Economics Bulletin

Volume 40, Issue 1

Credit Quality and Stock Returns of Commercial Banks

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Abstract

Commercial banks exhibit distinctive dynamics that are priced in their stock returns. This paper evaluates conventional asset pricing models using an exchange rate adjusted portfolio of banking firms from fourteen European countries and proposes a banking specific risk factor. Our findings suggest that credit quality premium (proportion of non-performing loans to total loans and measured as BdMGd - bad minus good) is systematic in nature. Hence, investors demand incremental risk premium for investing in banking stocks with lower credit quality. We also note that the credit quality premium is more significant for banks that are smaller in size. We conclude that the variation in stock returns for banking firms is better explained by an asset pricing framework augmented for credit quality as compared to conventional pricing propositions. These findings have considerable implications for portfolio management and pricing of banking equities, notably in an international context.

Citation: Nawazish Mirza and Amir Hasnaoui and Birjees Rahat, (2020) "Credit Quality and Stock Returns of Commercial Banks", *Economics Bulletin*, Volume 40, Issue 1, pages 1-17
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Submitted: October 01, 2019. **Published:** January 01, 2020.

1 Introduction

The propositions about asset pricing by Sharpe (1964), Lintner (1965) and Mossin (1966) revolve around a single factor capital asset pricing model (CAPM) with market risk premium as the only variable that is priced in stock returns. Over time, as the empirical literature on the subject evolved, a large number of academicians suggested additional factors that may affect stock returns. These included the *price earning (P/E) rati*o [Basu (1977)], *firm size* [Banz (1981)] and *book to market and equity capitalization* [Fama and French (1992)]. Fama and French (1992, 1993, 1995) established that the market risk of CAPM alone is unable to explain the variations in stock returns and firm size and book to market ratio are relevant determinants of expected returns. The three factor proposition emerged as a noteworthy alternate asset pricing model and its statistical evidences posed a serious challenge to the validity of CAPM. The exhaustive literature based on US and non US data provides mixed results for the three factor model. Some evidence suggests that *reports on death of beta* are premature and CAPM is still a better predictor of returns, while others propose that size and value premium are deterministic variables for returns and CAPM should be discarded in favour of the Fama and French three factor model.

Financial firms constitute a substantial portion of equity markets both in developed and emerging markets and thus are strong candidates for inclusion in investment portfolios. Moreover, the emphasis on the use of market discipline to analyse the risk taking behaviour of financial firms by the Bank for International Settlements warrants the need to understand the risk factors relevant to banking equities. Stone (1974) proposed interest rate sensitivity to explain the variation in stock returns of commercial banks. Some of the later studies reported empirical results in favor of interest rate factor [Fama and Schwert (1977), Flannery and James (1984)] while others deduced a weak relationship between the interest rate and stock returns [Flannery et al. (1997)]. However, a caveat to interest rate factor is its variability over time. The factor is reported to have a higher explanatory power when interest rate volatility is high, while during periods of interest rate stability the stock returns remained unaffected [Yourougou (1990), Choi et al (1992)].

Barber and Lyon (1997) examined the cross section of financial stock returns in NYSE vis-à-vis size and value premium and concluded that size and value factors are relevant for both financial and non-financial firms. Viale et al (2009) analysed the risk factors priced in US banking equities and concluded that the relevant risk factors are market risk premium and shocks to the slope of yield curve.

Bae (1990) studied the impact of expected interest rates and surprises to these interest rates on the stock returns of depository and non-depository institutions and reported a higher sensitivity for surprises to yield curves with longer maturity. Neuberger (1993) analyzed the impact of shocks to the yield curve of US commercial banks' returns from 1979 to 1990 and reported a shift in risk sensitivities. Dinenis and Staikouras (1996) analyzed the impact of expectations and innovations in interest rates on UK banks' stocks and found a negative relation between innovation and returns.

Despite the strong relevance of credit risk for the banking system, its impact on banking stocks is not very clear. Although the interest rates (or its innovations) have been widely discussed as a determinant of banking returns, yet the impact of credit risk on financial asset pricing has surprisingly been overlooked. The informational content of credit risk (disclosure regarding loan loss reserve or non-performing loans) provides strong evidence of banking returns sensitivity to such announcements. Beaver et al. (1989) studied the relationship between financial reporting, supplementary disclosures and bank share prices for US banks and found that supplementary variables of interest rate risk and default risk have significant explanatory power. They also deduced that loan loss provisions are more significant as compared to traditional valuation variables. Beaver et al. (1989) concluded that higher loan loss provisions are associated with higher market values of bank stocks.

Griffin and Wallach (1991) reported that the reclassification of non-performing advances evoked an adverse response in the stock market. These results depict the rational expectations of investors since an increase in loan loss provisions is a credible signal for a banks intention to sustain its asset quality. They concluded that stock markets discriminate between banks on the basis of default risk. Elyasiani and Mansur (1998) modeled the interest, market and exchange rate risk for Japanese banking institutions and suggested that the market and exchange rate risks were significant for all banks while interest rate risk was not relevant. Hatfield and Lancaster (2000) examined the market reaction to loan loss reserve additions and reported a negative reaction to loan loss additions prior to their announcement. They attributed the negative reaction to the surprise factor, as an increase in loan loss provisions indicate an erosion in asset quality. However, once the information is known, the investors perceive the additions as a strengthening of the risk absorption capacity. They concluded that banking stocks exhibit a strong reaction to announcements on default risk and asset quality.

Docking et al. (2000) analyzed the reaction of stock prices to loan loss reserve announcements and found there to be a significant negative relationship between loan loss announcements and abnormal returns. They noted that the loan loss reserves had a significant impact despite the fact that these provisions are accounting adjustments and do not represent concurrent cash flow implications. Cooper et al. (2003) investigated the predictability of a cross section of bank returns and concluded that the predictability power of bank specific variables is superior to traditional asset pricing models. Agusman et al. (2008) analyzed the relationship between accounting and capital market risk measures using panel data from ten Asian countries. Their findings suggest that despite the significant differences in banking practices, the firm specific risk, notably credit risk measured as loan loss reserve to gross loans, is more relevant than systematic risk and therefore can be used a substitute for market based risk measures.

Given these unique sensitivities of banking firms, it will be noteworthy to observe if conventional asset pricing variables can predict expected returns and whether there are more specific factors sensitivities for banking stocks. We use an international portfolio approach on listed banking stocks from fourteen European countries using data that span over ten years i.e. from 2009 to 2018 and propose an asset quality augmented (*bad minus good*) Fama and French model. The credit quality[1] of a bank is a unique factor that can possibly affect all aspects of a bank's performance. A substantial decline in asset quality will not only erode the profitability but could ultimately lead to the failure of the bank. Therefore, banks with better asset quality enjoy better credit standings while banks with low asset quality, owing to higher non-performing loans, have higher risk accompanied with a comparatively higher probability of default.

We report results for a single factor CAPM, Fama and French three factor model and a four factor credit quality model. The results demonstrate significant factor loadings for four factor asset quality model that was superior to Fama and French three factor model and a single factor CAPM. Therefore; our main findings suggest that a Fama and French model including size and value factors augmented for asset quality best captures the cross section of returns in European banking stocks.

This paper has multiple contributions towards existing literature. Firstly, we extend the asset pricing literature to financial stocks using an exchange rate adjusted international portfolio and a synthetic value weighted index. Secondly, we propose a unique risk factor of banking stocks that is very critical for their intermediary efficiency and long term survival. Lastly, our results have practical implications for investors and fund managers. The asset pricing of banking stocks for investment and valuation should take into account size, value and asset quality premium and credit quality should play an integral role in estimating the cost of equity of banking firms'. Lastly, these results provide an insight into the risk factors of banking stocks that might be of interest for regulators to analyse the risk taking behaviour of such firms.

The rest of the paper is organised as follows. Section II will discuss the data and methodology. Empirical results are presented in Section III, while Section IV will conclude.

[1] In this paper we examine loan quality of banks as a determinant of their stock returns. This will be sometimes referred as asset quality and used as a synonym for credit/loan quality.

2 Research Methodology

2.1 Data and Sample

This study focuses on listed banking stocks from 14 European countries including Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Spain, Sweden, Switzerland and United Kingdom for the period 2009 − 2018. The primary sample constitutes of banking common stocks from all countries that have daily dividend adjusted price data available. To be included in the sample for year *t*, the selected stocks should have data available on book value of equity, numbers of shares outstanding, non-performing loans and gross advances for year *t - 1*. We compute firm size as market value of equity (price times number of shares outstanding), book to market ratio and an asset quality measure of non-performing loans to gross advances (NPL/GA).

Furthermore, following Fama and French (1993), we address the survivorship bias by including only those stocks which have been listed for at least two years. Similarly, the stocks classified as *Dead* or *Delisted* are discarded from the sample. Lastly, we account for the non-synchronous trading phenomenon in the final sample as, in presence of sleeping stocks, the estimated risk parameters are likely to be biased. Therefore, in the final sample we consider only those banking stocks that demonstrate active daily trading and exclude stocks that have at least 85% non-zero returns in one year. Based on this criterion, the number of selected banking stocks from each country for various years is reported in Table 1.

The sample consists of 118 baking firms in 2009 that increased to 236 in 2018. We observed that the variation in sample is because of the thin trading criteria as most of the banks had no or substantially inactive trading during the early years. However, over time with an increase in overall market activity, the volumes for banking firms increased, resultantly doubling our sample by 2018. Since all of the stocks in the sample exhibit active returns, our sample is free from any bias that could arise due to non-synchronous trading. On average, the sample contains more banks from Denmark, Germany, France, Switzerland and United Kingdom while the contribution of Austria, Belgium and Luxembourg remained low.

The selected stocks from each country are combined to form *international portfolios.* An important consideration in the formation of such portfolios is common currency, as we cannot directly compare the risk and returns emanating from stocks denominated in different currencies [Fletcher (2000)]. Most of the countries included in the sample have prices and other data available in Euros; however, for Denmark, Sweden, Switzerland and United Kingdom, the daily prices are denominated in local currencies.

Table 1
Country Wise No of Firms 2009 – 2018

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Austria	7	7	7	9	9	11	11	11	10	10
Belgium	5	5	5	7	9	9	11	11	10	10
Denmark	12	13	15	18	19	19	21	21	23	24
Finland	3	5	5	6	8	9	5	5	4	4
France	7	9	11	15	17	17	17	15	18	21
Germany	9	11	14	14	17	11	16	29	29	29
Ireland	6	9	12	12	16	15	15	15	14	15
Italy	12	13	15	15	10	10	12	15	15	14
Luxembourg	3	3	3	3	3	4	4	8	11	10
Netherlands	4	4	4	4	5	11	11	13	15	13
Spain	9	7	7	12	15	15	15	17	19	21
Sweden	11	11	11	11	13	13	12	14	11	11
Switzerland	13	15	15	16	18	19	22	22	23	25
United Kingdom	17	19	22	22	27	25	25	26	27	29
Total	**118**	**131**	**146**	**164**	**186**	**188**	**197**	**222**	**229**	**236**

The Table presents the country wise number of banks in our sample for each year. This is the final sample that satisfy the selection criteria as described in section 2.1

To mitigate the impact of exchange rate, we convert the prices and fundamental data of these four countries into the common currency (Euro) at spot rate similar to Mirza and Afzal (2011). Once the prices are homogenized to *Euro*, the individual daily returns will be computed. These returns will take the form

$R_{i(t)} = Ln\left[\frac{P_{i(t)}}{P_{i(t-1)}}\right]$, where $R_{i(t)}$ represents return for stock i on day t while $P_{i(t)}$ and $P_{i(t-1)}$ represent prices (in euro) for stock i on day t and $t - 1$ respectively. These individual returns are then used to compute value weighted portfolio returns sorted for size, book to market and asset quality. The descriptive statistics for non-performing loans to gross advances are reported in Table 2. The average NPL/GA for France and Germany remained higher than other countries depicting bad asset quality for French and German banks, while Danish banks exhibited better asset quality with a low NPL/GA ratio.

2.2 Sorting Portfolios for Size, Value and Credit Quality

In order to capture the impact of traditional size and value premium, along with the augmented factor of credit quality, the portfolios are constructed using a three-way sort as adapted by Mirza et al. (2013). Using the median of market value of equity for year t, we classified all stocks into two size portfolios as big (B) and small (S) for year $t+1$ followed by book to market portfolios in two size groups based on book to market value. This results in a total of six market value and book to market portfolios, with three book to market portfolios in each size group.

Furthermore, we classified the stocks in each of these six portfolios according to their credit quality into two groups. There are two main ratios that are widely accepted as possible indicators of asset quality and credit risk, non-performing loans to gross advances (NPL/GA) and loan loss reserve to gross loans [Agusman et al (2008)]. However, to estimate credit quality, NPL/GA is preferred over loan loss reserve to gross loans because the NPL/GA ratio is dependent on a prudent and clean lending system and credit risk controls. A higher NPL/GA ratio indicates a higher proportion of non-performing loans vis-à-vis total loans and ultimately requires more provisioning.

The credit quality could affect a bank's performance by impacting both revenues and expenses. Initially, bad loans result in a reduction in interest revenues on loan portfolios and later a provision is required to expense out the impact of such loans.

Table 2
Country Wise Firm Statistics Firm
(Non-Performing Loans to Gross Finances %)

Country	2009		2010		2011		2012		2013		2014		2015		2016		2017		2018	
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Austria	6.4	5.6	7.0	5.4	5.1	5.2	4.6	3.1	4.7	1.6	3.8	3.4	3.6	2.9	3.5	3.7	3.5	1.9	6.5	5.4
Belgium	6.8	7.3	8.2	6.2	4.8	3.2	4.9	3.3	4.3	3.5	4.3	4.1	4.4	3.6	3.1	2.7	3.1	2.7	2.5	1.6
Denmark	2.0	1.0	2.6	1.5	7.2	1.5	2.5	1.8	2.3	1.7	2.2	1.8	2.3	1.6	1.6	1.0	1.1	1.0	4.0	1.5
Finland	1.7	1.5	1.7	1.5	2.2	0.7	3.2	0.7	2.3	0.7	2.4	0.7	6.2	1.1	3.2	0.9	0.9	0.8	1.6	1.5
France	14.9	14.5	16.5	14.9	11.1	8.6	10.7	7.9	11.7	11.1	10.2	8.4	7.2	6.4	7.0	5.7	6.9	5.5	7.2	5.3
Germany	13.7	9.8	13.4	9.3	5.7	5.2	8.0	7.1	6.9	6.8	8.2	6.1	10.4	5.5	5.5	4.0	5.2	3.6	4.8	3.5
Ireland	2.9	1.1	2.8	1.2	1.5	1.5	1.5	1.5	1.3	1.2	1.2	1.0	1.6	1.3	1.5	1.4	1.3	1.3	3.8	2.2
Italy	7.3	5.4	6.8	4.6	3.9	2.6	9.9	2.9	3.2	3.6	17.2	5.2	7.3	6.6	7.3	5.9	8.0	5.7	9.8	6.8
Luxembourg	8.3	6.1	8.7	7.4	5.2	5.4	5.5	6.3	4.5	4.6	4.1	3.9	3.8	3.0	2.5	2.1	6.4	0.8	5.5	2.7
Netherlands	5.2	3.9	6.8	5.0	2.9	2.0	6.2	3.1	2.4	2.7	2.1	2.3	2.5	2.5	3.0	2.4	2.3	1.8	3.2	2.9
Spain	3.5	2.9	5.5	2.1	7.1	4.4	6.2	3.1	6.5	6.1	2.5	1.6	2.0	1.3	1.7	1.1	3.1	1.5	6.1	4.9
Sweden	4.7	4.8	4.4	5.6	3.9	1.8	4.5	1.2	5.4	1.3	4.5	0.8	4.8	1.8	5.1	1.5	3.1	1.4	2.6	2.1
Switzerland	11.9	11.6	6.7	5.7	3.1	3.9	3.2	2.3	5.4	3.0	5.1	3.1	4.5	2.8	4.1	2.6	3.6	2.2	2.6	1.9
UK	7.3	3.7	7.6	5.5	5.1	4.1	11.3	5.4	13.5	4.4	6.1	2.8	4.1	1.4	4.0	1.9	4.5	1.9	5.6	4.0

The table represents credit quality ratio for the sample period. This is calculated as Mean (and median) for all banks for each country in a given year.

To include the asset quality factor in our proposition, stocks having a NPL/GA[2] value higher than the median are considered as bad quality banks (B_d), while those with a lower value are classified as stocks having good asset quality (G_d). In this manner we obtain a total of twelve value weighted portfolios that contain stocks which are sorted for size, book to market and asset quality. These portfolios are rebalanced every year in June for the sample period based on size, book to market and asset quality. The portfolio sorting procedure is illustrated in Table 3. The twelve portfolios are titled as per their size, book to market value and asset quality[3].

Table 3
Portfolio Sorting on Size, Value and Credit Quality

Market Capitalization	Value Factor	Credit Quality	Portfolios
Big Cap	High B/M	Bad Credit Quality	BHB_d
		Good Credit Quality	BHG_d
	Medium B/M	Bad Credit Quality	BMB_d
		Good Credit Quality	BMG_d
	Low B/M	Bad Credit Quality	BLB_d
		Good Credit Quality	BLG_d
Small Cap	High B/M	Bad Credit Quality	SHB_d
		Good Credit Quality	SHG_d
	Medium B/M	Bad Credit Quality	SMB_d
		Good Credit Quality	SMG_d
	Low B/M	Bad Credit Quality	SLB_d
		Good Credit Quality	SLG_d

The sorting procedure as proposed by Mirza et al. (2013)

[2] NPL/GA is the value of non-performing loans divided by the total value of the loan portfolio (including non-performing loans before the deduction of specific loan-loss provisions).
[3] To understand the notations, here is a brief representation. The portfolio BHB_d will represent stocks that are big (B) in size with high book to market ratio (H) and bad asset quality (B_d). Similarly, SLG_d will represent stocks that are small (S) in size with low book to market (L) and good asset quality (G_d).

2.3 Estimation of Variables

The testable versions of the three models that will be analysed for each of the twelve portfolios are mathematically represented as follows.

$$R_{p(t)} - R_f = \propto + \left(R_{m(t)} - R_f\right)\beta_{1p} + \varepsilon_t$$

$$R_{p(t)} - R_f = \propto + \left(R_{m(t)} - R_f\right)\beta_{1p} + (SMB_t)\beta_{2p} + (HML_t)\beta_{3p} + \varepsilon_t$$

$$R_{p(t)} - R_f = \propto + \left(R_{m(t)} - R_f\right)\beta_{1p} + (SMB_t)\beta_{2p} + (HML_t)\beta_{3p} + (B_dMG_{d_t})\beta_{4p} + \varepsilon_t$$

where $R_{p(t)} - R_f$ represents excess stock returns for each value weighted portfolio, $\left(R_{m(t)} - R_f\right)$ represents market risk premium, *SMB* [*small minus big*] represents size premium, *HML* [*high minus low*] represents value premium, B_dMG_d [*bad minus good*] is the proxy for asset quality premium, while β_{1p}, β_{2p}, β_{3p} and β_{4p} are factor loadings for market, size, value and asset quality premiums respectively.

Excess Returns

The excess returns on each of the twelve portfolios is the difference between value weighted portfolio intraday returns and risk free rate. Since Euro is our reference currency, we will use daily effective rate of Euro Overnight Index Average (EONIA) as the risk free proxy. EONIA is a reference rate used as a benchmark for European money and capital markets and quoted by European central bank.

Market Premium

The market premium is the excess return of the market index over risk free EONIA overnight index. As we are using an international portfolio approach, we construct a synthetic value weighted international index using stock indices of all fourteen European countries and respective market capitalization. An alternate approach could be to use an MSCI Europe benchmark, however, many banking stocks are not part of such indices.

Therefore, construction of a value weighted international index from all local indices using their market capitalization is logical. The logarithmic returns for an individual country index are calculated and then combined to formulate returns on an international index. Mathematically, the intraday market returns can be represented as

$$R_{m(t)} = \sum_{i=1}^{14} w_i RL_{mi(t)}$$

where $R_{m(t)}$ represents market returns at day t for our international index, w_i indicates the weight of local market index[4] vis-à-vis market capitalization and $RL_{mi(t)}$ is the daily return on the local market index for day t.

[4] The fourteen local market indices that are used to compute *returns for international index* includes ATX (Austria), BAS (Belgium), OMXC (Denmark), OMXH 25 (Finland), CAC 40 (France), DAX 30 (Germany),

Credit Quality Factor

We propose a bank specific risk factor that would better explain the variation in returns. A sustained asset quality is required for the long term survival of a financial institution, and banks with low asset quality are likely to face a credit and liquidity crunch. Therefore, investors are likely to demand a premium for investing in stocks that have bad asset quality. We measure asset quality by the NPL/GA ratio. A higher value will a reflect higher proportion of bad loans in total loans and such banks would be considered as ones having a bad asset quality and vice versa. The asset quality premium B_dMG_d is defined as the average returns on six value weighted portfolios having bad asset quality and six portfolios that depict good asset quality. A positive factor would demonstrate premium returns for firm with bad asset quality as compared to banks having good asset quality. Asset quality factor is sorted on the NPL/GA ratio and is neutral in terms of size and value factors. The asset quality premium is represented as

$$B_dMG_d = \frac{(\mathrm{BHB_d+BMB_d+BLB_d+SHB_d+SMB_d+SLB_d})}{6} - \frac{(\mathrm{BHG_d+BMG_d+BLG_d+SHG_d+SMG_d+SLG_d})}{6}$$

Size and Value Factors

The size (*SMB)* factor is the difference in average returns of six value weighted portfolios of banking firms with small market capitalization and six portfolios of stocks with big market capitalization. Hence, the *SMB* factor will be neutral of value and asset quality premiums. A positive *SMB* would reflect higher returns for small firms over big firms and vice versa. Mathematically, size premium is calculated as

$$SMB = \frac{(\mathrm{SH\ \ _d+SHG_d+SMB_d+SMG_d+SLB_d+SLG_d})}{6} - \frac{(\mathrm{BHB_d+BH\ \ _d+BMB_d+BMG_d+BLB_d+BLG_d})}{6}$$

The value *(HML)* factor is neutral with respect to size and asset quality. This is estimated as the difference between the average returns on four value weighted portfolios with high book to market ratio and four portfolios with low book to market ratio. A positive HML would reflect higher returns for value stocks as compared to that of growth stocks and vice versa. The value premium takes the form

$$HML = \frac{(\mathrm{BHB_d+BHG_d+SHB_d+SHG_d})}{4} - \frac{(\mathrm{BLB_d+BLG_d+SLB_d+SLG_d})}{4}$$

The daily descriptive statistics for twelve mimicking portfolios of size, value and credit quality, along with returns on our synthetic index and risk free rate, are reported in table 4. For all portfolios, the volatility in returns is increasing over time.

ISEQ (Ireland), MIB (Italy), LuxX (Luxembourg), AEX (Netherlands), IBEX 35 (Spain), OMXS 30 (Sweden), SMI (Switzerland) and FTSE all share (United Kingdom).

Table 4
Descriptive Statistics of Returns (2009 - 2018)

Year	BHB_d	BHG_d	BMB_d	BMG_d	BLB_d	BLG_d	SHB_d	SHG_d	SMB_d	SMG_d	SLB_d	SLG_d	Index	Rf
							Mean							
2009	0.04%	0.04%	0.07%	0.05%	0.06%	0.00%	0.05%	0.01%	0.02%	0.01%	0.09%	0.06%	0.10%	0.01%
2010	0.03%	0.11%	0.05%	-0.02%	0.05%	0.07%	0.07%	0.05%	0.03%	0.00%	0.04%	0.01%	-0.04%	0.02%
2011	-0.08%	0.01%	-0.06%	0.05%	-0.04%	-0.06%	0.01%	0.06%	-0.06%	0.02%	-0.01%	-0.11%	-0.07%	0.02%
2012	-0.03%	0.04%	-0.04%	0.01%	-0.09%	-0.09%	-0.04%	0.05%	0.00%	0.03%	-0.25%	-0.05%	-0.16%	0.02%
2013	0.11%	0.12%	0.12%	0.19%	0.08%	0.13%	0.06%	0.19%	0.10%	0.17%	0.08%	0.02%	0.08%	0.01%
2014	0.06%	0.20%	0.06%	0.10%	0.07%	0.14%	0.08%	0.09%	0.06%	0.09%	0.04%	0.06%	0.07%	0.01%
2015	0.11%	-0.06%	0.12%	0.14%	0.09%	0.22%	0.05%	0.06%	0.11%	0.14%	0.00%	0.13%	0.09%	0.01%
2016	0.08%	0.05%	0.11%	0.08%	0.13%	0.19%	0.03%	0.07%	0.03%	0.11%	0.01%	0.08%	0.09%	0.01%
2017	-0.07%	-0.03%	-0.11%	-0.03%	-0.06%	-0.07%	-0.09%	-0.02%	-0.03%	-0.07%	-0.16%	-0.01%	-0.02%	0.02%
2018	-0.44%	-0.22%	-0.26%	-0.15%	-0.26%	-0.16%	-0.36%	-0.26%	-0.38%	-0.28%	-0.19%	-0.11%	-0.20%	0.02%
							Median							
2009	0.00%	0.00%	0.04%	0.00%	0.00%	-0.01%	0.03%	0.00%	0.05%	0.03%	0.17%	-0.01%	0.15%	0.01%
2010	0.00%	0.06%	0.06%	-0.01%	0.16%	0.02%	0.01%	0.05%	0.00%	0.05%	0.03%	0.03%	0.02%	0.02%
2011	-0.04%	0.04%	0.03%	0.09%	0.08%	0.07%	0.02%	0.06%	0.00%	0.00%	0.02%	-0.03%	-0.01%	0.02%
2012	0.00%	0.06%	0.02%	0.03%	-0.06%	0.00%	-0.08%	0.03%	0.01%	0.03%	-0.09%	-0.08%	-0.18%	0.02%
2013	0.02%	0.06%	0.14%	0.08%	0.06%	0.07%	0.05%	0.11%	0.13%	0.12%	0.00%	0.00%	0.06%	0.01%
2014	0.06%	0.08%	0.08%	0.09%	0.10%	0.11%	0.07%	0.07%	0.08%	0.04%	0.03%	0.03%	0.09%	0.01%
2015	0.13%	-0.02%	0.08%	0.20%	0.08%	0.09%	0.03%	0.05%	0.00%	0.13%	0.04%	0.06%	0.11%	0.01%
2016	0.16%	0.08%	0.23%	0.15%	0.17%	0.24%	0.02%	0.05%	0.04%	0.15%	-0.01%	0.09%	0.24%	0.01%
2017	-0.01%	0.00%	-0.05%	0.00%	0.02%	0.03%	-0.07%	-0.01%	0.00%	-0.02%	-0.18%	0.00%	0.11%	0.02%
2018	-0.54%	-0.07%	-0.37%	-0.12%	-0.29%	-0.07%	-0.23%	-0.18%	-0.45%	-0.15%	-0.15%	-0.05%	-0.14%	0.02%
							Standard Deviation							
2009	0.76%	1.60%	1.04%	0.97%	1.31%	1.35%	0.34%	0.30%	0.62%	0.34%	1.61%	1.87%	1.17%	0.001%
2010	0.89%	0.94%	0.72%	1.25%	1.04%	1.43%	0.91%	0.37%	0.82%	0.40%	1.90%	1.24%	1.33%	0.003%
2011	1.45%	1.02%	1.08%	1.13%	1.44%	1.53%	1.77%	0.38%	1.36%	0.56%	2.90%	1.02%	1.58%	0.003%
2012	2.09%	1.08%	1.23%	0.83%	1.85%	1.72%	0.98%	0.27%	1.15%	0.87%	2.27%	0.78%	1.96%	0.001%
2013	1.17%	0.88%	1.17%	1.11%	0.99%	1.34%	0.65%	0.57%	1.77%	0.48%	2.46%	0.66%	1.39%	0.001%
2014	0.60%	1.36%	0.63%	0.92%	0.60%	0.84%	0.61%	0.44%	0.87%	0.45%	0.64%	0.69%	0.81%	0.001%
2015	0.57%	1.29%	0.62%	0.70%	0.64%	1.42%	0.34%	0.54%	0.98%	0.43%	0.00%	0.93%	0.68%	0.001%
2016	0.79%	1.12%	1.07%	1.40%	0.96%	1.47%	0.55%	0.64%	1.08%	0.54%	0.84%	0.99%	1.03%	0.001%
2017	1.09%	1.50%	1.42%	1.15%	1.34%	1.13%	0.57%	0.60%	0.93%	0.78%	1.81%	0.70%	1.29%	0.001%
2018	2.52%	1.76%	2.22%	1.75%	2.33%	1.20%	1.28%	1.10%	2.85%	0.91%	2.78%	0.69%	2.00%	0.001%

The table represent descriptive statistics for 12 sorted portfolios. synthetic index and risk free rate. All values are intraday for the sample period

3 Empirical Results and Discussion

The regression results for the single factor CAPM, three factor Fama and French, and asset quality augmented four factors model on size, value and asset quality mimicking portfolios are reported in Tables 5, 6 and 7. The single factor CAPM is significant for big stocks portfolios. This is logical as bigger banks are more sensitive towards index based risk premium. The market risk premium is positive for all portfolios while the intercept is insignificant in all instances, indicating that CAPM is able to capture some of the variations.

The incremental explanatory power for most portfolios increased for Fama and French three factor model, indicating that additional variation is explained by incorporating size and value premium. The signs of coefficients are consistent with size and value fallacy with positive SMB coefficient for small stocks (SHB_d, SHG_d , SMB_d, SMG_d, SLB_d) and negative for big stocks (BHB_d, BHG_d, BLB_d, BLG_d). Similarly, we report negative HML coefficients for low book to market stocks (SLB_d, SLG_d, BLB_d, BLG_d) and a positive value factor for high book to market stocks (BHB_d, BHG_d, SHB_d, SHG_d). However, we could not deduce significant loadings for value premium in BMB_d, BMG_d and SLG_d portfolios.

The results for the four factor model augmented by asset quality are very encouraging, with maximum adjusted R^2 of 85% for BLB_d portfolio and a minimum of 13.5% for SMG_d. For all twelve portfolios we observe a substantial increase in explanatory power, with an increase in adjusted coefficient of variation. The coefficients on all four risk premia were significant. Additionally, a significant value coefficient for BMB_d, BMG_d and SLG_d was observed, which were insignificant in three factor model. The signs of the coefficients are also consistent with the presence of asset quality premium, with a positive B_dMG_d factor for banks with bad asset quality (BHB_d, BMB_d, BLB_d, SHB_d, SMB_d, SLB_d) and a negative factor for banks with good asset quality (BHG_d BMG_d BLG_d SHG_d SMG_d SLG_d). None of the intercepts were significant.

It is notable that for all three-time series models the R^2 increases from small banks to large banks. This was expected because the stocks of larger banks are more actively traded than those of smaller banks and market wide factors are more likely to influence the active stocks. The inclusion of credit quality premium increased the explanatory power of all portfolios, however, for small size banks it is interesting to note that the increase is phenomenal. This implies that although asset quality is vital for all banks, an increase in the infected portfolio has an overwhelming impact for small banks.

Table 5

Single Factor (CAPM) Regression on Portfolios Sorted for Size, Book to Market and Asset Quality

	Intercept	β_1	t(α)	t(β_1)	R^2
BHB_d	-0.0001	0.588***	-0.696	3,96	0.325
BHG_d	0.0002	0.278**	0.959	2,14	0.091
BMB_d	0.0001	0.723**	1.018	2,01	0.703
BMG_d	0.0003	0.352	1.839	0,325	0.178
BLB_d	0.0001	0.862**	0.596	1,984	0.789
BLG_d	0.0003	0.314**	1.351	1,9674	0.102
SHB_d	-0.0002	0.169	-1.215	0,282	0.065
SHG_d	0.0001	0.082	1.452	0,127	0.039
SMB_d	-0.0002	0.317	-1.064	0,732	0.099
SMG_d	0.0001	0.090	0.958	0,348	0.040
SLB_d	-0.0002	0.857	-0.855	0,394	0.379
SLG_d	0.0000	0.176	-0.030	0,361	0.057

The table presents regression results for single factor CAPM using excess returns of 12 sorted portfolios. *** represents significance at 99%, ** represents significance at 95% and * represents significance at 90%.

Table 6

Three Factor Regression on Portfolios Sorted for Size, Book to Market and Asset Quality

	A	β_1	β_2	β_3	t(α)	t(β_1)	t(β_2)	t(β_3)	Adj R^2
BHB_d	-0.0002	0.583**	-0.548*	0.458*	-1.372	2,132	-1,6119	1,683	0.477
BHG_d	0.0001	0.300**	-0.500***	0.515*	0.589	1,9874	-4,203	1,8303	0.293
BMB_d	0.0000	0.629**	-0.371*	-0.021	0.323	2,994	-1.8562	-1.281	0.740
BMG_d	0.0002	0.198	-0.677**	0.023	1.138	0,066	-2,1475	0.911	0.315
BLB_d	0.0000	0.731*	-0.345*	-0.179**	-0.160	1,564	-1,819	-1,995	0.816
BLG_d	0.0000	-0.185	-1.083***	-0.884***	0.246	0,025	-3,213	-3,390	0.472
SHB_d	-0.0001	0.395	0.404	0.476**	-0.616	0,6164	-1,541	2,2748	0.247
SHG_d	0.0002**	0.199	0.197	0.258*	2.112	0,381	1,143	1,8741	0.169
SMB_d	-0.0001	0.567	0.721*	0.288**	-0.368	0,428	1,7614	2,196	0.203
SMG_d	0.0001	0.163	0.172***	0.119***	1.371	0,723	3,617	2,047	0.079
SLB_d	-0.0001	0.790	0.730**	-0.879***	-0.450	0,3539	1,9654	-2,7616	0.607
SLG_d	0.0000	0.140	0.251**	-0.350	0.238	0,8071	1,998	-1,4257	0.173

The table presents regression results for Fama and French three factor model using excess returns of 12 sorted portfolios. *** represents significance at 99%, ** represents significance at 95% and * represents significance at 90%.

Table 7

Four Factor Regression on Portfolios Sorted for Size. Book to Market and Credit Quality

	Intercept	β_1	β_2	β_3	β_4	t(α)	t(β_1)	t(β_2)	t(β_3)	t(β_4)	Adj R^2
BHB_d	0.0000	0.088**	-0.931**	0.378**	1.031**	-0.275	2.187	-2.197	2.152	1.987	0.660
BHG_d	0.0000	0.575**	-0.286**	0.559*	-0.574**	-0.031	2.0614	-2.084	1.859	-2.0816	0.365
BMB_d	0.0001	0.397**	-0.551**	-0.058**	0.483**	1.400	2.0916	-2.133	-2.068	2.0683	0.797
BMG_d	0.0001	0.266*	-0.624**	0.034*	-0.142**	0.970	1.781	-1.9854	1.645	-2.0449	0.320
BLB_d	0.0001	0.530**	-0.500*	-0.211**	0.418**	0.747	1.963	-1.733	-2.1518	-1.9874	0.850
BLG_d	0.0000	0.014**	-0.929**	-0.852*	-0.415**	-0.244	1.985	-2.047	-1.614	-1.98745	0.505
SHB_d	0.0000	0.322*	0.348**	0.465*	0.152***	-0.399	1.654	-2.0512	1.829	2.717	0.256
SHG_d	0.0001	0.292**	0.269*	0.273**	-0.193***	1.728	2.0177	1.9412	2.021	-2.7611	0.208
SMB_d	0.0000	0.242*	0.470*	0.236**	0.677***	0.273	1.743	1.827	1.9657	2.9136	0.285
SMG_d	0.0001	0.281*	0.264**	0.138**	-0.246***	0.922	1.839	1.911	1.992	-2.733	0.135
SLB_d	0.0001	0.291*	0.343**	-0.960**	1.041***	0.629	1.805	1.9367	-2.1436	2.9841	0.709
SLG_d	-0.0001	0.442*	0.485*	-0.301*	-0.629***	-0.588	1.7198	1.6139	-1.8236	-2.960	0.305

The table presents regression results for credit quality augmented model using excess returns of 12 sorted portfolios.

*** represents significance at 99%, ** represents significance at 95% and * represents significance at 90%.

This is logical as banks with a smaller equity base would find it more difficult to absorb the loan losses emanating from a deteriorating asset quality, as compared to their larger counterparts. Lastly, as mentioned earlier, smaller equities are more likely to be influenced by firm specific factors and asset quality is the most critical bank specific risk factor. These results clearly propose that in case of banking stocks, the variation in returns is jointly explained by market, size, value and a firm specific factor of asset quality.

4 Conclusion

This paper endeavors to explain the behavior of exchange rate adjusted returns of banking stocks from fourteen European countries under a traditional asset pricing framework of CAPM and Fama and French three factors model. Given the unique business and financial risk of banking stocks, we propose to augment the traditional size and value factors model by including an asset quality premium. The selected banking equities were sorted into twelve portfolios at the interaction of size, value and asset quality factors. Our empirical results provide evidence that the maximum variation in stock returns of banking stocks is explained by the augmented four factor model. Moreover, small banks with their limited scale are more sensitive to deterioration in asset quality as they have a limited cushion to absorb loan losses.

These results have policy implications specifically for investors and regulators in general. The investment in financial stocks should take into account the asset quality of the credit portfolio of these institutions. Banks with higher infection are likely to face pressure on their spreads via reduced interest revenues. Simultaneously, the loan loss provisions will increase the non-interest expense, affecting the overall profitability of the bank. Ultimately this impact will be absorbed in equity, thus reducing the risk absorption capacity of the bank. Since, this treatment of credit infection is unique to banking firms, investment in financial stocks warrants the pricing of asset quality.

Moreover, on account of deregulation in the financial sector, regulators under the Basel framework focus on market discipline to evaluate and control the risk taking behavior of banking firms. To implement such market based measures, it is critical to understand the risk factors that are priced in banking equities and among all such factors, we propose the fundamental relevance of asset quality premium.

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