-0.80	1.57	46.03	47.73	-6.40	12.63
2001	7.21	2.95	3.79	3.42	52.57	47.43	10.81	3.31	3.79	5.69	-0.10	1.42	35.07	52.63	-0.88	13.18
2002	6.99	3.19	1.62	5.37	23.17	76.83	8.55	3.09	1.62	5.90	0.02	1.01	18.95	69.05	0.19	11.82
2003	8.59	3.45	1.02	7.57	11.87	88.13	8.73	3.81	1.02	7.38	0.48	-0.16	11.69	84.57	5.55	-1.81
2004	5.59	3.92	1.18	4.41	21.09	78.91	10.36	4.45	1.18	10.51	-2.07	0.75	11.39	101.41	-20.00	7.20
2005	4.86	2.14	2.94	1.92	60.52	39.48	-0.90	3.23	2.94	-0.70	0.38	-3.52	-328.18	78.33	-42.52	392.37
2006	6.02	2.77	4.71	1.31	78.24	21.76	12.04	4.42	4.71	7.39	-1.31	1.25	39.13	61.38	-10.86	10.35
2007	9.00	3.20	4.57	4.43	50.80	49.20	7.55	4.00	4.57	4.53	-0.03	-1.53	60.54	60.04	-0.33	-20.25
2008	5.91	3.11	1.67	4.24	28.26	71.74	13.25	5.49	1.67	3.09	-1.24	9.73	12.60	23.35	-9.38	73.42
2009	13.17	8.91	0.09	13.08	0.68	99.32	10.11	7.60	0.09	6.53	-1.25	4.74	0.89	64.62	-12.39	46.88
2010	6.83	2.43	0.09	6.74	1.32	98.68	8.97	2.48	0.09	4.77	0.39	3.72	1.00	53.17	4.37	41.46
2011	8.39	2.82	0.04	8.35	0.48	99.52	9.72	2.66	0.04	7.96	0.16	1.57	0.41	81.87	1.61	16.11

Table10. Inflation Adjusted Cost of Equity in CAPM and TFPM for Banking Sector over period 1987-2011 (%)

	1987-1991				
CAPM	7.55	9.76	11.19	13.95	10.45
TFPM	7.89	15.97	13.45	16.27	12.47
	1992-1996				
CAPM	9.27	4.71	8.14	10.95	6.58
TFPM	12.49	9.68	10.11	18.08	10.0312
	1997-2001				
CAPM	10.27	10.62	6.02	4.01	4.57
TFPM	12.39	12.70	12.65	9.31	8.17
	2002-2006				
CAPM	4.44	6.41	3.24	2.42	3.48
TFPM	6.00	6.54	8.00	-3.34	9.50
	2007-2011				
CAPM	6.52	3.80	11.29	5.01	6.71
TFPM	5.07	11.14	8.23	7.15	8.03

	1987-2011
CAPM	7.55
TFPM	10.80

Table11. Beta in CAPM for each bank over period 1987-2011

	MTB	WFC	BK	NTRS	BAC	PNC	KEY	STI	C	BBT	STT
1987	1.1622	0.8960	0.7656	0.7352	0.9674	0.7422	0.8932	0.6907	1.2892	0.7924	1.5574
1988	0.8496	1.0999	0.5255	1.3213	1.5459	0.9716	0.2242	1.7654	2.2862	0.4469	2.0649
1989	0.5515	0.7205	1.3518	1.1389	1.9301	1.4512	1.0006	0.9951	1.4475	0.1487	1.3957
1990	0.8039	2.1113	2.1900	1.1170	1.9189	1.6092	1.1444	1.3723	2.0059	0.9898	2.4713
1991	1.0614	1.8204	2.5516	0.7056	1.9721	1.0775	1.3894	1.2932	2.2194	-0.0671	0.9619
1992	1.3649	1.2496	0.7460	1.1847	0.9488	0.6217	2.2237	1.6635	2.5763	1.3991	1.9141
1993	-0.3028	0.6473	0.4082	1.1793	0.6438	0.7544	1.4317	-0.3071	1.9333	1.1905	0.7581
1994	0.1064	1.4889	1.9386	0.5526	1.8431	1.2048	1.2412	1.0344	1.9376	1.1367	0.8161
1995	0.5167	2.3485	2.8046	-0.4402	1.6744	0.8735	2.0953	1.3771	2.4574	0.2705	1.0848
1996	0.0633	0.7665	0.8396	0.0297	0.2910	0.8941	1.1133	0.8571	1.2089	1.0779	0.8543
1997	0.4160	1.2341	1.2643	1.6231	1.2970	1.0234	1.1061	1.3876	1.6396	0.7615	2.5591
1998	1.2196	1.1535	1.4650	1.5817	1.2864	1.1725	1.3476	1.3750	1.5633	1.2732	1.4613
1999	0.5874	0.4930	1.0969	1.1795	1.0972	-0.1510	-0.5069	0.6224	1.5357	0.2209	1.3137
2000	0.3299	-0.0412	0.4112	0.3658	0.8026	0.0898	-0.1930	-0.0552	0.5758	-0.2497	0.4067
2001	0.1888	0.0729	1.0040	0.9524	0.4734	0.4934	0.0278	0.1287	1.2918	0.1851	1.0517
2002	0.4121	0.2465	1.3622	1.1544	0.7362	1.0397	0.4914	0.3262	1.8056	0.5092	1.1391
2003	0.7883	0.6654	2.3591	1.6717	0.5740	0.7870	1.4746	0.9873	0.9967	1.1036	1.5898
2004	0.1707	0.2218	0.7879	1.7723	0.3059	1.0465	0.4534	0.3861	0.8046	-0.0805	1.7085
2005	0.1387	0.1941	1.1768	0.5326	0.1342	0.2657	0.3845	0.1355	-0.1186	0.2383	0.2102
2006	-0.0049	-0.2688	0.3627	0.4065	-0.2346	0.1851	0.6703	-0.0096	0.0493	-0.0920	1.1849
2007	0.3594	0.6460	0.4742	0.6138	0.5676	0.5089	-0.0093	0.6668	1.9238	0.6385	1.2069
2008	0.3067	0.2514	0.1869	1.5429	1.0781	0.6357	0.3644	0.5316	1.3993	0.1933	0.7860
2009	1.5764	2.9717	0.7959	0.1841	4.1941	2.1748	0.3472	1.9974	4.4119	2.0542	1.7411
2010	0.1157	1.4146	0.9455	0.8230	1.1496	1.0281	0.9320	1.4993	1.2930	1.0299	1.3414
2011	0.9118	0.6482	1.3878	1.2340	1.7931	0.9260	1.5492	1.2054	2.0544	0.9127	1.7183

Table12 Coefficients and T-Value for US banking sector over period 1987-2011

	CAPM			TFPM					
	Coefficient	T-Statistic		Coefficient			T-Statistic		
	β	β		β	Si	Hi	β	Si	Hi
1987	0.9538	12.3595		0.9805	-0.0371	0.0829	7.4660	-0.1180	0.2236
1988	1.1911	3.3360		1.4771	0.2544	1.4244	5.7016	0.8618	3.5218
1989	1.1029	4.7057		1.2505	0.6225	0.0965	4.8507	1.3841	0.1510
1990	1.6122	4.3602		1.5711	0.8592	0.4104	2.4749	0.8472	0.2071
1991	1.3623	8.8963		1.4128	0.4962	0.3111	7.7098	1.5467	0.5374
1992	1.4448	4.2362		1.7061	-0.0487	0.5899	5.7817	-0.2862	2.6490
1993	0.7579	1.2295		1.0811	0.3428	0.8411	1.7937	0.4933	2.0405
1994	1.2091	3.9957		1.2530	-0.3929	0.8492	4.7492	-0.7842	1.8350
1995	1.3693	1.9328		1.9100	-0.1800	1.4323	3.2453	-0.3943	2.6134
1996	0.7269	2.5485		1.0986	-0.3524	0.5985	4.2358	-1.3560	1.5761
1997	1.3011	5.8814		1.5014	-0.4644	0.5846	6.7767	-2.5642	1.5990
1998	1.3545	10.7796		1.7029	-0.8068	0.4349	8.2609	-1.6962	1.1725
1999	0.6808	1.3585		1.4585	-0.7096	1.0273	3.2260	-2.1447	2.0409
2000	0.2221	0.4176		0.9272	-0.4729	0.5678	1.8839	-1.1389	0.8755
2001	0.5337	3.3651		0.8875	-0.0568	0.5140	5.0485	-0.2590	2.5037
2002	0.8384	6.8452		0.9213	0.0095	0.3647	7.1794	0.0468	1.5468
2003	1.1816	4.6763		1.1515	0.2875	-0.0571	3.6394	0.6211	-0.0823
2004	0.6888	2.1386		1.6394	-1.2308	0.2693	4.6482	-3.4902	0.7736
2005	0.2993	1.0055		-0.1095	0.2262	-1.2690	-0.2873	0.4965	-3.4776
2006	0.2044	0.4418		1.1529	-0.7764	0.4497	1.7352	-1.5138	0.7656
2007	0.6906	3.2735		0.7072	-0.0149	-0.5518	3.1455	-0.0270	-0.7917
2008	0.6615	1.3545		0.4829	-0.7381	3.5127	1.4035	-0.7574	4.5138
2009	2.0408	5.7612		1.0193	-0.7438	1.7107	1.7353	-1.0811	2.2433
2010	1.0520	3.7892		0.7446	0.2327	1.3433	2.6524	0.3481	2.4154
2011	1.3037	7.5325		1.2416	0.0932	0.5652	3.9676	0.1338	0.7574