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Bank equity risk and return pre and post Basel II

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Abstract: This paper explores the efficiency of the Basel II regulation in regards to how risk and return in bank equity has developed before and after the implementation of the regulation. Using DCC-MGARCH model we estimate the time-varying systemic risk, idiosyncratic risk and return for nine countries including five of the world's leading economies namely, U.S, UK, Germany, Japan and Hong-Kong and the Nordic countries. The empirical findings present inconsistent results. While systemic risk for the U.S, Finland, Norway and Hong-Kong has been reduced the opposite is observed for the rest of the country portfolios.

JEL codes: G10; G15; G18

Keywords: Bank equity, Basel II, Regulation, DCC-MGARCH model

1 Introduction

In the wake of the recent financial crisis, there has been an increased demand for firmer and stricter capital regulations. There is a view among scholars that the crisis was primarily a regulatory failure (Acharya & Schnabl, 2012). As a result, Bank for International Settlements has introduced new regulations, generally referred to as Basel III, which seeks to seal the loophole that was exposed during the financial crisis. In its core essence Basel III increases minimum capital ratios, tightens the definition of bank capital and requires tighter liquidity requirements (Cosimano & Hakura, 2011).

Traditional bank regulation has had a primary focus on capital-adequacy. The argument is based on the fact that bank financing occurs via insured-government deposits and implicit guarantees. While insured deposits prevent bank runs, it also creates an incentive for increased risk-taking. Knowing that eventual losses will be borne by the taxpayers causes a classic moral hazard effect. The purpose of capital regulation is therefore to minimize moral hazard and strengthen banks enough so that they are able to absorb eventual losses arising from macroeconomic shocks without becoming insolvent or needing publicly funded bailout programs (Brunnermeier, Crocket, & Chase, 2009).

The first international collaboration regarding bank capital started in 1988, with the adoption of the Basel Accord by the G10 countries with the purpose of increasing the safety and soundness of the international banking system. The accord had a primary focus on minimum capital adequacy ratio, which in practices meant that banks had to hold a minimum capital of 8 percent of their total risk-weighted assets. In principal the accord was successful in reaching the goal of an adequate level of capital in the international banking system, which leads to the acceptance of the framework as standard with over hundred countries adopting it. However, the framework was suffering from a key shortcoming. The risk-weights that were assigned did not take into account the risk sensitivity within the same asset class. The low sensitivity could therefore lead to increased asset-risk and regulatory arbitrage as banks could swap low risk assets to high-risk assets. In order to seal this loophole Basel II was introduced in June 2004 with the goal to be completely implemented in 2006. The Basel II regulation rests on three pillars i) risk sensitive capital requirements, which was the key alteration from Basel I ii) centralized supervision and iii) Market discipline (Santos, 2001; Stolz, 2002).

While policymakers view capital as the fundamental tool to mitigate risk, there is less of a consensus among economic scholars. The literature on bank asset risk under capital regulation imposed by the Basel Accords provides ambiguous predictions VanHoose (2006). Several studies such as, Koehn and Santomero (1980), Furlong (1988), Flannery (1989), all show increased asset volatility due to capital regulation. On the other stand of the literature, Rocket (1992) Hall (1993), Calem and Rob (1996), and Thakor (1996) claim that portfolio risk is reduced with capital regulation. Moreover, institutional differences appear to influence banks' ability to reduce asset risk. Rime (2001a) shows that the Basel Accord did not have an impact on Swiss banks asset risk. Meanwhile, it had a substantial impact on U.S banks.

This paper seeks to explore the efficiency of the Basel II regulation through studying how risk and return in bank equity has developed before and after its implementation. Our sample data consist of country portfolios for nine countries including five of the worlds' leading economies namely, U.S, UK, Germany, Japan and Hong-Kong and the Nordic countries, Sweden Norway, Denmark and Finland. We apply Engle and Sheppard's (2001) Dynamic Conditional Correlation Multivariate GARCH-model (DCC-MGARCH) to estimate systemic risk (the beta values). The DCC-GARCH model has the advantage of providing time-varying correlation coefficients and cross market conditional correlations which captures the time-varying nature of systemic risk exposure for each portfolio. The model can therefore be interpreted as a dynamic conditional beta model, which allows the beta values to be time-varying (Elyasiani &Mansur, 1998).

The observed findings present a mixed result for the different country portfolios. The systemic risk was reduced for the U.S, Finland, Norway and Hong-Kong indicating that Basel II has been an efficient regulation. However, the opposite result was obtained for the rest of the countries, were systemic risk actually increased.

To our knowledge there is no other paper who explores the efficiency of Basel II. Thus, we contribute to the literature on financial regulation by estimating the development of risk before and after the implementation of Basel II. The rest of the paper is organized as followed. Section II contains a literature review on capital-adequacy regulation. Section III provides data and model specification. Section IV presents the main results. Section V provides a discussion and conclusion.

2 Literature review

Starting with the Modigliani and Miller in (1958) who stated that in a complete market, where there is no friction and information asymmetry a firm's value is not affected by its capital structure. Thus, earlier literature such as Kahane (1977); Kareken and Wallace (1978) and Sharpe (1978) had a primary focus on complete market preference models. In this state of the world all deposits are fully insured and banks are charged with a flat insurance premium rate. This creates a classic moral hazard problem were banks lack incentive to adjust their risk return demand. The moral hazard problem can be eliminated through properly priced risk prima. However, in a complete market setting where there is no asymmetric information there is no need for financial intermediaries and hence deposit insurance is unnecessary. Given that financial markets contain frictions such as, taxes, financial distress, information asymmetry and transaction costs, has led researchers to study the efficiency of capital regulation in an incomplete market-setting model.

Thus, the theoretical literature has provided contradicting implications. Several models imply that flat capital requirements may lead to increased portfolio risk and thereby increase the probability of distress. Merton (1977); Pyle (1984) and Keeton (1988) use Black and Scholes put option pricing model to show that a flat deposit insurance premium underprices risk which will lead banks to maximize the value of the put option in order to maximize the value of equity shareholders. This is done through an increase in leverage and asset risk, which in turn increases the probability of default. Continuing with the asset portfolio approach Hart and Jaffee (1974), Kahane (1977), Koehn and Santomero (1980) and Kim and Santomero (1988) argue that capital requirement reduces expected returns and leverage which may cause banks to choose a riskier portfolio in order to compensate for the lost in utility. Regulators can reduce this effect through the introduction of risk-based capital requirements. Furthermore, Rocket (1992) shows that the effect of risk based capital requirement on asset-risk depends crucially on correct risk weights, such that any increase in a bank's portfolio risk is reflected by an increase in capital. If the risk weights do not reflect the assets systemic risk proportionally capital requirement may have the exact opposite effect of intention and lead to an increase in asset risk rather than reducing it.

Turning to empirical literature, there is more of a consensus among researchers. In the beginning of the1980s the U.S replaced peer group capital regulation (which meant that regulators compared capital ratios with peer banks based on their average balance sheet) with minimum capital requirements. Keeley (1988) analyzes the effect of this change using data from the100 largest banks in the U.S and concludes that it was successful, as it resulted in an increase in book value capital ratio for low banks with low capital ratio. This was done primary through a reduction in asset growth. Furlong (1988) studies the change in default risk and asset risk in U.S banks before the implementation of the first Basel Accord from 1975-1986. The result shows that asset-risk doubled during 1981-1986 that is during the period when capital requirement was imposed on U.S banks. Asset risks increased such that it outweighs the improved capital ratio and lead to an increase in default risk. On the other hand, data shows there was a dramatic shift in asset risk portfolios towards low-risk assets among U.S banks during the period 1989-1993. Haubrich and Wachtel (1993) examine whether this change was due to the implementation of Basel I. Their result implies that the shift in asset-risk for weakly capitalized banks was due to the implantation of Basel I.

Shrieves and Dahl (1992) analyze the relationship between changes in bank capital and changes in portfolio risk for U.S banks during the mid-1980s. Their finding shows a positive relationship and indicates that banks will increase asset risk unless constrained by regulation. Jacques and Nigro (1997) analyze whether Shrieves and Dahl (1992) results holds under risk-based capital standards. Their result shows a negative relationship between changes is capital ratio and risk. Thus, there is a substantial increase in capital ratio and a reduction in asset risk suggesting that risk-based capital regulation has had a significant contribution to this change.

Furthermore, Sheldon, (1996) studies the effect of Basel I on asset volatility using cross-country data. The result shows an increase in bank asset-risk. Wagster, (1999) shows that Basel I increased systemic risk for Canadian, UK and U.S banks indicating that bank capital did little to mitigate bank risk in these countries. Montgomery, (2004) uses data from Japanese banks to show that the Basel Accord did not a have a significant effect on Bank portfolios.

3 Data and model specification

3.1. Data description

We construct equally weighted country portfolios, collecting historically daily adjusted equity prices from all publicly traded banks that are listed in Thomson Reuters DataStream. Due to a dominating amount of banks in the U.S and Japan we limit the amount of banks in these portfolios. For the U.S we use 25 randomly chosen banks within quartile3 and quartile4 ranked by turnover size and for Japan the 10 largest banks (quartile4) ranked by turnover size. In total our sample contains 117 banks from nine countries. The data covers the period from November 3rd 1995 to December 30th 2014. The time period is chosen such that it will include as many banks as possible as well as being in a significant timeline before the implementation of the Basel II accord[1]. In practice this period is divided into two-sub periods pre-implementation of the Basel II accord (1995/11/03 to 2006/12/30) and post-implementation of the Basel II (2010/01/01 to 2014/12/30/). This yields a gap during the time period of 2007-2009, which is during the global financial crisis. For each portfolio we use a country specific benchmark index to estimate the beta values.

[1] All nine countries implemented the Basel II accord between 2007-2008.

3.2 Model Specification

Using adjusted equity prices daily returns are calculated for each bank and used to calculate the daily return for each country portfolio. Equity returns are calculated as simple returns. Based on each portfolio daily return, the risk and return for each portfolio is estimated. In order to be able to analyze the risk return trade-off we estimate both the idiosyncratic and systemic risk[2]. The idiosyncratic risk is estimated using a univariate GARCH (1/1) model while we estimate the systemic risk using Engle and Sheppard's (2001) DCC-GARCH model to calculate the beta values[3].

The financial literature on volatility modeling has been extensively developed since the introduction of the ARCH and GARCH model by Engle (1982) and Bollerslev (1986) respectively. It is a wildly applied model were the popularity is based on the models ability to cope with the stochastic properties and irregular features of stock returns such as clustering behavior, time-variation, and volatility persistence. According to traditional financial theory the expected return on a security is proportional to its systematic risk (beta). As in theory the variance should be measured as the conditional covariance of a security return with the market return (Campbell, Lo, & MacKinlay, 1996). However, empirical estimations have been based on unconditional distribution of returns. Applying the DCC-GARCH model provides time-varying correlation coefficients and cross market conditional correlations which captures the time-varying nature of systemic risk exposure for each country portfolio. The model can therefore be interpreted as a dynamic conditional beta model, which allows the beta values to be time-varying. The parameters are estimated for the two sub periods (pre and post Basel II) within each country portfolio. We apply the DCC-model to control for diversification effects. To statistically ensure our result we perform a difference in difference model to analyze how risk and return has developed post Basel II.

[2] Idiosyncratic risk is diversifiable while systemic risk is not thus, investors should be compensated for systemic risk. For a detailed discussion see De Bandt and Hartmann (2000)

[3] Estimating time-varying beta values using a DCC-model is commonly used, see (Marshall, Maulana, & Tang, 2009)

3.3 Methodology

The daily volatility for each bank and country portfolio is estimated using a univariate GARCH (1/1) model. Formally expressed as:

$$h_t = w + \delta\eta_{t-1}^2 + \gamma h_{t-1} \tag{1}$$
$$\omega \geq 0, \delta \geq 0, \gamma \geq 0$$
$$\delta + \gamma \leq 1$$

where: w denotes the weighted average of the long run variance, $\delta\eta_{t-1}^2$ refers to lagged squared returns times assigned weight and γh_{t-1} lagged variance times assigned weight. Returns of an asset are sticky to it's the long run average. The weights assigned determine the pace of the change in the variance and the pace it returns tends to move towards it's to its long run mean. The function is optimized with a non-linear log likelihood function (see eqs.9) with respect to its inequality constrains, under the assumption that the conditional returns are normally distributed with zero mean. In the next step we estimate the DCC-GARCH model in order to obtain the time-varying correlation coefficients between each country portfolio and the benchmark index. The estimation of the model proceeds in two steps. In the first step the conditional variance is estimated using a univariate GARCH (1/1) model. In the second step, the correlation parameters are estimated based on the standardized residuals obtained in the first step. The formal estimation proceeds as follows;

$$r_t|\phi_{t-1} \sim N(0, H_t) \tag{2}$$

where: r_t is a $k \times 1$ vector of returns containing all available information up to ϕ_{t-1} and H_t is a $k \times k$ matrix of time varying variances. Hence, the conditional covariance matrix is decomposed to:

$$H_t = D_t R_t D_t \tag{3}$$

where: D_t is a $k \times k$ diagonal matrix of the conditional standard deviations for each time-series obtained from estimating a univariate GARCH (1/1) process that is, $D_t = diag\{\sqrt{h_{i,t}}$. R_t is the conditional correlation matrix.

R_t is defined as:

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1} \tag{4}$$

where: $Q_t = |q_{ij,t}|$ is a positive definite covariance matrix determining the structure with the following dynamics:

$$Q_t = (1 - \alpha - \beta)\bar{Q} + \alpha\delta_{t-1}\delta'_{t-1} + \beta Q_{t-1} \tag{5}$$

where: $\bar{Q}$ refers to the unconditional covariance of the standardized disturbances, defined as $\bar{Q} = E[\delta_t, \delta'_t]$. $\alpha + \beta < 1$ are scalars were α measures the effect of a specified shock and β captures the lagged dynamic correlation. Q_t^{*-1} denotes the inverted diagonal matrix of the squared root of the elements of Q_t, that is:

$$Q_t^{*-1} = \begin{bmatrix} 1/\sqrt{q_{kk,t}} & 0 & 0 \\ 0 & 1/\sqrt{q_{kk,t}} & 0 \\ 0 & 0 & 1/\sqrt{q_{kk,t}} \end{bmatrix} \tag{6}$$

Thus, the conditional correlation estimator can be expressed as:

$$P_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ij,t}\, q_{ij,t}}}, \qquad \forall i, j = 1, \ldots, n. i \neq j \tag{7}$$

The parameters are estimated and optimized using the quasi-maximum likelihood function. Formally expressed as:

$$L(\phi) = -\tfrac{1}{2}\textstyle\sum_{t=1}^{T} \begin{bmatrix} (n\, log(2\Pi) + log|D_t|^2 + \varepsilon'_t D_t^{-1} \varepsilon'_t) \\ +(log|R_t| + \delta'_t R_t^{-1} \delta_t - \delta'_t \delta_t) \end{bmatrix} \tag{8}$$

where: (ϕ) is a vector of parameters to be estimated. T denotes the number of observations and n is the number of equations. For simplicity equation 8 is separated into two log-likelihood functions were l_1 maximizes the variance parameters while l_2 maximizes the conditional correlations.

$$l_1 = \frac{1}{2}\sum_{t=1}^{T}[n\ log(2\Pi) + log|D_t|^2 + \varepsilon_t' D_t^{-1} \varepsilon_t'] \tag{9}$$

$$l_2 = -\frac{1}{2}\sum_{t=1}^{T}[log|R_t| + \delta_t' R_t^{-1} \delta_t - \delta_t' \delta_t] \tag{10}$$

The conditional correlations obtained from the DCC-model is used to estimate the beta value thus, the systemic risk. The beta value measures the correlation of an investment with market the movement. Formally expressed as:

$$\beta_i = \frac{Corr\ R_i R_{index} * \sigma_{Ri} \sigma_{Rindex}}{\sigma^2(R_{index})} \tag{11}$$

where: $Corr\ R_i R_{index}$ is the conditional correlation between the portfolio returns and the return of each countries benchmark index return. $\sigma_{Ri}\sigma_{Rindex}$ is the standard deviation of each portfolio return and the country specific benchmark index return. A beta value between 0 and 1 indicates movement in the same direction as the market.

4 Empirical results

4.1 Data properties

In order to determine the appropriateness of the GARCH-model, normality tests are preformed were skewness and kurtosis are examined before and after the implementation of the Basel II regime. The result is presented in Table 1, were returns in mean decreased for the U.S and Japan after the implementation of Basel II indicating poorer performance. Meanwhile, we note the opposite for the rest of the portfolios. The standard deviation declined for all country portfolios with exception of Japan indicating lower unconditional volatility post Basel II. For all portfolios the skewness is close to zero implying lack of asymmetry in the data. The kurtosis test shows a significant increase leptokurtic for Germany, Denmark, Finland and Norway the Jarque-Bera test for normality is rejected at 5% for pre and post-Basel II, validating the choice to use Bollerslev and Wooldridge's (1992) Quasi Maximum Likelihood method.

Table 1
Descriptive statistics for each portfolio

Country	Mean	Std.dev	Skewness	Kurtosis	Jarque-Bea
Panel A: pre-Basel II					
U.S	.0006435	.0083968	.0656717	5.560044	175.50
U.K	.0005143	.0144492	.2312931	6.182624	239.13
Germany	.0003953	.0091148	-.3472529	9.564216	438.20
Sweden	.0007348	.0158393	.344578	6.19887	268.48
Denmark	.0007937	.0036961	.7398265	22.71034	903.26
Finland	.0005081	.0191421	.1761915	14.25408	547.99
Norway	.0004814	.0067791	-.380865	9.963516	464.07
Japan	.0002974	.0149531	.4126616	6.000816	277.14
Hong-Kong	.0005206	.0159528	.2390712	16.24059	606.49
Observations	2809	2809	2809	2809	2809
Panel B: post-Basel II					
U.S	.0011305	.0149594	.731713	10.9643	252.46
U.K	-.0001156	.0168694	.2566683	6.833847	112.51
Germany	.0001135	.0148818	.2830905	5.226453	73.68
Sweden	.0006477	.0163325	.1759626	6.963712	109.39
Denmark	.0002333	.0089624	.2055433	5.658658	79.24
Finland	-.0006873	.0298814	.3551473	12.97132	220.19
Norway	.0002839	.0084652	.1051797	5.764877	76.58
Japan	.0004606	.0148267	-.5535	10.65795	218.16
Hong-Kong	.0002421	.0110803	-.1108103	6.16054	87.03
Observations	1073	1073	1073	1073	1073

4.2 GARCH modelling

As specified in section 3 the conditional volatility is estimated using a univariate GARCH (1/1) model corresponding to equation 1. The conditional daily volatility is obtained through the estimation of the standardized residuals corresponding to equation 3. As observed in Table 3 the coefficients of the model are statistically significant for all country portfolios (with the exception of Finland) confirming time variation in volatility. Moreover, it can be noted that the long run variance denoted w has increased post Basel II for U.K, Germany, Sweden, Denmark, Finland and Norway while the United States and Japan have experienced a reduction in w. An increase (reduction) in the long run variance indicates greater (lower) conditional volatility. An increase in the ARCH- term indicates a faster pace of change in the conditional variance, while a reduction in the GARCH-term indicates a slower pace of variance return towards its long run mean. Thus, with the exception of Japan this is observed for all the country portfolios. Furthermore, the sum of the ARCH and the GARCH term ($\delta + \gamma \leq 1$) is either larger or close to one for all the country portfolios[4] confirming that conditional volatility is significantly time persistence. There has been a reduction in volatility persistence for all country portfolios except Germany and Japan were the opposite is observed.

In the next step we estimate the dynamic conditional correlation between the country portfolios and each country benchmark index (see section 3 for a detailed explanation of the model). The core estimates of the model are presented in Table 4. The conditional correlations have not been constant over time which is in line with previous studies[5]who demonstrate that international correlations are significantly time varying. We observe a decrease in conditional correlation for the U.S, Germany, Denmark and Hong-Kong portfolios. Meanwhile conditional correlations have increased for the United Kingdom, Sweden, Finland, Norway and Japan. An increase in correlation indicates diversification effects. The DCC estimates satisfy the mean-reverting condition $\alpha + \beta < 1$ implying that the conditional variance reverts towards its equilibrium.

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[4] We neglect Finland due to insignificant result.

[5] See, Solnik(2005), Engel & Sheppard (2001) and Goetzmann, Li &Rouwenhorst (2003)

Table 2
Univariate GARCH model estimation

Country	δ	γ	w	Persistence
Panel A: pre-Base II				
U.S	0.250**	0 .518**	0.0008**	0.787
	(0.026)	(0.067)	(0.000145)	
U.K	0.211**	1.018**	0.0006**	1.229
	(0.021)	(0.057)	(0.0002)	
Germany	0.297**	0.672**	0.0006241**	0.970
	(0.021)	(0.043)	(.0001405)	
Sweden	0.221**	0.787**	0.0010984**	1.008
	(0.022)	(0.059)	(0.0002516)	
Denmark	0.257**	0.725**	0.0006128**	0.982
	(0.023)	(0.046)	(0.0000634)	
Finland	-0.043	0.880	0.0664115	0.049
	(2.74)**	(3.83)**	(47.69)**	
Norway	0.290**	0.379**	0.0005755 **	0.669
	(0.019)	(0.052)	(0.0001169)	
Japan	0.114**	0.844**	0.0002986 **	0.958
	(0.015)	(0.088)	(0.0002701)	
Hong-Kong	0.347**	0.681**	0.00081**	1.028
	(0.018)	(0.027)	(0.000232)	
Panel B: post-Basel II				
U.S	0.116**	1.212**	0.0012589**	1.212
	(0.033)	(0.248)	(0.0004614)	
U.K	0.131**	1.234**	0.0002707**	1.234
	(0.029)	(0.171)	(0.0004574)	
Germany	0.189**	0.735**	0.0000416 **	0.735
	(0.033)	(0.129)	(0.0003974)	
Sweden	0.114**	1.272**	0.0007495**	1.272
	(0.023)	(0.127)	(0.0004305)	
Denmark	0.157**	0.880**	0.000305**	0.880
	(0.030)	(0.148)	(0.000247)	
Finland	0.110**	-0.043	-0.0005235	-0.002
	(0.019)	(0.065)	(0.0008592)	
Norway	0.066**	0.916**	0.0004768**	0.916
	(0.009)	(0.012)	(0.0002374)	
Japan	0.137**	0.759**	0.0007317**	0.759
	(0.020)	(0.136)	(0.0004547)	
Hong-Kong	0.226**	0.734**	0.0002161**	0.734
	(0.031)	(0.090)	(0.0003027)	

Notes: The values in the parentheses refer to standard errors, (**) denotes the level of significance at 5%.

Table 3
DCC- GARCH model estimation

Country	Conditional Correlation	α	β
Panel A: pre-Basel II			
U.S	0.691**	0.013**	0.985**
	(0.812)	(0.002)	(0.002)
U.K	0.738**	0.037**	0.926**
	(38.08)	(5.10)	(66.91)
Germany	0.664**	0.026**	0.954**
	(24.68)	(5.25)	(106.34)
Sweden	0.759**	0.040**	0.955**
	(9.87)	(6.02)	(128.06)
Denmark	0.325**	0.033**	0.944**
	(7.48)	(4.25)	(62.73)
Finland	0.019	0.006	0.850
	(0.84)	(0.54)	(3.50)**
Norway	0.366**	0.039**	0.918**
	(10.46)	(4.04)	(40.31)
Japan	0.638**	0.025 **	0.968**
	(10.38)	(3.78)	(89.59)
Hong-Kong	0.780**	0.041**	0.920**
	(45.58)	(3.93)	(37.30)
Panel B: post-Basel II			
U.S	0.682**	0.160**	0.788**
	(0.052)	(0.023)	(0.032)
U.K	0.750**	0.017**	0.913**
	(37.71)	(1.24)	(19.80)
Germany	0.451**	0.013**	0.970**
	(7.85)	(1.82)	(49.55)
Sweden	0.866**	0.058**	0.880**
	(53.28)	(4.20)	(35.44)
Denmark	0.240**	0.022**	0.955**
	(3.29)	(2.13)	(35.12)
Finland	0.030	0.034	0.739**
	(0.73)	(1.11)	(2.79)
Norway	0.547	0.035	0.911
	(13.35)**	(2.77)**	(39.27)**
Japan	0.835**	0.064 **	0.889**
	(31.89)	(3.01)	(20.30)
Hong-Kong	0.775**	0.019**	0.974**
	(12.45)	(4.65)	170.34

Notes: The values in the parentheses refer to the z-values.
(**) denotes the level of significance at 5%

As specified in section 3 the conditional correlation values obtained from the DCC estimation are used to estimate the dynamic conditional beta values (corresponding to equation 11). In order to statistically verify our results, we perform a difference in difference estimation. The first column in table 4 presents the difference in the mean values of returns post Basel II. It may be observed that all country portfolios exhibit a lower rate of mean returns post Basel II except for Sweden and Japan, were we observer an increase. Column 2 presents the overall effect of systemic risk (Beta) post Basel II and column 3 presents the effect of systemic risk on returns post Basel II. For the U.S, Norway and Hong-Kong the overall effect of systemic risk has been negative meanwhile the effect of beta on return has been positive. That is, an increase in Beta is accompanied with an increase in returns. For Germany, Sweden, Denmark and Japan the effect of beta has been positive that is, we observe an increase in systemic risk (beta) post Basel II. In the meantime, the effect of beta on returns has been negative. That is, a decrease in beta is followed by a decrease in returns. The overall effect of beta and the effect of beta on returns has been negative for Finland. However, this result is not statistically significant.

Column 4 in table 4 presents the overall effect of daily volatility (idiosyncratic risk) post Basel II and column 5 presents the effect of daily volatility on returns. For the U.S, Germany, Denmark and Norway the overall effect of daily volatility and the effect of daily volatility on returns has been negative. The overall effect of daily volatility is negative for Sweden, Finland, Japan and Hong-Kong. That is, daily volatility has decreased post Basel II. The effect of daily volatility on returns has been positive hence, an increase in daily volatility is followed by an increase in returns. UK is the only country portfolio that exhibits a negative overall effect of daily volatility and a negative effect of daily volatility on returns. It should be notated

Colum 1 in table 4 shows the overall effect Basel II with Beta as the explanatory variable. The time dummy is negative for the U.S Norway, Hong-Kong and Finland, indicating that the overall effect of Basel II has increased systemic risk. For the U.K, Germany, Sweden, Denmark and Japan the result shows the opposite effect, thus the systemic risk may have increased after the implementation of Basel II. Observe that the result for Finland and Japan is not statistically significant. Colum 2 shows that beta has had a positive effect on returns for the U.S, U.K, Norway and Hong-Kong. For

Germany, Sweden, Finland and Japan we observe a negative effect of beta on returns. Colum 3 shows the overall effect of daily volatility after the implementation of Basel II. The result shows that daily volatility has increased after the implementation of Basel II for the U.S, Germany, Denmark and Norway meanwhile it has decreased for the U.K, Sweden, Finland, Japan and Hong-Kong. The effect of daily volatility on return has been positive for the U.S, U.K, Germany, Denmark, and Norway. As for Sweden, Finland, Japan and Hong-Kong the effect of daily volatility on returns has been negative. Note that daily volatility estimators are statistically insignificant except for the overall effect of daily volatility for Finland.

Table 4
Difference in difference estimation

Country	Return (1)	Overall effect of beta (2)	Beta return trade-off (3)	Overall effect of volatility (4)	Volatility return trade- off (5)
U.S	-0.0005	-0.001 (2.96)**	0.451 (2.21)*	0.002 (1.25)	-0.130 (0.87)
U.K	-0.0003	0.005 (9.38)**	7.666 (26.38)**	-0.000 (0.13)	-0.010 (0.08)
Germany	-0.0002	0.003 (8.85)**	-8.303 (16.84)**	0.002 (1.07)	-0.146 (1.18)
Sweden	0.0001	0.016 (14.14)**	-9.508 (16.57)**	-0.001 (0.38)	0.067 (0.44)
Denmark	-0.0002	0.004 (16.62)**	-7.744 (16.47)**	0.002 (1.35)	-0.240 (1.34)
Finland	-0.0008	-0.002 (1.78)	-1.675 (1.11)	-0.019 (2.13)*	0.513 (1.38)
Norway	-0.0002	-0.005 (13.22)**	2.421 (5.58)**	0.002 (1.13)	-0.063 (0.52)
Japan	0.0004	0.006 (1.60)	-4.434 (1.45)	-0.002 (0.78)	0.197 (0.93)
Hong-Kong	-0.0001	-0.003 (4.84)**	9.040 (16.39)**	-0.001 (0.33)	0.084 (0.44)

Notes: The values in the parentheses refer to the t-values. (**) denotes the level of significance at 5%. Returns are calculated as the difference in the mean values.

5 Conclusion

Basel II was implemented with the goal of increasing the safety and soundness of the international banking system, through stricter capital regulation. The purpose of this paper is to explore the efficiency of the Basel II regulation through studying how risk and return in bank equity has developed before and after the implementation of the accord. Using Engle and Sheppard's (2001) DCC-MGARCH model we calculate the time-varying beta values of the capital asset pricing model, which states that the return of an investment is proportional to its systematic risk (beta).

The empirical findings present inconsistent result for the different country portfolios. The systemic risk for the U.S, Finland[6], Norway and Hong-Kong was reduced after the implementation of the Basel II accord, suggesting that the regulation was efficient in reaching its goal for these countries. Furthermore, for the U.S Norway and Hong-Kong we observe that the effect of beta on returns has been positive indicating that an increase in systemic risk has been accompanied with higher equity returns thus, this is consistent with financial theory were higher systemic risk should be compensated with higher returns. As for Finland the risk-return trade-off has been negative implying that shareholders have been undercompensated in proportion to the risk of equity. For the rest of the country portfolios we observe an increase in systemic risk after the implementation of Basel II indicating an inefficient regulation, as it fails to reach its goal of reducing systemic risk. For Germany, Sweden, Denmark and Japan we observe a negative risk-return trade-off. That is, as systemic risk has increased return has decreased which again indicates that shareholders have been undercompensated in proportion to the risk of equity. The risk return trade-off for the U.K has been positive thus, an increase in systemic risk is associated with an in increased equity returns.

The overall idiosyncratic risk has increased for the U.S, Germany, Denmark and Norway. This may indicate a more volatile bank equity market for these countries. For the UK, Sweden, Finland, Japan and Hong-Kong the idiosyncratic risk has been reduced. This reduction has been followed by an increase in conditional correlations hence, indicating a less volatile bank equity market. However, the reduction in volatility

[6] Note that the result for Finland is not significant.

for Hong-Kong may be caused by a diversification effect due to a reduction in conditional correlation.

Concerning the relationship between volatility and return, the trade-off coefficient can have any sign, as fluctuations in volatility are mostly due to shocks to non-systemic risk (Elyasiani & Mansur, 1998). The fundamental argument is based on the fact that, volatility is a measure of total risk thus, an increase in volatility does not necessarily have to be accompanied by an increase in risk premium. According to Glosten et al. there may be two reasons why the intertemporal trade-off between risk and return may be negative. Risky periods may correspond with periods when investors have a better ability to endure risk. Moreover, if investors become more risk avert during risky periods competition may increase asset prices and lower risk premium.

Furthermore, it shall be emphasized that our results do not prove causality but rather provides an indication of the development direction. The inconsistent empirical results call for further research. One suggestion is to test for differences in the implementation of the Basel II regulation. Furthermore, adding micro data on banks, in order to explore if the difference in the performance and robustness can explained.

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