THE IMPACT OF REGULATION OF BANKS IN THE US AND THE EU-15 COUNTRIES

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Introduction

The regulation of financial markets has become one of the most discussed topics by both academics and practitioners in resent years. The terms such as Basel II, Solvency II, and MiFID (The Markets in Financial Instruments Directive) are widely used by financial market players. This paper intends to contribute to these discussions as it tries to evaluate regulatory pressure on selected banks around the world.

The basic aim of the paper is to assess the behavior of American and European banks, and to analyze their reaction to regulatory pressure (one of the forms of banking regulation). We try to answer two key questions: Does regulatory pressure induce American and European banks to increase their capital? Does the strengthening of capital requirements induce them to increase or decrease their portfolio riskiness?

To answer the key questions we estimate a modified version of the simultaneous equations model developed by SHRIEVES and DAHL [26]. In the model, regulatory pressure is one of the explanatory variables and the dependent variables are changes in risk and capital. The model is modified in two main aspects; we first use more advanced approaches towards the regulatory pressure variable (we model the regulatory pressure variable in three different ways), and two, we also include a year dummy variable to capture year-specific effects. There are many methods that can be used to estimate the model; we have chosen the method of two-stage least squares (2SLS) and three-stage least squares (3SLS) estimates in order to test for the robustness of the results.

Data for our research was obtained from BankScope, a database that has statement data on more than 11,000 banks worldwide. We take into consideration panel data for 1,263 American and European banks from the 2000-2005 period.

As we will discuss later in the paper, the conclusions of our research contribute to the literature by providing empirical support to the theories provided by SHRIEVES and DAHL [26], KIM and SANTOMERO, [15] and KOEHN and SANTOMERO [16].

This paper is organized as follows: the second part provides a theoretical framework for the research; the third part describes the model and data used; the fourth section discusses the results of our research and compares them with the findings of other authors; finally, the fifth part concludes the paper and state final remarks.

1 Theory Review

Several opinions on regulating bank capital exist. For instance, SANTOS [25] noted that moral hazard problems and their potential externalities result from bank failures. In addition he stated that insurance schemes have proven successful in protecting a bank from sudden and severe deposit withdrawals, so called bank runs, but at a cost that leads to moral hazard.

There is a plethora of literature dealing with the capital and risk relationship; we can find a number of different theories that give conflicting predictions on whether more stringent capital regulation curtails or promotes bank performance and stability. One branch of literature introduces the stabilizing effects of capital requirements. The stabilizing effects are based on the option-pricing model. In this model, an unregulated bank takes excessive portfolio and leverage risks in order to maximize its shareholder value at the expense of deposit insurance (see FURLONG and KEELEY [8], KEELEY and FURLONG [14]). While capital requirements cannot eliminate these moral hazard incentives, they can reduce them by forcing banks to absorb a larger part of potential losses. Therefore, the value of the deposit insurance option decreases and the incentives for excessive risk taking diminishes.

Thus, capital regulation leads to more capital and less risk taking, and hence to lower probability of a bank default.

Another branch of literature gives different predictions. KIM and SANTOMERO [15], KOEHN and SANTOMERO [16] agree with the above theory in that more stringent capital requirements force banks to increase their level of capital, but they argue that capital is very costly.

SHRIEVES and DAHL [26] give a different rationale in regards to why banks that have built up capital have, at the same time, also increased their risk. They argue this is consistent with a number of hypotheses (bankruptcy cost avoidance, managerial risk aversion, etc) which are not mutually exclusive, meaning that each may underlie capital and risk decisions at any point in time in some subset of banks.

On the other hand, HEID, PORATH, and STOLZ [10] argue that the assumptions of the above theories are not realistic, as these theories abstract from rigidities and adjustment costs. However, the reality is somewhat different from the theory because banks may not be able to instantaneously adjust capital or risk due to adjustment costs or illiquid markets.

More recently, JEITSCHKO and JEUNG [13] presented a new unified approach in investigating the relationship between bank risk taking and bank capital. They introduced a model that incorporates the incentives of three agents (the deposit insurer, the manager, and the shareholder). Their results show that a bank's risk can either increase or decrease with capitalization. The final effect depends on the relative forces of the three agents.

An increasing number of papers have tried to test the above theories in order to find the empirical relationship between capital and risk adjustments (e.g. see Berger [4]). For a summary of the findings we refer to Section 4.4, where we compare our results with the results of other authors.

2 Building a Model

In this section we will discuss the capital and risk behavior of US and EU banks. We will introduce the Shrieves and Dahl simultaneous equations, and then we will describe the data and explain why the 2SLS and 3SLS estimation procedures are used.

2.1 Model Specification

To our knowledge, we are the first to test and compare the capital and risk behavior of US and EU banks. We base our analysis of US and European banks' capital behavior on the simultaneous equations model developed by SHRIEVES and DAHL [26]. This model is used to assess how banks react to requirements placed by the regulator on their capital. An important aspect of the model is that it recognizes that changes in both risk and capital have endogenous (i.e. discretionary) and exogenous components. In the model, observed changes in capital and risk levels include the two components, a discretionary adjustment and a change caused by factors exogenous to the bank. When talking about exogenous changes to capital, these changes can result from enforced increases in capital required by regulators or unanticipated changes in earnings caused by fluctuations in income. With respect to risk, exogenous changes include unanticipated shocks to the national or local economy, such as the changing characteristics of a bank loan portfolio or volatility of loan collateral such as real property. Hence, the model looks like:

$$\Delta CAP_{j,t} = \Delta^d\, CAP_{j,t} + E_{j,t} \tag{1}$$

$$\Delta RISK_{j,t} = \Delta^d\, RISK_{j,t} + S_{j,t} \tag{2}$$

where $\Delta \mathrm{CAP}_{j,t}$ and $\mathrm{RISK}_{j,t}$ are the observed changes in capital and risk levels, respectively, for bank j in period t, the variables $\Delta^d\,\mathrm{CAP}_{j,t}$ and $\Delta^d\,\mathrm{RISK}_{j,t}$ are the discretionary changes in capital and risk while $E_{j,t}$ and $S_{j,t}$ are random shocks.

Following SHRIEVES and DAHL [26], the discretionary changes in capital and risk, $\Delta^d CAP_{j,t}$ and $\Delta^d RISK_{j,t}$, are modeled using the partial adjustment framework, thereby recognizing that banks may not be able to adjust their desired capital ratio and risk levels instantaneously. In this framework, the discretionary changes in capital and risk are proportional to the difference between the target levels and the observed levels in period *t*-1:

$$\Delta^d\, CAP_{j,t} = \alpha\,(CAP^*_{j,t} - CAP_{j,t-1}) \tag{3}$$

$$\Delta^d\, RISK_{j,t} = \beta\,(RISK^*_{j,t} - RISK_{j,t-1}) \tag{4}$$

where $CAP^*_{j,t}$ and $RISK^*_{j,t}$ are bank *j* 's target capital and risk levels, respectively; α, β are parameters.

Substituting equations (3) and (4) into equations (1) and (2), the observed changes in capital and risk can be written as:

$$\Delta CAP_{j,t} = (CAP^*_{j,t} - CAP_{j,t-1}) + E_{j,t} \quad (5)$$

$$\Delta RISK_{j,t} = (RISK^*_{j,t} - RISK_{j,t-1}) + S_{j,t} \quad (6)$$

This means that the observed changes in capital in period t is a function of the target capital in period t ($CAP^*_{j,t}$), the capital in period $t-1$ ($CAP_{j,t-1}$), and random shocks $E_{j,t}$. The observed changes in risk in period t is a function of the target risk level in period t ($RISK^*_{j,t}$), the risk level in period t-1 ($RISK_{j,t-1}$), and random shocks $S_{j,t}$. The target capital ratio and the risk level are not directly observable, but are assumed to be dependent on some set of observable variables describing the bank's financial condition and the state of the economy in each country. AGGARWAL and JACQUES [1] give an example of exogenously determined random shock on the bank that can influence its capital level; a change in the bank´s macroeconomic environment.

2.1.1 Definitions of Capital and Risk

In this study we will follow JACQUES and NIGRO [12], MURINDE and YASEEN [21], and others. We will use the following definition of capital (CAP): the ratio of total regulatory capital to risk-weighted assets (RCRWA). This definition has become more popular since the introduction of risk-weighted assets in Basel capital accords. As mentioned above, total capital represents total regulatory capital; it includes Tier 1 and Tier 2.

The definition of bank risk (RISK) is quite problematic and the literature suggests a number of alternatives, all of which are subject to some criticism. In this study we opt for the ratio of risk-weighted assets to total assets. This measure is in line with the standard work in this area. It was proposed by SHRIEVES and DAHL [22] and used subsequently by JACQUES and NIGRO [12], RIME [22], AGGARWAL and JACQUES [1], HEID, PORATH, and STOLZ [10], ROY [23], and many others. The rationale for using this arbitrary measure is that portfolio risk is primarily determined by the allocation of assets across the different risk categories.

However, it should be pointed out that alternative (and probably even better) measures of risk (such as value at risk, economic capital, or the volatility of the market price of bank assets) were not available for the sample banks during the observed period, hence it was not possible to test for robustness of the results with respect to different definitions of risk.

2.1.2 Variables Affecting Changes in Banks' Capital and Risk

The partial adjustment model, presented in equations (5) and (6), predicts that changes in capital in period t are a function of the target capital, the lagged capital, and any exogenous factors, while changes in risk in period t are a function of the target risk, the lagged risk, and any exogenous shocks. In the following section we introduce the possible explanatory variables, which are proxies for the target capital and risk levels, and their expected impact on banks' capital and risk. All these variables have been used by SHRIEVES and DAHL [26], with the exception of the profitability indicator, emphasized by RIME [22] and ROY [23], and the year dummy variable, proposed by HEID, PORATH, and STOLZ [10] and used also by GODLEWSKI [9] or ROY [24]. The explanatory variables are: bank size (SIZE), profitability indicator (ROA), regulatory pressure (REG), current loan losses (LLOSS), changes in risk (ΔRISK) and capital (ΔCAP), and year dummy variable (dy2001 – dy 2005).

Size (SIZE)

SHRIEVES and DAHL [26], RIME [22], and others state that size may influence target risk and capital levels due to its relationship with risk diversification, the nature of bank investment opportunities or the bank ownership characteristics, and access to equity capital. As SHRIEVES and DAHL [26] note, "access to equity capital may affect the relative importance of bankruptcy cost avoidance or managerial risk aversion theories." AGGARWAL and JACQUES [1] pointed out that larger banks may be willing to hold less capital owing to the fact that they have better ability to increase capital if needed when compared to other banks. In addition, as noted by ROY [24], large banks carry out a wider range of activities which should increase their ability to diversify their portfolio, and hence to reduce their credit risk. Thus, we will include the SIZE variable in the capital and in the risk equations to capture size effects. SIZE will be measured as the natural log of bank total assets. SIZE variable is suppose to be inversely related to changes in risk and capital.

Profitability Indicator (ROA)

RIME [22], ROY [23], and others argue that current profits (which are measured here as return on assets, ROA) may have a positive effect on banks' capital as profitable banks may prefer to increase capital through retained earnings than through equity issues. Banks have to rely mainly on retained earnings to increase capital. The bank's ROA is included in the capital equation with an expected positive effect on capital.

Current loan losses (LLOSS)

Loan loss provisions represent funds that banks set aside to cover bad loans. We will follow the definition of ROY [24], which was also used by AGGARWAL and JACQUES [1], and approximate these losses (LLOSS) with the ratio of loan loss provisions to total assets. We can consider this ratio as a proxy for asset quality. Banks with lower asset quality (higher LLOSS) are expected to have higher risk. Therefore, we will include LLOSS in the risk equation with an expected positive effect on risk.

Changes in risk (Δ RISK) and capital (Δ CAP)

The theories discussed in Section 3 assume that capital and risk decisions are interdependent and determined simultaneously, which suggests the inclusion of Δ RISK in equation (7) and Δ CAP in equation (8). Following SHRIEVES and DAHL [26], we will include these two variables in the right part of the model in order to allow for the different relationships between them. By this inclusion we can find out whether changes in bank capital and asset risk are positively or negatively related to one another (or whether there is no relationship at all). Thus, at the end we can support one of the theory branches mentioned in Section 3.

Year dummy variables (dy 2001 – dy 2005)

HEID, PORATH and STOLZ [10], Roy [23], and others also used year dummy variable to capture further year specific effects. We will include this variable in the risk and capital equation as well. We will cover the six-year period from 2000 to 2005. We will assign a dummy variable for each reference period, except for year 2000 in order to avoid perfect colinearity. These dummy variables are added to the model specification in order to take account of macroeconomic shocks (for example changes in the volume or in the structure of loan demands) that can systematically impact bank capital and credit risk ratios.

2.1.3 Modeling Regulatory Pressure

The main emphasis of this study is on the regulatory pressure variable (REG). This variable is meant to capture the impact of the Basel capital requirements (the response of banks to the 8 % risk-based capital standard) as it describes the behavior of the banks that fell short of the regulatory standards. Moral hazard theory predicts that a bank approaching the regulatory minimum capital ratio may have an incentive to boost capital and reduce risk in order to avoid the regulatory costs triggered by a breach of the capital requirements. However, others argue that poorly capitalized banks may be tempted to take more risk in the hope that higher expected returns will help them increase their capital. We expect that regulatory pressure has a positive impact on changes in capital. Its impact on changes in risk is the question.

Tab. 1: Expected signs of bank characteristic variables

Name of Variable	Change in Capital	Change in Risk
SIZE	-	-
LLOSS		+
ROA	+	
REG	+	?

Source: own.

Several approaches for modeling regulatory pressure exist. In this paper we will discuss only the capital volatility approach (for other approaches see MATEJAŠÁK [20]). Under this approach we define regulatory pressure as a dummy variable, which is 1 if a bank's capital ratio is below the threshold level which is equal to the minimum capital requirement plus one standard deviation of the bank's own capital adequacy ratio, 0 otherwise.

REG = 1 if CAR < (8 % + bank-specific standard deviation of CAR)
= 0 otherwise

Although the choice of one standard deviation is somehow arbitrary, the rationale for using this measure is that banks build a buffer above the regulatory minimum for precautionary reasons and the amount of this buffer depends on the volatility of capital ratio, so this approach utilizes more information than previous methods as it utilizes also volatility of CAR. This approach was suggested by ROY [24].

2.1.4 Specification

On the basis of the previous analysis, the model defined by equations (5) and (6) is specified as follows:

$$\Delta CAP_{j,t} = \alpha_0 + \alpha_1 REG_{j,t-1} + \alpha_2 ROA_{j,t} + \alpha_3 SIZE_{j,t} + \alpha_4 RISK_{j,t} + \alpha_5 CAP_{j,t-1} + \alpha_6 dy2001 + ... + \alpha_9 dy2005 + \varepsilon_{j,t} \quad (7)$$

$$\Delta RISK_{j,t} = \beta_0 + \beta_1 REG_{j,t-1} + \beta_2 LLOSS_{j,t} + \beta_3 SIZE_{j,t} + \beta_4 \Delta CAP_{j,t} + \beta_5 RISK_{j,t-1} + \beta_6 dy2001 + ... + \beta_6 dy2005 + \upsilon_{j,t} \quad (8)$$

where REG represents regulatory pressure defined:

REG = 1 if CAR < (8 % + bank-specific standard deviation of CAR)
= 0 otherwise

2.2 Data Used

Data on the EU 15 and US banks were obtained from BankScope, a database of bank account figures. The database is a joint product of Fitch Ratings (a major rating agency) and Bureau Van Dijk (publisher of financial databases).

Banks that did not report their total capital ratio for at least two consecutive years were omitted from the data set. To obtain a homogenous sample, banks with capital ratio above 100 % were treated as outliers and excluded from the sample. However, those banks that disappeared through mergers and acquisitions do remain part of the sample because their assets and liabilities appear on the balance sheet of the acquiring bank. The figures are measured on a yearly basis which represents the highest periodicity for which data is systematically available.

All the variables used in this study were available on BankScope, except for the RISK variable. Therefore, the total capital level K = (Tier 1 + Tier 2), total assets (A), and the capital adequacy ratio (CAR) were extracted from the database in order to compute the RISK variable in two steps. In the first step risk-weighed assets were calculated (RWA), and in the second step the RISK variable was calculated.

1) $CAR = \dfrac{K}{RWA}$ then $RWA = \dfrac{K}{CAR}$

2) $RISK = \dfrac{RWA}{A}$

The sample altogether consists of 5,323 observations on 1,263 US and EU-15 banks which were in existence between 2000 and 2005.

The following table shows the mean values of the sample for some bank characteristics for both American and European banks for each of the six sub-periods. The table also includes changes in risk and capital.

Tab. 2: Basic Sample Characteristic

	Number of banks	Number of Observations
EU 15	580	2 116
USA	683	3 207
TOTAL	**1 263**	**5 323**

Source: Own calculations.

Tab. 3: Means of bank characteristics, by year

	2000		2001		2002		2003		2004		2005		Grand average
	EU 15	USA	EU 15	USA	EU 15	USA	EU 15	USA	EU 15	USA	EU 15	USA	
CAR %	14.0	14.7	15.0	15.0	14.9	15.3	15.2	15.2	14.6	15.0	14.5	15.0	14.9
SIZE t	8.1	7.5	7.5	7.6	7.6	7.7	7.8	7.7	8.2	7.9	8.7	7.9	7.8
ROA t	0.7	1.1	0.7	1.1	0.6	1.2	0.8	1.2	0.9	1.2	1.0	1.2	1.0
LLOSS t	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.002	0.001	0.002	0.003
CAP t	14.0	14.7	15.0	15.0	14.9	15.3	15.2	15.2	14.6	15.0	14.5	15.0	14.9
RISK t	0.66	0.67	0.66	0.67	0.66	0.66	0.67	0.67	0.68	0.68	0.63	0.69	0.67
Δ CAP t	-0.05	-0.38	0.98	0.37	-0.08	0.30	0.28	-0.17	-0.53	-0.16	-0.12	-0.03	0.03
Δ RISK t	0.01	0.01	0.00	0.00	0.01	-0.01	0.01	0.01	0.00	0.01	-0.04	0.01	0.00
No. of obs.	352	633	434	612	427	572	431	533	416	450	56	407	

Source: Own calculations.

2.3 Methodology

To solve the model, we estimate the system of simultaneous equations defined by (7) and (8) using both a two–stage least squares (2SLS) procedure, and three-stage least-squares (3SLS) procedure. Both techniques are used in order to test for robustness of the results. 2SLS framework allows us to take account of the simultaneity of banks' adjustments in capital and risk. It recognizes the endogeneity of changes in capital and risk, so it is preferable for a single equation models that assumes either risk or capital to be an exogenous variable to the bank. 2SLS, unlike ordinary least squares (OLS), provides consistent parameter estimates.

3SLS technique also recognizes the endogeneity of changes in capital and risk. Thus, unlike OLS, it provides consistent estimates of the parameters. Moreover, it is preferable to two-stage least squares (2SLS) because 3SLS is a full information technique that estimates all parameters simultaneously. In addition, 3SLS takes into account the cross-equation correlations, so in using this technique we get estimates that are asymptotically more efficient than under 2SLS estimates. However, as noted by INTRILLIGATOR [11], 3SLS may be sensitive to misspecification or measurement errors. This suggests the comparison of the 2SLS and 3SLS results.

2SLS, as the name suggests, is done in two steps. In the first step we estimate the reduced form equations using OLS and save the fitted values for the dependent variables. This step is done to obtain consistent parameter estimates. In the second step we estimate the structural equation using OLS but replace all endogenous variables with their fitted values from the first stage.

3SLS method provides one additional step in the estimation procedure. This extra step allows for non-zero covariance between the error terms. It is asymptotically more efficient than 2SLS since the latter ignores any information that may be available as the errors across equations may be correlated.

The 2SLS and 3SLS procedure were run with the SAS software package.

3 Empirical Results

Estimation of simultaneous equations (7) and (8) using 2SLS produces essentially the same results as 3SLS. Therefore, the latter is retained for the remainder of the study as the 3SLS estimation method is more efficient. The model results are shown in the following table:

Within the capital volatility approach, the REG is a dummy variable that equals 1 if the bank's capital ratio is below the minimum level plus one bank-specific standard deviation, or equals 0 otherwise. If REG is defined in this way, we find that there were 271 European cases (13 % of the EU sample) and 123 American cases (4 % of the US sample) that were under regulatory pressure.

Before analyzing the regulatory pressure and the overall relationship between capital and risk, we discuss the signs of the remaining variables and we start by presenting the results which are essentially the same for both US and EU banks.

Banks with lower asset quality (higher LLOSS) had greater risk. SIZE has a negative and signifi-

Tab. 4: Capital volatility approach – results

Estimation method	EU 15				USA			
Variables	ΔCAP_t		$\Delta RISK_t$		ΔCAP_t		$\Delta RISK_t$	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
ROA_t	0.1011	1.36			0.4187***	8.68		
$SIZE_t$	-0.4558***	-9.48	-0,0042***	-4.61	-0.1032**	-2.28	-0.0015**	-2.08
$LLOSS_t$			2.2561***	5.05			0.4537***	4.97
REG_{t-1}	0.6683*	1.96	-0.0013	-0.18	3.1327***	7.59	-0.0477***	-6.71
$RISK_{t-1}$			-0.2109***	-15.18			-0.1029***	-11.76
CAP_{t-1}	-0.3663***	-18.98			-0.1501***	-12.93		
$\Delta RISK_t$	11.5107***	3.52			22.3755***	4.24		
ΔCAP_t			0.0006	0.54			0.0034***	2.65
Dum 2001	0.4683	1.31	-0.0197***	-2.76	0.8566***	3.64	-0.0159***	-4.16
Dum 2002	0.3908	1.10	-0.0181**	-2.54	1.3273***	5.17	-0.0254***	-6.43
Dum 2003	0.3125	0.90	-0.0011	-0.15	0.6615***	2.86	-0.0076*	-1.92
Dum 2004	0.2749	0.77	-0.0054	-0.75	-0.0316	-0.13	0.0030	0.73
Dum 2005	0.8317	1.18	-0.0177	-1.24	0.1900	0.77	0.0058	1.38
Sys.weight.R^2	0.17				0.11			
No. Obs.	2 065				3 172			

*** indicates significance at the 1 % level
** indicates significance at the 5 % level
* indicates significance at the 10 % level

Source: Own calculations.

cant impact on capital, indicating that large American and European banks increased their capital less than other banks. One possible explanation is that these banks compete on international markets where they have to face fiercer competition with international banks that are, in general, less capitalized. ROY [23] states that large banks have easier access to capital markets and therefore they can operate with lower amounts of capital. Alternatively, as noted by ROY [23], this may be due to a diversification effect. The argument is that portfolio diversification reduces the probability of experiencing a large drop in the capital ratio, and the diversification increases with bank size.

The parameter estimates on lagged capital ratios were negative and significant with the parameter estimates of -0.37 for EU banks and -0.15 for US banks. The parameter estimates on lagged risk ratios were also negative and significant (-0.21 for EU banks and -0.10 for US banks.). In general, these values imply adjustments of bank capital ratios and risk to desired levels. Looking at the amplitude of the estimates we can observe that European banks are quicker in the adjustment of both capital and risk to desired levels. The difference between US and European banks is that for American banks current earnings (ROA) have a significant and positive impact on changes in capital. This means that profitable US banks can more easily increase their capital through retained earnings.

Table 4 shows that this approach led to significant estimates of the regulatory pressure in the capital equation for both European and US banks. Ceteris paribus, banks within one standard deviation of the threshold increase their capital more than other banks. European banks close to minimum regulatory requirements increased their capital to risk-weighted assets ratio by 0.7 percentage points more than other European banks. When compared to US banks, the impact of regulatory pressure is even greater in the USA. The US banks that were below the minimum requirement plus one standard deviation, increased their capital to risk-weighted assets ratio by 3.1 percentage points more than other US banks. Thus, the impact of the regulatory pressure is larger in amplitude for US banks than for EU banks. One possible explanation is that European banks may have greater difficulties in adjusting their capital or that US regulators have a stricter attitude towards undercapitalized banks so that US banks fear breaking the rules more than their European counterparties.

In the risk equation, nothing new occurs; the regulatory pressure has a significant and negative impact only for US banks. In conclusion, our findings provide basic evidence that Basel I standards have a positive effect on both US and European banks' capital adequacy ratios. Second, if under regulatory pressure, both European and US banks increase their capital. In addition, US banks also decrease their risk.

3.1 Comparison with Other Findings

As presented in Section 3, general theory provides rather rivaling predictions on the relationship between capital and riskiness of banks. As shown in the following table, the empirical studies on the issue do not provide any clear conclusions either.

Although all of the authors listed in the above table based their analyses of bank behavior to large extent on the SHRIEVES and DAHL [26] model, the results and conclusions differ significantly. Our results are similar to the findings of SHRIEVES and DAHL [26] who analyzed the behavior of 1,800 US banks over 3 years, from 1984 until 1986, just before the Basel I requirements were implemented. Our results are similar to theirs in the key conclusions: there is a significant positive impact of regulatory pressure on capital and a negative and significant impact on risk levels; changes in risk and capital levels are positively related.

The empirical findings of other research papers go in opposing directions. Table 7 shows that some authors find that regulatory pressure positively influences capital ratios in banks, while others find a negative relationship. When it comes to the impact of regulatory pressure on risk levels, their

Tab. 5: Comparison with other findings

	Year	Sample and Period	Impact of regulatory pressure on CAP	Impact of regulatory pressure on RISK	Relationship between CAP and RISK
This study	2007	580 European banks and 683 US banks over 6 years (2000 – 2005)	+ for B (EU banks) 0 and + for B (US banks)	0 for B (EU banks) - for B (US banks)	+ for B
Roy	2005	586 banks from G10 (with assets over $100 million) over 8 years (1988 – 1995)	- and 0 for B	+ and 0 for B	- for B
Murinde and Yassen	2004	98 banks in 11 countries during 8 years (1995 – 2002)	- and + for B	- and 0 for B	- and 0
Abhiman and Ghosh	2004	27 Indian banks over 6 years (1996 – 2001)	- for B	- for B	- for B
Heid, Porath and Stolz	2003	570 German savings banks over 8 years (1993 – 2000)	- and 0 for B	+ and 0 for B	0
Rime	2001	154 Swiss banks over 8 years (1989 – 1996)	0 for A + for U	0 for A 0 for U	0
Aggarwal and Jacques	2001	1,685 US banks (with assets over $100 million) over 6 years (1991 – 1996)	+ for A in 91 + for U in 91 0 for A in 92 0 for U in 92 0 for A in 93-96 0 for U in 93-96	+ for A in 91 + for U in 91 0 for A in 92 0 for U in 92 - for A in 93-96 - for U in 93-96	+ and – in 91 + and – in 92 + in 93-96
Shrieves and Dahl	1992	1,800 US banks over 3 years (1984 – 1986)	+ for B	- for B	+ for B
Note: + significantly positive, - significantly negative, 0 insignificant A adequately capitalized banks, U undercapitalized banks, B banks as a whole					

Source: own.

conclusions also differ considerably. Some authors find a positive relationship while others find a negative relationship. Alternatively, some authors find no relationship. Finally, the conclusions also differ significantly when it comes to the question of the relationship between changes in risk and capital, as already mentioned in Section 3.

Conclusion

Bank capital requirements play a prominent role in sustaining financial stability. There are different theories that have rivaling predictions about how banks adjust their risk and capital behavior to imposed regulatory constraints. To our knowledge, we are the first to test and compare the capital and risk behavior of US banks and banks from the EU 15 region. Using the freshest data from the 2000–2005 period we have estimated a modified version of the simultaneous equation model developed by SHRIEVES and DAHL [26]. The model is modified in two main aspects; we use more advanced approaches towards the regulatory pressure and we also include a year dummy variable to capture year-specific effects. We find that capital regulation has a significant impact on capital and risk taking for both US and EU 15 banks in several respects. We find that both European and US banks close to the minimum regulatory threshold tend to increase their capital adequacy by increasing their capital. American banks in addition reduce their risk-taking. These findings indicate that expected penalties implied by possible breach of capital obligations have the desired effect on bank behavior and that bank capital regulation is effective in binding excessive risk taking.

Moreover, we find empirical evidence that even well capitalized EU banks try to maintain their capital on a safe level. This may relate to “cautionary behavior.” Finally, we observe a positive and significant relationship between capital levels and risk exposure for both US and EU banks. This means that banks raise their risk and capital simultaneously. Hence, we contribute to the literature by providing empirical support to the theories provided by SHRIEVES and DAHL [26], KIM and SANTOMERO [15], and KOEHN and SANTOMERO [16], who all predict a positive relationship between risk and capital adjustments. However, our results indicate that additions to capital over-compensate the increase in risk, so the regulatory standards do not have the unintended effect of increasing the probability of bank default.

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ABSTRACT

THE IMPACT OF REGULATION OF BANKS IN THE US AND THE EU-15 COUNTRIES

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The regulation of financial markets and banking industry has become one of the most discussed topics by both academics and practitioners in recent years. One of the reason is the fact that bank capital requirements play a prominent role in sustaining financial stability. There are different theories that have rivaling predictions about how banks adjust their risk and capital behavior to imposed regulatory constraints. This paper intends to contribute to these discussions as it tries to evaluate regulatory pressure on selected banks around the world in the 2000-2005 period. To our knowledge, we are the first to test and compare the capital and risk behavior of US banks and banks from the EU 15 region in this period. In order to provide our analysis, we estimate a modified version of the simultaneous equations model developed by Shrieves and Dahl. This model analyzes adjustments in capital and risk at banks when they approach the minimum regulatory capital level. In the model, regulatory pressure is one of the explanatory variables and the dependent variables are changes in risk and capital. There are many methods that can be used to estimate the model; we have chosen the method of two-stage least squares (2SLS) and three-stage least squares (3SLS) estimates in order to test for the robustness of the results. The results indicate that regulatory requirements have the desired effect on bank behavior. We find that both European and US banks close to the minimum regulatory threshold tend to increase their capital adequacy by increasing their capital. Finally, we observe a positive and significant relationship between capital levels and risk exposure for both US and EU banks.

Key Words: *banking regulation, Basel Capital Accord, capital adequacy, banks, simultaneous equations model, European Union.*

JEL Classification: *C30, G18, G21.*