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The cost of equity for global banks: a CAPM perspective from 1990 to 2009[1]

This article provides estimates of the inflation-adjusted cost of equity for banks in six countries over the period 1990–2009. This cost is estimated using the single-factor capital asset pricing model (CAPM), where expected stock returns are a function of risk-free rates and a bank-specific risk premium. Cost of equity estimates declined steadily across all countries from 1990 to 2005 but then rose from 2006 onwards. The fall in the cost of equity reflects (i) the decrease in risk-free rates over this period, and (ii) a decline in the sensitivity of bank stock returns to market risk (the CAPM beta) in all countries except Japan. The estimates show wide variation across banks, highlighting the difficulty of estimating expected returns using the CAPM.

JEL classification: G12, G21, G32.

One lesson drawn from the ongoing financial crisis is that banks should hold more common equity in their capital structure. Common equity is the first category of bank capital available to absorb losses; the greater this cushion, the more losses a bank can withstand while remaining financially viable. For this reason, common equity is also the most expensive form of bank capital, as investors expect to be rewarded for the greater risk they bear through some combination of dividends and capital appreciation.

If banks are expected to have more common equity in their capital structure, how much will this extra equity cost? Perceptions of banks' riskiness have clearly risen over the course of the crisis, as seen in falling stock prices and widening spreads on bank bonds and credit default swaps. Even so, the impact on banks' cost of equity is not immediately observable. Bank stocks have become more volatile and the risk premium for banks may have increased. However, this rise may have been offset by the sharp fall in risk-free rates and the support provided by governments and central banks. While it is too early to measure how these events might affect banks' cost of equity in the future, this paper traces changes in these inputs over 1990–2009.

[1] The views expressed in this article are those of the author and do not necessarily reflect those of the BIS. The author would like to thank Claudio Borio, Stephen Cecchetti, Jacob Gyntelberg, Robert McCauley and Christian Upper for very useful comments and discussions. Thomas Faeh provided excellent research assistance. All errors and omissions remain my own.

This feature provides estimates of the cost of equity for banks headquartered in six countries: Canada, France, Germany, Japan, the United Kingdom and the United States.[2] The 20-year period examined incorporates several business cycles globally, as well as a number of asset bubbles and other shocks to the financial system. Cost of equity estimates are generated using the capital asset pricing model (CAPM), which the Federal Reserve System has used as its sole methodology since October 2005 (Barnes and Lopez (2006)).[3] The study looks at a sample of 89 banks, and includes institutions that have merged or been acquired, gone bankrupt or been rescued, and those that have remained intact over this period.

The estimates of the cost of equity for banks declined steadily across all countries (except Japan) from 1990 to 2005 but then rose from 2006 onwards. There are clear cyclical patterns, with increases in all countries around 1994 and again in 1999–2000. Part of the overall decline is explained by the fall in risk-free rates over this period. The main contributor, however, is the fall in the banking sector risk premium, which represents more than two thirds of the level of the cost of equity estimates. This risk premium is the product of the CAPM beta and the historical equity market risk premium (which is treated as a constant). The decline is therefore due to the lower CAPM betas, reflecting the lower covariance of bank stock returns and market returns. Here again Japan is the exception, as the beta for banking stocks in that country has remained mostly unchanged over this period.

The article first reviews prior studies of banks' cost of equity and the methodologies employed. The second section outlines the CAPM, and the third presents the empirical results, with the details and data sources in a box. The fourth section looks at explanations for changes in the banking sector's cost of equity over time. The fifth section checks the sensitivity of the estimates to key assumptions, and the conclusion summarises the findings.

Prior studies of bank cost of equity

There are few studies of bank cost of equity

Even though banks must hold capital for regulatory purposes, only a few studies provide estimates of the cost of equity for financial institutions, particularly for banks outside the United States. Most corporate finance studies exclude banks, arguing that the role of leverage, taxes and other factors is different in this highly regulated sector.

One possible measure is the historical return on equity …

Zimmer and McCauley (1991) estimate the cost of equity for 34 international banks from six countries over the period 1984–90. They proxy the cost of equity using the bank-level return on equity (ROE). This measure takes the ratio of banks' reported earnings to market capitalisation, with earnings adjusted for inflation and accounting distortions. This ROE is then averaged over time and across banks from each country to arrive at the

[2] The cost of equity is one input into a firm's weighted average cost of capital, which reflects the costs and respective weights of debt, equity and preferred shares in a firm's capital structure.

[3] The cost of equity was also estimated using the multifactor Fama-French model (Fama and French (1996)). The results were similar and are available upon request.

Bank real cost of equity estimates across studies				
	Zimmer and McCauley (1991)	Maccario et al (2002)	This study	
Method	Real return on equity	Inverse of P/E ratio	CAPM	
	1984–90	1993–2001	1993–2001	2002–09
Canada	10.3	12.0	10.7	5.4
France	…	7.7	10.6	7.3
Germany	6.9	7.0	11.4	9.0
Japan	3.1	2.8	12.0	11.2
United Kingdom	9.8	8.9	9.5	6.6
United States	11.9	8.8	10.4	7.2

Sources: Maccario et al (2002); Zimmer and McCauley (1991); author's estimates. Table 1

country estimates. The authors recognise that although a backward-looking accounting measure may not be optimal for measuring the cost of equity, it has the advantage of being observable. Their results show that the ROE was highest for banks in the United States, Canada and the United Kingdom and significantly lower in Germany and Japan (Table 1).

… and another is based on a dividend discount model

Maccario et al (2002) measure the cost of equity for non-US banks using a dividend discount model (DDM) approach, adjusted for inflation.[4] They study banks in 12 countries over the 1993–2001 period and measure the cost of equity using the inverse of a bank's forward-looking price/earnings multiple (the earnings yield). To use the DDM in this manner, the authors assume that analyst forecasts are the best estimate of next year's earnings, earnings grow thereafter at the same rate as the economy, and a fixed ratio of earnings is paid out as dividends. A direct implication of this approach is that more profitable banks face a higher cost of equity. The authors conclude that banks located in Canada, Sweden and the Netherlands face the highest cost of equity, and German and Japanese banks the lowest (Table 1). While the use of earnings forecasts has its merits, accounting studies highlight the shortcomings of this approach as well as its sensitivity to the inputs (Easton (2009)). The DDM approach is therefore not used in this paper.

The Federal Reserve System uses cost of equity estimates to price its services …

Green et al (2003) and Barnes and Lopez (2006) describe the methods used by the Federal Reserve to estimate the cost of equity for US banks. Since the passage of the Monetary Control Act of 1980, the Federal Reserve Banks have been required to charge depository institutions for the Fed's payment services at prices that fully reflect the costs a private sector provider would incur. The Fed's methodology for imputing these costs is known as the Private Sector Adjustment Factor (PSAF). One input to this calculation is an estimate of the average bank's cost of equity, which until 2002 was based on the comparable accounting earnings method, where the cost of equity was set to

[4] A DDM views the price of a stock today as the discounted present value of future dividends payable to shareholders. By forecasting a bank's future earnings and dividends, an estimate of the cost of equity can be backed out from the current stock price.

equal the average ROE for a representative group of banks – similar in spirit to the measure used in Zimmer and McCauley (1991).

… and relies on the CAPM

Given concerns about these estimates, the PSAF cost of equity from 2002 to 2005 was the average of three estimates based on comparable accounting earnings, a dividend discount model and the CAPM (Green et al (2003)). The average estimate for US banks based on the CAPM by Green et al is 15%, much higher than the comparable estimates from either Zimmer and McCauley (1991) or Maccario et al (2002). In 2004 the Fed began an internal review of these methods, involving in-house research and consultations with academics and private sector consultants. As part of this review, Fed economists Barnes and Lopez (2006) tested whether the CAPM estimates were robust to changes in the size of the peer group, the introduction of additional factors and variations in the calculation method. They concluded that cost of equity estimates based on averaging CAPM estimates across a group of banks were reasonable for the purposes of the Federal Reserve System, which therefore adopted the method as the sole approach for estimating the bank cost of equity as of 2006. The CAPM approach is used in this study.

The capital asset pricing model

The cost of equity is the expected return on common stock …

The cost of equity is typically defined as the expected return that investors require to purchase common stock in a firm. It is therefore an important input for bank management when raising capital and making investment decisions and for investors when they value equity securities and construct their portfolios. The CAPM method remains the one most commonly used by practitioners and financial advisers to estimate a firm's cost of equity, as shown in surveys by Brunner et al (1998) and Graham and Harvey (2001).

… and compensates investors for risks …

According to the CAPM, the expected return demanded by investors should compensate them for the additional risk incurred from adding a given security to a diversified equity portfolio. The model implies that investors require a firm-specific premium for holding a company's stock, where this premium is related to how much the security changes the risk of the overall equity portfolio. The firm's cost of equity is then the sum of this firm-specific premium plus the return on a risk-free asset.

… based on the sensitivity of a stock to market movements

The firm-specific premium is the product of two components: the CAPM beta and the equity market risk premium. The former provides a measure of the sensitivity of a stock's returns to market risk. Specifically, it measures the covariance of bank stock returns and market returns, scaled by the variance of market returns. Details on the calculation of this beta are provided in the box. By definition the overall stock market has a beta of one; a stock with a beta below one is less variable than the market, while a stock with a beta above one is more variable. A higher covariance translates into more risk and requires a higher risk premium, while lower covariance requires a lower premium.

Investors expect to earn a premium for holding equity

The second part of the firm-specific premium is the equity market risk premium, which represents the incremental return that investors require from

Equity market risk premium, 1900–2001 Relative to long-term government bonds		
	Mean	Standard deviation
Canada	5.7	17.9
France	6.7	21.7
Germany[1]	9.6	28.5
Japan	10.0	33.2
United Kingdom	5.5	16.7
United States	6.7	20.0

[1] Excludes 1922–23.

Sources: Dimson et al (2002). Table 2

holding risky equities rather than risk-free securities.[5] The equity market risk premium is forward-looking, unobservable and probably time-varying. Given that the CAPM posits an equilibrium relationship, this risk premium is viewed as reverting to some mean value over the longer-term horizon that matters for companies and investors. The CAPM is therefore not appropriate for making short-term investment decisions or identifying market mispricing. Instead, the CAPM cost of equity is the discount rate that a firm should use when deciding to undertake capital investments over the life of a project. Similarly, an investor would use this estimate as the expected return when choosing between different asset classes on a buy and hold basis. Estimating the size of the equity market risk premium is controversial. Different authors have suggested that the correct premium for the US stock market is between 3 and 8% (Fama and French (2002)), with some researchers suggesting it is near zero. Resolving this debate lies beyond the scope of this article.

Historical returns provide a guide to the equity market risk premium

Given that the expected equity market return cannot be observed, the usual practice is to proxy the premium by looking at the historical returns on equities relative to risk-free rates. As they are the longest and most well researched measures for a wide selection of countries, this study uses the estimates of Dimson et al (2002) of the equity market risk premium for 16 countries over the 102-year period from 1900 to 2001 (Table 2).

Estimation and results

The cost of equity for each country's banking sector is the average across its banks

Estimates of the cost of equity for each country are calculated by taking the equal-weighted average of the individual estimates for its banks. Additional details are provided in the box. Working on the assumption that any cost of equity estimate will be imprecise, this study focuses on relative changes in country averages over time, and checks whether reasonable estimates can be obtained using a banking sector equity sub-index as a proxy for individual banks.

[5] DeLong and Magin (2009) survey the literature on the equity market risk premium.

Estimating the cost of equity

The CAPM is a general equilibrium theory that quantifies the trade-off between risk and expected return using a single risk factor, namely the return on the overall stock market (Campbell et al (1997)). An equity investor constructing a mean-variance efficient portfolio will seek to maximise returns for a given level of risk. Based on this theory, the nominal cost of equity (or expected return) for any stock is a linear combination of the nominal risk-free rate and a firm-specific risk premium:

$$E[R_i] = R_f + \beta_{im}(E[R_m] - R_f) \quad (1)$$

where $E[R_i]$ is the expected return on stock i, $E[R_m]$ is the expected return on the market portfolio, and R_f is the nominal yield on the risk-free asset. The difference between the expected market return and the nominal risk-free rate is the equity market risk premium, which is forward-looking and measures the average annual return that an investor may be expected to earn on their equity portfolio relative to a risk-free asset. While other market risk premia are time-varying, this expected return is the equilibrium return. β_{im} is known as the CAPM beta and measures the covariance of a stock's return with the market return, divided by the variance of the market return. The product of a firm's beta and the equity market risk premium is the firm-specific risk premium. Because an individual company's beta can change based on firm-specific factors, the firm-specific risk premium is time-varying.

The CAPM relationship is most commonly estimated using realised excess returns, measured as actual returns less the return on a risk-free asset. The assumption is that historical returns are a good proxy for expected returns, and monthly excess returns are approximately independently and identically distributed (IID) through time and jointly multivariate normal. Empirically, equation (1) is estimated using ordinary least squares for each stock, as follows:

$$R_{it} - R_{ft} = \alpha_i + \hat{\beta}_{im}(R_{mt} - R_{ft}) + \varepsilon_{it} \quad (2)$$

where i denotes the stock of a given firm and t denotes the time period. The CAPM beta (or market risk factor) is the slope coefficient in this regression. If markets are efficient, the intercept α_i should not be statistically different from zero and the residuals should be IID. Researchers have found that CAPM beta estimates for individual stocks are volatile and imprecise, and the residuals across firms may exhibit common sources of variation due to omitted variables (such as industry membership). The standard approach is to estimate betas and form portfolios that average across estimates; this study employs this type of approach. We form portfolios by country and measure the cost of equity as the average estimate across banks headquartered in a given country. Having calculated a bank's time-varying CAPM beta using equation (2), its cost of equity can be calculated using the equilibrium relationship in equation (1).

CAPM estimates are generated as follows. The first step is to calculate monthly returns on the equity index and individual stock using month-end values.[①] The monthly yield on a risk-free instrument is then subtracted to generate ex post excess returns. Next, monthly excess stock returns for each bank are regressed on the excess market returns for the national stock market index where a bank is headquartered. The study follows the standard approach of running rolling regressions using the past 60 months (five years) of observations, beginning in January 1985. This procedure produces the time-varying CAPM beta estimates from 1990 to 2009. Beta values in the 5% of the tails (both extremely low and high) are dropped to reduce the impact of outliers. The bank-specific equity premium is equal to the product of the CAPM beta and a country's historical equity market risk premium. The cost of equity is then the risk-free rate plus the bank-specific equity premium. The annual yield on a 10-year government bond is used as the risk-free rate, as this longer maturity approximates a shareholder's investment horizon. The inflation-adjusted cost of equity is then calculated by subtracting year-ahead inflation expectations from the nominal cost of equity estimates. Finally, the monthly estimates for the banks headquartered in a given country are averaged on an equally weighted basis to generate a monthly estimate of the cost of equity for each country's banking sector, as well as the standard deviation of this estimate.

Criticisms of the CAPM

Critics of the CAPM highlight a number of theoretical and empirical shortcomings of this model. Fama and French (2004) group these criticisms under two headings: the rational risk story and the behavioural story. Under the former, financial markets are efficient, investors are rational and forward-looking, and the expected return on an asset is a function of how its return covaries with the state of the economy. In this view, the main theoretical failure of the CAPM is the assumption that investors care only about the mean and variance of portfolio returns, and ignore other important dimensions of risk. The main empirical shortcoming is that a single market factor is not sufficient to explain the cross-section of realised returns, as seen in the large number of studies of CAPM anomalies. The solution is to use a more complicated asset pricing model along the lines proposed by the arbitrage pricing theory, where the risk factors reflect unidentified state variables that matter for consumption and investment choices.

The behavioural story views markets as irrational, with investor overreaction to good and bad times leading to swings in asset prices that cannot be justified by fundamentals. In this view, risk is not correctly priced due to cognitive biases of actors who overextrapolate past performance, leading to systematic and predictable mispricing of assets. These mispricings eventually unwind. Responding to this criticism, Stein (1996) argues that it does not matter whether expected return premia are rational or irrational since in either case they are part of the opportunity cost of equity.

Banks in sample by year

	United States	United Kingdom	France	Germany	Canada	Japan	Total
1990	28	11	4	6	6	9	64
1995	31	12	5	6	6	9	69
2000	33	17	8	6	6	10	80
2005	34	18	9	9	6	12	88
2009	34	18	9	9	6	13	89
All years	641	313	141	141	120	211	1567
% sample	41%	20%	9%	9%	8%	13%	100%

Table A

Data sources

The study is based on individual stock price data for 89 banks located in Canada, France, Germany, Japan, the United Kingdom and the United States. The sample banks are the largest publicly traded institutions, based on total assets, as reported in the annual survey of the top 1,000 banks by *The Banker* magazine. As many banks are included in each year as data are available. When two banks merge (eg JP Morgan and Chase Manhattan), only the surviving firm remains in the sample. Banks are included in the sample until their stock is no longer traded. As a result, the sample is unbalanced and changes over time as banks merge and are replaced by the surviving entity. Monthly data on the national stock market index for each country are taken from Datastream. The following indices are used: the S&P/TSX Composite (Canada), the CAC 40 (France), the DAX (Germany), the Nikkei (Japan), the FTSE 100 (United Kingdom) and the S&P 500 (United States). Results using MSCI indices for the European countries produce very similar estimates. Monthly data on government bonds are taken from the BIS Data Bank. Data on the historical equity market risk premia for each market are from Dimson et al (2002). Finally, monthly data on year-ahead expectations for inflation come from Consensus Forecasts.

[1] In the absence of data on the time series of dividends paid by banks to their common shareholders, this study uses monthly price returns, not total returns. This omission should not materially affect the results as banks in the countries studied pay dividends infrequently (quarterly, semiannually or annually) The covariance between bank returns and market returns is therefore not significantly affected. When dividends data are included for a subset of banks over the past five years, the results are very similar.

Bank-level estimates

Estimates vary significantly across countries …

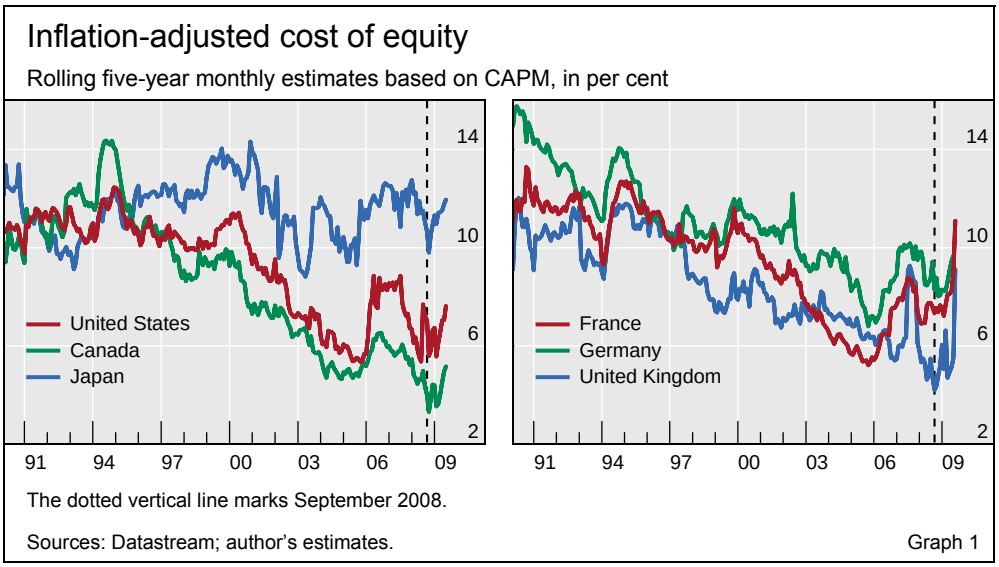
Graph 1 shows the monthly estimates of the cost of equity for banking sectors in the six countries from 1990 to mid-2009. Canadian and UK banks enjoyed the lowest average cost of equity over this period, followed by French and US banks. German and Japanese banks faced the highest costs, due to the high equity market risk premium in their countries. This relative ranking contrasts with the results based on earlier studies that estimate the cost of equity over different time periods and using different methods (Table 1). The studies' dissimilar results confirm that cost of equity estimates are sensitive to the methodology employed.

… with levels trending downwards over two decades …

The real cost of equity based on the CAPM has been trending downwards for most of the past two decades. The monthly cost of equity estimates reach a low in 1992 for Japanese banks, in 2005 for French, German and US banks, in 2008 for UK banks, and in 2009 for Canadian banks. The decreases in the cost of equity across countries are large and economically important, falling by more than 700 basis points over this period. The greatest decline occurred for Canadian banks, followed by German banks, which began the 1990s at the highest level of all six countries but then converged towards the levels seen in other European countries.

… punctuated by cyclical rises

While the trend is downward, there are clear cyclical patterns for each country, with upsurges in the banking sector cost of equity around 1994 and again in 1999–2000 for all countries. Banks in most countries also experienced increases in either 2006 or 2007, and again in 2009. While the rises in 2007 may be explained by the onset of the subprime turmoil in July of that year, those over 2006 were equally large: around 300 basis points for US banks relative to 2005, 150 basis points for Japanese banks, 115 basis points for Canadian banks and 40 basis points for French banks. The vertical line in Graph 1 marks September 2008, the month when Lehman Brothers declared bankruptcy, leading to a general loss of confidence in the financial sector. Cost of equity estimates rise following this event for all banking sectors, with the largest increases in the United Kingdom and France.



The dotted vertical line marks September 2008.

Sources: Datastream; author's estimates. Graph 1

Period averages reveal longer-term trends …

These trends are more apparent when examining country averages across three periods: 1990–2000, 2001–05 and 2006–June 2009 (Table 3). The table shows the average level of the cost of equity estimate and its standard deviation for each period. The next two columns break the cost of equity into two parts, the risk-free rate and the banking sector risk premium. The relative importance of these two components for the level of the cost of equity is shown in the next two columns, and the right-hand column shows the average CAPM beta for a country's banking sector. Here we discuss developments in the cost of equity, while movements in the components are examined in the next section.

The decade 1990–2000 saw an average cost of equity near or above 10% in all cases. The mean values of the cost of capital decline in each period for most countries, with the largest declines seen over 2001–05. By 2009, the average estimate for Canada had fallen to close to 5% and for the United Kingdom to 6%. Japan is the exception to this pattern: its banks have faced an estimated cost of equity above 11% since 1990.

… but conceal considerable variation across banks

The country averages conceal considerable variation across individual banks. Table 3 shows the standard deviation of the cost of equity estimates, based on the cross-section of the bank-level estimates for each country. For US banks during the 2006–09 period, for example, an estimate one standard deviation above the mean has a value of 10.3%, more than double a value one

Components of real cost of equity estimates

Country	Period	Cost of equity[1]		Of which:		As percentage of level:		CAPM beta
		Mean of estimates	Standard deviation	Real risk-free rate	Banking risk premium[2]	Real risk-free rate	Banking risk premium[2]	
Canada	1990–2000	10.7	0.8	5.0	5.7	46%	54%	1.0
	2001–05	6.1	1.2	2.8	3.3	47%	53%	0.6
	2006–09	5.2	0.8	2.0	3.3	37%	63%	0.6
France	1990–2000	11.1	1.4	4.7	6.4	43%	57%	1.0
	2001–05	7.3	2.5	2.7	4.6	37%	63%	0.7
	2006–09	7.6	3.2	2.4	5.2	31%	69%	0.8
Germany	1990–2000	12.2	2.7	4.1	8.1	33%	67%	0.9
	2001–05	9.5	3.6	2.8	6.8	29%	71%	0.7
	2006–09	9.0	4.2	2.1	7.0	23%	77%	0.7
Japan	1990–2000	11.8	3.3	2.6	9.2	22%	78%	0.9
	2001–05	11.1	3.6	1.6	9.5	14%	86%	1.0
	2006–09	11.6	4.6	1.2	10.5	10%	90%	1.1
United Kingdom	1990–2000	9.9	2.2	4.3	5.6	44%	56%	1.0
	2001–05	7.3	2.6	2.4	4.9	33%	67%	0.9
	2006–09	6.1	2.8	2.1	4.0	34%	66%	0.7
United States	1990–2000	10.7	2.2	3.4	7.3	32%	68%	1.1
	2001–05	7.4	2.7	2.2	5.2	29%	71%	0.8
	2006–09	7.5	2.8	2.0	5.5	26%	74%	0.8

[1] In per cent, based on simple average across sample banks for a given country. [2] The banking sector risk premium is the product of the CAPM beta and the equity market risk premium. Table 3

standard deviation below of 4.7%. Similar variation is seen for the other countries, with the highest dispersion for Japan. The standard deviation of the estimates has increased over time in five out of the six countries, highlighting the difficulty of measuring a bank's cost of equity using the CAPM method.

Sector-level estimates

Calculating bank-level estimates is data-intensive …

Collecting and calculating bank-level estimates of the cost of equity is data-intensive and time-consuming. Given the importance of these measures, it is useful to see whether reasonable estimates can be obtained using a banking sector equity sub-index as a proxy for individual banks. Banking sub-indices are available for the 20-year period for the United Kingdom and Germany, and from January 1988 for Canada, October 1988 for Japan, January 1995 for the United States and January 1999 for France. The monthly excess returns of these indices are regressed on the excess market returns from the national stock market index to generate the CAPM cost of equity estimates as before.

… but necessary as equity sub-indices are a poor proxy

The estimates based on banking sub-indices also trend downwards, and have an unconditional correlation with the bank-level estimates of 88%. Country estimates based on the banking sub-indices, however, are an average 122 basis points higher than those based on individual banks. The higher cost of equity based on the banking sub-index can be linked to the higher beta; the sensitivity of banking sub-index returns to market movements is higher than the sensitivity of individual bank returns. This higher beta is due to two differences between the banking sub-indices and the bank-level measures. First, the sub-indices are market capitalisation-weighted portfolios whereas the bank-level estimates are equal-weighted. Banks with a higher market capitalisation have a greater impact on the index returns. When a bank's stock price is rising (falling), its market capitalisation rises (falls) and its relative importance for the return on the sub-index increases (declines). The bank-level estimates, by contrast, are the simple average of the banks in the sample. Second, the banking sub-indices include only a subset of banks, namely those that are part of the market index. In some countries, the sample used in this paper is broader.

Overall the sub-index estimates are closest to the average bank-level estimates for the United States, but farthest away for the United Kingdom. The estimates diverge significantly during the recent crisis period, when the banking sub-index would suggest a much greater increase in the banking sector cost of equity. The cost of equity estimate based on the average of individual banks is preferable as it is more representative of the cost of equity for the average bank in a given country.

What explains changes in cost of equity estimates?

The CAPM cost of equity can be decomposed into two parts …

This section decomposes the cost of equity estimates for a given country's banking sector into two parts. The CAPM estimate is the sum of a current risk-free rate and a bank-specific risk premium. We look at the relative importance of these two components over time (Graph 2).

Components of the real cost of equity

… the contribution of risk-free rates …

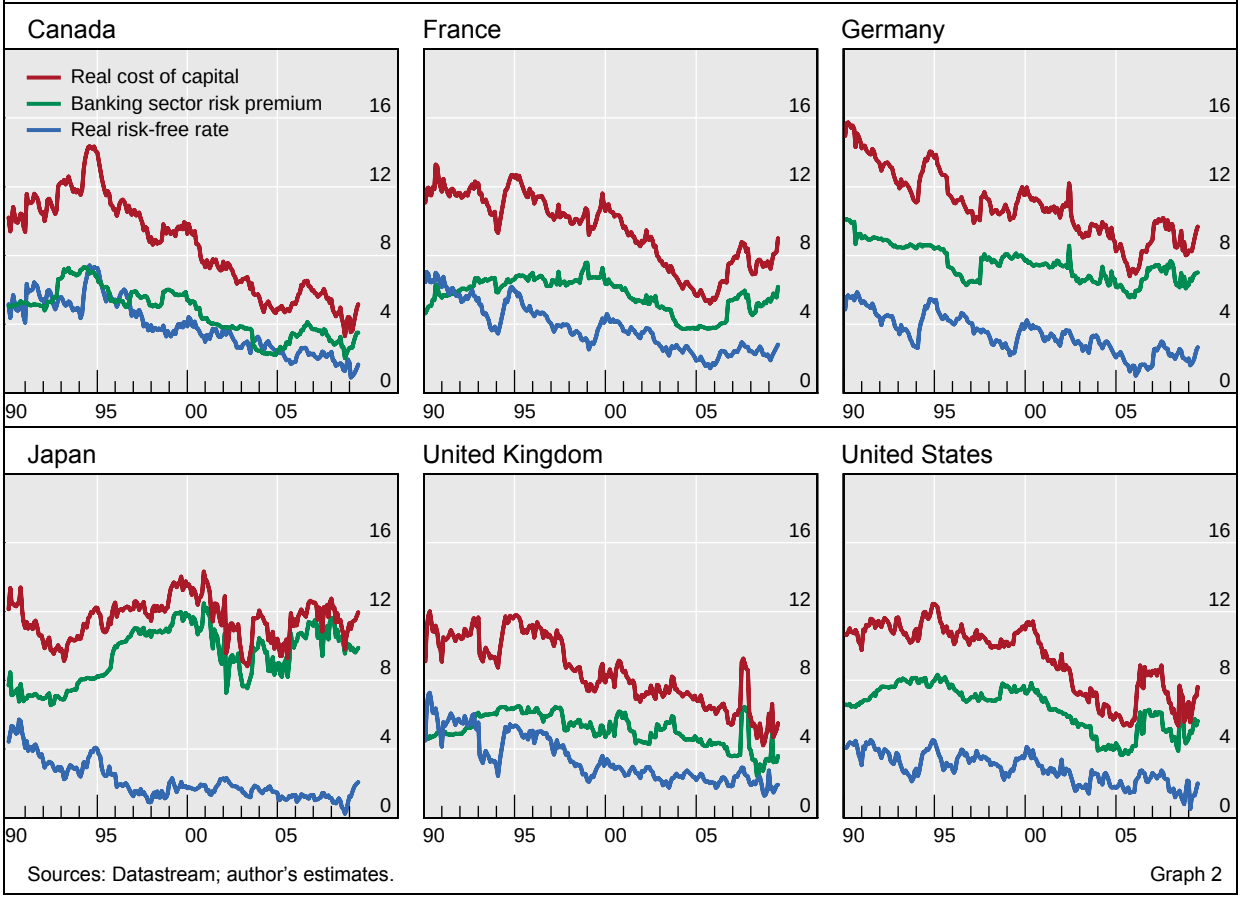
Under the CAPM, risk-free government bonds provide the benchmark return when evaluating an investment in equities. Given the greater risk associated with equities, an investor expects to earn a premium over the risk-free rate (Graph 2). On average, the risk-free rate represents one third of the level of the CAPM estimates over the 20-year period examined here. Yields on risk-free bonds adjusted for inflation have declined from 1990 to 2009, contributing to the decline in the cost of equity. These yields reached levels around 2% in most countries and close to 1% in Japan (Table 3). In Canada, inflation-adjusted 10-year Treasury yields have declined from an average of 5% in the 1990–2000 period to 2% in 2006–09. As a result, the contribution of the risk-free rate to the Canadian bank cost of equity has declined from 46% to 37%.

… and the banking sector risk premium …

In the CAPM, the banking sector risk premium is firm-specific and rises for stocks with greater sensitivity to market risk. While the level of this premium has been falling over time, its proportionate contribution to the cost of equity has been increasing (Table 3). In the period 2006–09, it represents two thirds of the estimate for banks in Canada, France and the United Kingdom, around three quarters for the United States and Germany, and 90% for Japan. Clearly, this risk premium is important for understanding changes in cost of equity estimates.

Components of cost of equity estimates by country

In per cent



Sources: Datastream; author's estimates.

Graph 2

The fall in the risk premium is due to the decline in the beta of bank stocks over time. A lower beta shows that the sensitivity of bank returns to market movements (both positive and negative) has diminished on average. Again this decline in bank betas is seen in all countries except Japan. In the United States, for example, the CAPM beta over 1990–2000 was 1.1, but it has since fallen to 0.8. Given that the equity market risk premium is treated as a constant, the lower beta leads directly to a decline in the banking sector risk premium in this estimation. For example, this lower beta explains a reduction of 200 basis points (ie (1.1 – 0.8) x 6.7%) in the cost of equity estimates for US banks.

… which has declined due to a fall in banking betas

Bank betas trend downwards for most countries over the 20-year period (Table 4). This decline has both a statistical explanation and an economic one. Statistically, betas decrease because either the covariance of bank returns with market returns declines (the numerator) or the variability of the market increases (the denominator). Both effects are present. The covariances increase on average over 2001–05 for all countries except Japan,[6] but the rise in variance of market returns is even greater, leading betas to fall. In Japan, the decline in covariance is less than that in market variance, so betas rise. Over the period 2006–09, covariances and variances are sharply lower in all countries, with changes of similar magnitude for both variables in five out of six countries, leaving betas relatively unchanged. The exception is the United Kingdom, where the drop in covariance is much larger, leading to a lower beta on average.

Bank betas decline in most countries

Economically, the declining covariance of bank stock returns with market returns reflects changing investor perceptions of bank profitability and riskiness. Over much of the recent period, bank earnings were high and stable, reflecting the growth in new sources of income. Banks steadily increased dividends, with global banks raising dividend payouts on average by a compound rate of 15% per annum over 2002–07. Higher earnings partly reflected an increase in risk that was not widely understood, with banks reportedly taking on more leverage (both on- and off-balance sheet) and funding mismatches. Investors do not appear to have priced this greater risk correctly until the financial crisis. As a result, stable and growing earnings with larger dividend payouts were associated with bank returns that were less volatile than the overall market prior to 2007.

Lower betas are due to a lower covariance of bank stock returns and market returns

The onset of the financial crisis coincided with a rise in bank betas (Table 4). Average bank betas increased over 2006 for most countries. The average US bank beta, for example, went up from 0.58 in 2005 to 0.84 in 2006, an increase of one third. European bank betas rose again over 2007, with the biggest increase for UK banks in the third quarter when Northern Rock received support from the Bank of England. After declining in the first quarter of 2008, US bank betas rose sharply through the third quarter of 2008 when Lehman Brothers went bankrupt. This movement of betas is consistent with investors viewing bank stocks as riskier as the crisis progressed, with the risk

Bank betas rise as the financial crisis unfolds

[6] Note that variances and covariances are estimated over the previous 60 months, which introduces some sluggishness into the beta estimates and consequently the cost of capital.

Bank betas by country[1]						
	Canada	France	Germany	Japan	United Kingdom	United States
1990	0.91	0.81	1.00	0.73	0.87	0.98
1995	1.04	1.01	0.83	0.87	1.14	1.19
2000	0.86	0.93	0.78	1.14	1.01	1.09
2005	0.52	0.57	0.61	0.93	0.79	0.58
2006	0.65	0.67	0.69	1.08	0.73	0.84
2007	0.61	0.83	0.76	1.09	0.87	0.83
Q1 2008	0.50	0.69	0.74	1.10	0.61	0.69
Q2 2008	0.54	0.77	0.65	1.06	0.49	0.70
Q3 2008	0.43	0.77	0.69	1.00	0.52	0.84
Q4 2008	0.43	0.80	0.65	1.01	0.61	0.67
Q1 2009	0.48	0.83	0.69	0.98	0.70	0.76
Q2 2009	0.60	0.86	0.73	0.98	0.61	0.83

[1] Averages across banks and periods for each country. Table 4

declining following government interventions to support systemically important banks in the fourth quarter of 2008. By the second quarter of 2009, bank betas were back to their 2007 levels for Canadian, French, German and US banks, but lower for Japanese and UK banks.

In summary, cross-country changes in the cost of equity estimates over time can be explained by variations in two factors: the decline in real risk-free yields and the decreasing sensitivity of bank stocks to market risk as measured by the CAPM beta. Lower betas are explained by a lower covariance of bank stock returns with market returns. Canada has particularly benefited over this 20-year period, with cost of equity estimates for its banks halving. In Japan, a decline in risk-free rates has been offset by a rise in the banking sector risk premium. This premium has increased due to the higher beta, which, when multiplied by the historical equity market risk premium for Japanese equities (10.0%), led to an increase in the risk premium for bank stocks.

Sensitivity of estimates to assumptions

The CAPM estimates are sensitive to the inputs

While the CAPM approach is motivated by theory, its implementation relies on a number of assumptions. This section considers the sensitivity of the estimates to changes in two assumptions – the equity market risk premium and the calculation of the beta.

The equity market risk premium may be time-varying, not constant

The CAPM estimates in this paper are based on a constant equity market risk premium for each country based on its long-term average (Table 2). As a direct result of this assumption, changes in the banking sector risk premium are only possible due to changes in the CAPM beta. How would allowing the equity market risk premium to vary across periods affect the estimates in this case?[7] Estimates are calculated assuming that the equity market risk premium

[7] Unfortunately there is no simple way to derive time-varying estimates of the expected equity market risk premium. As shown in Table 2, the historical proxies have high standard

in each country is 10% below its long-term mean over 2001–05, and 10% above its mean since 2006. Such a change affects the level but not the path of the estimates. It lowers the country estimates of the average cost of equity over 2001–05 by 32 to 94 basis points, with the biggest drop for Japan (where the equity market risk premium is highest). The cost of equity is 33 to 105 basis points higher than the estimates in Table 3 thereafter.

Beta estimates can be calculated in various ways

A second concern is the method used to estimate the CAPM beta, which relies on rolling regressions using the past five years of monthly observations. Overlapping windows imply that the beta changes slowly, with increases in the covariance of a bank's stock returns relative to the market only showing up over time. An alternative specification is to calculate betas for each year based on 12 months of returns. These estimates are noisier due to the reduced number of observations, but the periods no longer overlap and any changes in covariance will appear more quickly.[8] Overall this change results in no consistent pattern across countries. In the recent period (which includes the crisis), the cost of equity estimates are higher for France and Germany and lower for Japan. Counterintuitively, however, the estimates are lower for the United Kingdom and the United States as the measured betas are lower on average using this method.

Conclusion

This study provides estimates of the real cost of equity for banks headquartered in six countries over the period 1990–2009. The estimates are based on the single-factor CAPM model used by the Federal Reserve System. The real cost of equity decreased steadily across all countries except Japan from 1990 to 2005 but then rose from 2006 onwards. There are clear cyclical patterns for each country, with increases in the banking sector cost of equity around 1994 and again in 1999–2000. Part of the decline derives from the fall in real risk-free rates over the period examined. The main contributor, however, is the banking sector risk premium, which represents more than two thirds of the estimate. The sensitivity of banking stocks to market risk has diminished over time, as seen in the fall in CAPM beta estimates in all countries except Japan. This decline in bank betas is explained by the lower covariance of bank stock returns with market returns for much of this period. Since the onset of the crisis, bank betas have risen for most countries.

References

Barnes, M L and J A Lopez (2006): "Alternative measures of the Federal Reserve Banks' cost of equity capital", *Journal of Banking and Finance*, no 30, pp 1687–711.

deviations that are three times larger than the averages, suggesting periods with large positive and negative values. For more on this topic, see Fama and French (2002).

[8] The mean betas produced by this averaging method are statistically different from the rolling estimates at the 5% significance level for all countries except France.

Brunner, R F, K M Eades, R S Harris and R C Higgins (1998): "Best practices in estimating the cost of capital: survey and synthesis", *Financial Practice and Education*, no 9, pp 13–28.

Campbell, J Y, A W Lo and A C MacKinlay (1997): *The econometrics of financial markets*, Princeton University Press.

DeLong, J B and K Magin (2009): "The US equity return premium: past, present and future", *Journal of Economic Perspectives*, no 23, pp 193–208.

Dimson, E P, R Marsh and M Staunton (2002): *Triumph of the optimists: 101 years of global investment returns*, Princeton University Press.

Easton, P (2009): "Estimating the cost of capital implied by market prices and accounting data", *Foundations and Trends in Accounting*, no 2, pp 241–364.

Fama, E F and K French (1996): "Multifactor explanations of asset pricing anomalies", *Journal of Finance*, no 51, pp 55–84.

——— (2002): "The equity premium", *Journal of Finance*, no 58, pp 637–59.

——— (2004): "The capital asset pricing model: theory and evidence", *Journal of Economic Perspectives*, no 18, pp 25–46.

Graham, J R and C R Harvey (2001): "The theory and practice of corporate finance: evidence from the field", *Journal of Financial Economics*, no 60, pp 187–243.

Green, E, J A Lopez and Z Wang (2003): "Formulating the imputed cost of equity capital for priced services at Federal reserve Banks", *Federal Reserve Bank of New York Economic Policy Review*, no 9, pp 55–81.

Maccario, A, A Sironi and C Zazzara (2002): "Is banks' cost of equity capital different across countries? Evidence from the G10 countries major banks", Libera Università Internazionale degli Studi Sociali (LUISS) Guido Carli, working paper, May.

Stein, J (1996): "Rational capital budgeting in an irrational world", *Journal of Business*, no 69, pp 429–55.

Zimmer, S A and R N McCauley (1991): "Bank cost of capital and international competition", *FRBNY Quarterly Review*, winter, pp 33–59.