Capital Adequacy, Risk Profiles and Bank Behaviour: Empirical Evidence from Jordan

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ABSTRACT

Given the high rates of growth and the overall dramatic regulatory changes toward banks, this study explores how bank behave against changes in capital requirements imposed by the regulatory bodies in Jordan. Yet, the relationship between change in risk levels and adjustments in capital is tested by employing multivariate panel regressions/simultaneous equations model, in which the Generalized Least Square (GLS), the Fixed Effect Model (FEM), and the Random Effect Model (REM) are used. The study concludes strong positive effects of the regulatory framework and banks capital stipulated levels that need to be reconstructed to meet their risk profiles. The study revealed that while Jordanian banks become close to the minimum level of capital requirements they tend to increase their capital base, given their different risk's levels.

JEL Classification: G21, D21

Keywords: Capital Adequacy, Bank Behaviour, Panel Data.

1. INTRODUCTION

Within the Jordanian context, several dramatic regulatory changes has emerged over the last few years, inducing more rivalry toward banks, high rates of growth, new electronic trading innovations as well as local and global expansionism. Yet, given banks crucial role as financial intermediaries, the expansion creates the need for continuous reforms and supervision, in which capital constraints is of the most. The motive is to lower the probability of failure, as these constraints are built. Controversial results are revealed regarding the impact of capital constraints. For example, the imposition of a higher capital-to-assets ratio to be followed by banks would provide adverse impact on banks performance.

In this regard, as stressed by Koehn and Santomero (1980), regulating bank capitals through ratio constraints appear to be an inadequate tool to control the riskness of banks, reflecting the need to look after other control techniques to control the probability of banks failure, asset restrictions for example. This view is supported by Dietrich *et al*. (1983) who investigated the effectiveness of capital regulation, in which they concluded that regulation on banks is inefficient. Marcus (1983) also revealed the same conclusion about the effect of capital regulation on bank holding companies. Several other related studies illustrated additional disadvantages of regulation. Kim and Santomero (1988), and Rochet (1992), revealed that if capital is relatively expensive, the forced reduction in leverage diminishes the banks expected return. On the contrary, by using 103 largest U.S banks as a sample, Keeley (1988) suggested that the capital regulations are effective.

Worldwide, in the last few years, significant decline in banks capital ratios are observed. Under which regulators issued explicit capital requirements that required banks to hold a fixed proportion of their total

Received on 16/11/2006 and Accepted for Publication on 24/10/2007.

assets as capital. However, while capital requirements contribute to increase bank capital levels, there are still a number of bank failures that exist. In response, the Basel Committee on Banking Supervision (BCBS) forced banks to comply with the realized risk-based capital standards(1). At this stage, it could be concluded that the Basel accord agreement was made against a background of concerns about a decline in capital proportions held by banks, exacerbated by the expansion of the off-balance sheet activity, and worries that banks from certain jurisdictions are seeking a short-term comparative advantage in some markets by maintaining a very low level of capital.

While it is of great interest to scrutinize the relationship between capital requirements and bank behaviors, this study tests for the interrelationship between capital requirements and banks behavior within the Jordanian context, given differences in banks risk profiles. The test is undertaken under the assumption that regulatory pressure induces banks to increase their capitals, but does no effect on the level of risk. The test provides the chance to address the procedures banks adopt as interaction to improve their capital ratio when they approach to the regulatory capital minimum level. As well, the test attempts to meet the enquiry whether the regulatory conditions affect bank capital, when the capital ratio is closed to the regulatory minimum. Which items of balance sheet bear the bulk of adjustments pressure, when banks are subject to the regulatory pressures? Do banks increase their capital or do they reduce their higher-risk assets? Does the increase in capital requirements lead banks to reduce or to increase the riskness of their portfolios?(2)

The rest of the study is structured as follows. Section 2 outlines some economic indicators and reviews the related literature. Methodology and data description is given throughout section 3 which describes the variables operational definitions and the structural tests employed in this study. Section 4 presents the empirical results, in which a description of the regression techniques used and a detailed discussion of the regression results are outlined. Summary and conclusions are given by section 5.

2. ECONOMIC INDICATORS AND LITERATURE REVIEW

The level of economic performance in Jordan, particularly during the period 1990-2002, have shown high rates of growth. The GDP as well as the GNP have been expanded at high rates. The industrial base was further diversified; expansion in the overall banking products, growth in domestic revenues, and surplus in balance of payments. In particular, Jordan has witnessed considerable developments in its financial and banking system, in parallel to the achieved economic and social progress. However, as reported in Table (1), the performance of the Jordanian economy, in 2003 in specific, was driven by the increase in domestic demands, growth of national exports, and lower interest rates structure to cope with prevalent domestic economic conditions and interest rates developments in the international markets. Institutionally, the banking system expanded to reach 24 commercial banks as at November 2004. As in Table (2), banks performed their businesses through 456 branches, reflecting 11.6 thousand of population per branch. The expansion of banks products provided by the geographical branches is coupled with increase in levels of risk, which consequently induce regulation to impose heavy legislation, particularly those imposed in banks capital base.

The Central Bank of Jordan attempts to diversify among the different regulation forms to be followed by banks in order to control and enhance the overall soundness of the banking system. Public intervention is concerned with providing emergency liquidity assistance; designing optimal deposit insurance schemes; setting minimum solvency requirements for banks; and supervising the banking industry by monitoring banks.

Table (1): The Jordanian Economy: Some Economic Indicators over the period 1999-2003

Year	1999	2000	2001	2002	2003
Gross National Product (GNP)	5758,6	6084,6	64717,7	6777	7143
Gross Domestic Product (GDP)	5767	5989	6339	6698	7056
Growth Rate of GDP	3,1	4,1	4,9	4,8	3,3
Money Supply (M2)	6747	7434	7866	8419	9465
Net Foreign Assets of Banking System	3003	3852	3991	4418	5492
Net Domestic Assets of Banking System	3744	3582	3875	4000	3973
Deposit in JD held at Banks	4681	5000	5203	5532	6082
Deposit in FC Held at Banks	2821	3224	3517	3835	3886

Source: Central Bank of Jordan, various annual Issues. JD stands for the local currency, the Jordanian Dinar, while FC stands for foreign currency.

Table (2): Number of Licensed Banks and Branches - 1964-2004

Year	1964	1970	1980	1990	2000	2002	2003	2004
number of banks	8	8	15	18	21	21	21	24
number of branches	22	41	124	298	469	471	449	456

Source: Central Bank of Jordan, various annual issues

In the literature, regulators have increased their focus on the capital adequacy of banking institutions in order to support the stability of the financial system. A major step toward such interest is the 1988 agreement G-10 countries on minimal-risk-based capital requirements for banks. Yet, the Basel accord is established with two fundamental objectives. First, to strengthen the soundness and stability of the international banking system, and second is to obtain a high degree of consistency in its application to banks in different countries, with a view to demising the existing sources of competitiveness in quality among international banks. In the light of maintaining these objectives, the accord requires banks to meet a minimum capital ratio which is at least 8% of total risk-weighted assets.

Pelzaman (1970) showed that there is no significance effect of the ABC ratio on subsequent capital changes. His result depends on using state-wide average data. In contrast, by using banks level data, Mingo (1975) regressed the percentage growth in capital on a range of conditional variables such as the ratio of the actual bank capital to the capital desired by the regulatory, in which he concluded that there is a strong and statistically significant positive effect of ABC ratio on subsequent bank capital changes. Kahane (1977), Kareken and Wallance (1978) and Sharpe (1978) examined the effectiveness of capital standards in controlling bank solvency in complete market by using state performance model.

Benston *et al*. (1986), Furlong and Keeley (1989) and Keeley Furlong and (1990) showed that an unregulated bank will take excessive portfolio and leverage risks in order to maximize its shareholders value at the expenses of the deposit insurance. Kim *et al*. (1988) explored the use of simple capital ratios in regulation and they concluded an effective mean of capital ratios to element the insolvency risk of banks. Based on the crucial effect of regulation on the level of

risk in the asset portfolio, Alfriend (1988) reported a positive relationship between the risk of the assets portfolio & the capital standards; confirming what has been achieved by Furlong *et al*. (1987) in which capital regulations were conducted to increase asset risk. Kim and Santomero (1988) apply the single-period mean variance model to demonstrate that the traditional uniform capital ratio forms an ineffective way to control the probability of bank insolvency. The reason behind such result is that it ignores the individual banks different preference structures and allows "risky" banks to circumvent the restrictions via financial leverage and/or business risk.

The study of Wall *et al*. (1989) concluded that regulators are working in developing guidelines that will enable banks to self-manage their risk exposure, the bank may adopt internal risk limits to establish links between this kind of risk exposure and capital criteria, which has important advantages. For instance, it would reduce the costs of comply with the capital requirement by allowing banks a choice between the expense of developing more sophisticated information gathering systems, and maintaining higher capital. The works of Keeton (1989), Avery and Berger (1991) and Kaufman (1992) provided evidence about the effect of based capital standards. Their result observed that whether the risk weights used in the risk-based capital standards do not accurately reflect the true risk of an asset, then banks may actually have an incentive to increase portfolio risk.

Gennotte and pyle (1991) reported that value-maximizing banks may increase portfolio risk and so the probability of failure increases in the case if bank investments are subject to decreasing returns of investment. Shrieves and Dhal (1992) pointed out that capital ratio and total assets risk are positively correlated, and vice versa. The study of Park (1994) discusseed why capital requirement affects banks investment decision, in which the results revealed two reasons behind the changes in the investment decision of banks. The first is related to banks ability to take advantages of deposit financing which is cheaper because of the deposit insurance, while the second is related to the cost of equity that can be excessive due to information asymmetry between mangers and the stock market. Mc Connell and Servase (1995) confirmed that leverage quality (total debt over total assets) is negatively correlated to the firm value of a high growth firm, while it is positively correlated to that of a low growth firm. Lindgren *et al.* (1996) observed that since 1980, over 130 countries comprising almost three-fourths of IMFs member countries have experienced significant banking problems, which requires heavy regulations. Blum (1999) concentrated on the consequences of regulation on bank behavior specifically. In his dynamic framework, Blum (1999) showed that capital adequacy rules may increase banks riskness[(3)]. Gorton and Winton (1999) stated that rising capital requirements can increase the cost of capital.

Cyree *et al*. (2000) focused on studying the determination of bank growth during two time periods, 1983-1988 and 1989-1994. They found that banks that are federally charted are less likely to grow in both time periods, reflecting a possible explanation in which charted banks keep higher capital. Four reasons are put forward by Benston (2000) to justify why banks should be involved under government regulations. The first is to offset the moral hazard and agency cost that result from deposit insurance, while the second is to allay concerns about consumer protection. The third is to meet demand by politically powerful groups for concerns on competition, and finally to serve the interests of popularly elected government officials. Santos (2000) analyzed some of the approaches to redesigning the 1988 Basel Accord on capital standards, and revealed that there is still no census on the optimal design of bank capital regulation and there are differences in opinion regarding the market failure that justify banking regulation. Further, Santos (2000) discussed some useful insights for the design of capital standards, i.e., raising the minimum required capital standards may improve banks stability but it represents potential sources of costs. Increasing the cost of operating in the banking business may lead to ineffectiveness, as intermediation through other financial intermediations is not a perfect

substitute for banks.

Adding to the study of Bernanke *et al.* (1991), Johnson (1992) tested for the relationship between the capital adequacy and negative growth of banks, Barth *et al*. (2001) manifested that restricting banking activities is negatively associated with bank development by using 107 countries. Morrision (2001) employed the general equilibrium model to examine the role of regulator in the auditing of banks and in the setting of capital requirements in preventing crisis. He focussed on the relationship between capital requirement and regulatory authorities. He concluded that if public confidence is maximized toward regulators, then the ability to detect weak banks will be increased sufficiently, causing non-occurrence of bank crisis. Depending on a sample that consisted of U.S. commercial banks which were operating continuously during the period of 1989-1997, Furfine (2001) concluded that regulatory standers have a significant impact on the optimal portfolio allocation of commercial banks.

Under the fact that most of the earlier studies focused on assessing the impact of capital requirements on banks behavior, Rime (2001) provided empirical evidence on the reaction of the Swiss banks capital to any constraints presented by regulatory position**.** The results indicated that regulatory presser required banks to increase their capital. But regulatory presser didn't have any significant impact on banks' risk. Ghosh *et al*. (2003) used multivariate panel regression model to investigate the relationship between changes in risk and capital. The results revealed that capital requirements do significantly affect banks capital ratio decisions, and regulatory framework should be designed to encourage banks to obtain higher CRAR than the stipulated capital level. Ghosh *et al*. (2003) revealed that there is no conclusive evidence of risk aversion among Indian banks.

The regulation influences on banks capital and assets classification are under the interest of several other empirical related studies. Kopecky and VanHosse (2004) stated that risk-based capital standards changed basic short and long-run loan market outcomes, relative to the outcomes under either non-risk based capital standards or no capital requirements. Moreover, they showed that non-risk based standards primarily influence the structure of bank liability. Calem, and LaCour-Little (2004) concluded that appropriate capital changes for credit risk vary substantially with loan characteristics and portfolio diversifications. Homolle (2004) investigated whether more stringent capital requirements lead to reduce or to increase bank risk-taking, and he concluded that some banks increased assets risk due to the enforcement of a more stringent capital requirements. Lin *et al*. (2004) explored the relationship between Capital Adequacy (CA) in assessing Insolvency Risk (IR) and financial performance by applying the index of IR to the failure risk in the Taiwan's banking industry during 1993-2000. In such light, their study demonstrated a positive relationship between the CA and the IR, while on the other hand, they showed a significant negative relationship between IR and financial performance.

3. METHODOLOGY AND DATA DESCRIPTION

This study applies a version of a model built on previous work by Shrieves and Dahl (1992), and subsequently Rime (2001). This study used multivariate panel regression models, namely; GLS, FEM, and REM to test adjustments in capital and risk within the Jordanian banks. If we assess bank response to capital requirements, we first observe the following simple identity:

$$Capital = \left(\frac{Capital}{Total\ Risk\ Weighted Assets}\right) * \left(\frac{Total\ Risk\ Weighted Assets}{Total\ Assets}\right) * Total\ Assets \quad \ldots(1)$$

Or

$$Cap = R * P * TA \quad \ldots(2)$$

Where: *Cap* goes for capital, *R* is the risk weighted capital ratio, *P* is the portfolio factor, and *TA* stands for total assets. Then, by using the superscript notation for proportionate changes ($\hat{R} = \Delta R/R$); we obtain after

rearrangement:

$$\hat{R} = CA\hat{P} - \hat{P} - T\hat{A} \quad \ldots(3)^{(4)}$$

The multivariate panel regression model is formulated where the changes in capital ratio depend on its lagged value. Hence, because banks may not be able to adjust their capital ratios and risk levels instantaneously, we use changes in capital and risk, proportional to the difference between the target level and level existing in period *t-1*.

$$\Delta Cap = \alpha(Cap_t - Cap_{t-1}) + \varepsilon \quad \ldots(4)$$

$$\Delta Risk = \beta(risk_t - risk_{t-1}) + \delta \quad \ldots(5)$$

Thus, observed changes in capital and risk in period *t* are a function of the target capital and risk levels, the lagged capital and risk levels, and any exogenous factors. While there are numerous variables that affect changes in capital and risk, equations 6 and 7 predict that changes in capital and risk in period *t* are a function of the target capital and risk levels, the lagged capital and risk levels, and any exogenous factors or shocks.

$$\Delta Cap = \alpha_0 + \alpha_1 REG + \alpha_2 ROA + \alpha_3 SIZE + \alpha_4 \Delta RISK_t + \alpha_5 CAP_{t-1} + \varepsilon \quad \ldots(6)$$

$$\Delta Risk = \alpha_0 + \alpha_1 REG + \alpha_2 LLP_{j.t} + \alpha_3 SIZE + \alpha_4 \Delta Cap_t + \alpha_5 Risk_{t-1} + \nu \quad \ldots(7)^{(5)}$$

Where *Cap* is a measure of capital, *REG* is a measure of regulation pressure; *ROA* is return on assets, *SIZE* is a measure of bank size, proxied by log of total assets, Δ is a measure of bank risk, *LLP* represents current loan losses provisions, for bank *j* in period *t*. ε and v stands for any exogenous factors or shocks.

The sign of *ROA* is expected to be positive in its impact on capital, reflecting the expected sign of the coefficient of *ROA* to be positive (> 0), indicating thereby that profitable banks can move easily, and improve their capitalization through retained earnings. The *SIZE* is expected to have a negative sign in its impact on capital, indicating that large banks increased their capital level less than other banks. On the other hand, the *SIZE* has a positive impact on risk reflecting the fact that big banks disengage from mortgage lending (preferential risk weight of 50%). Continuously, the expected sign of regulatory pressure (*REG*) is positive on the ratio of capital-to-risk weighted assets, and has no impact on banks risk. but concerning current loan losses, they are expected to be negative in its impact on the banks risk, indicating that the expected sign of the coefficient of *LLP* is negative (< 0) .

Data and Variables Operational Definition

The data used in this study comprise a sample of a group of commercial and investment banks operating in Jordan. Under the availability of data, the study period extended over the years 1990 to 2003, inclusive. Description of variables are given below while more detailed description is provided in Appendix D, where Appendix E provides a list of the banks included in the study sample. For measurement purposes, while there are various measures that can be employed to measure bank capital, two measures of banks capital is used in this study. (a) the Ratio of Capital-to-Total Assets (RCTA)[6]. (b) the Ratio of Capital-to-Total Weighted Assets (RCWA). This measure has become more popular since the introduction of risk weighted capital standards and has been used by Jacques and nigro (1997), Aggrawal and Jacques (1998) and Ediz, and Michael and perrandin (1998).

The risk weighting of balance sheet assets ratio employed in this study is defined as the five different weights, being 0%, 10%, 20%, 50%, 100%, to the banks claims against a counterparty, the application of the risk weightings can be very broadly categorized as follows: claims against government attracting one of the lowest three weights, claims against other banks which weighted 20%, claims against all other counterparties which weighted 100%, with the exception of loans that are fully secured by mortgages over the residential or rented property of the borrower which attract 50% weight, where the loan valuation ratio is greater than

80%, the risk weighting reverts to 100%[7]. The main inclusions in each of the weighting categories and the procedure of satisfaction are presented in Appendix C. Peltzman (1970) and Mingo (1975) regressed percentage growth in capital on arrange of conditioning variables, including the banks lagged ABC ratio (ratio of actual bank capital to the capital desired by the regulator). Other studies adopt the RCTA and RCWA i.e., Ediz *et al*. (1998) and Rime (2001), which are used in this study.

In order to measure the bank risk level, this study used the ratio of Risk Weighted Assets-to-Total Assets (RWA). The study expects a positive relationship between the level of risk and the change in banks capital. The reason is attributed to the fact that if the bank holds risky assets in its portfolio it should increase the size of its capital to support such risky portfolio. Based on equations 4 and 5, we predict that the changes in capital and risk, in period *t* (dependent variable), are a function of the targeted capital and risk levels, lagged capital and risk levels, and other exogenous factor or shocks.

For regulatory pressure, it can be evaluated in several techniques. Ediz *et al*. (1998) used a relatively refined technique of regulatory pressure, which reflects the impact of the capital ratio volatility on the probability of failing to meet the legal requirements. As a substitute, Aggarwal and Jacques (1998) measured regulatory pressure using the prompt corrective action (PCA), classification between adequately capitalized and under-capitalized institutions. In this study, we embrace both measures of regulatory pressure. However, regulatory pressure variables, REG, are unity if the banks capital ratio is within one standard deviation of the minimum capital requirements imposed by the central bank, and zero otherwise, according to the probabilistic approach. On the other hand, within the PCA- based approach, we build first regulatory variables (PCAU), which are unity for banks with an RCWA of less than 8% and zero otherwise, and the second regulatory pressure variables (PCAA) which are unity for banks with an RCWA comprised between 8 and 10%. This variable is adopted in this study. Theoretically, we have a positive relationship between regulation and change in capital[8].

In reference to Return on Assets (ROA), it is considered as a primary indicator of managerial efficiency. It indicates how capable the management of the bank has been in converting the institution assets into net earnings. It is used as a performance measure, and is defined as the ratio of banks before-tax net income divided by its total assets. We have a positive relationship between the return on assets and change in capital, in the case if the financial institutions prefer to increase capital through retained earnings than through equity issues, or through the current profits.

In reference to SIZE, the natural log of total assets is used to capture the size effect. SIZE is expected to have an influence toward the targeted risk and capital levels due to its relationship with risk diversification, investment opportunity, and access to equity capital. The SIZE variable is included in both capital and risk equations. A positive relationship between the size of bank and the change in capital is expected, reflecting a positive coefficient, (> 0).

For current loan losses variable, a verity of proxies can be used i.e., the ratio of non-performing assets to total loans and leases, the ratio of net loan charge-offs to total loans and leases, and the ratio of allowance for loan losses to total loans. In fact, banks are facing credit risk typified by the probability that some of their assets, especially the loans item, may decline in value or perhaps become worthless. Under such concern, while banks normally hold little owners capital relative to the aggregate value of their assets, only a relatively small percentage of total loans needs to turn bad to push any bank to the threshold of failure. To face such type of risk, provision accounts, which are considered as bookkeeping entry and non-cash expense, are developed. The aim is to shelter a portion of the banks current earnings from taxes to help preparing for bad loans. In this study, the current loan losses that are included in the risk equation can express Loan Loss Provisions (LLP). It is approximated by the ratio of new provisions to total assets. The sign is expected to be negative in its impact on the bank level of risk.

Overall, given the fact that risk-based capital

standards are explicitly linked to capital and risk by assigning risk weights to broad categories of on-and-off-balance sheet assets, reciprocity relationships between risk and capital exist. After assigning assets to the appropriate risk category, the bank calculates their total risk-weighted assets as the sum of the value of each asset multiplied by the corresponding risk weight. In all, banks are required to hold capital equal to a certain percentage of the total risk-weighted assets. Yet, theoretically, relationships between capital and risk are interdependent, in a régime to risk-weighted capital requirements. We can assume that banks bounded by the regulatory capital requirements will compensate on increase (decrease) in RWA with an increase (decrease) in RCTA to keep their RCWA constant[9]. Therefore, the study anticipates a positive relationship between changes in risk and changes in RCTA. Consequently, the relationship between changes in RWA and RCWA may be rather weak or even not significant.

Descriptive Statistics

Based on the Jordanian capital requirements for the period 1990-2003, Table 3 shows the average level of excess capital as percentage of required capital and the standard deviation for different categories of Jordanian banks. For big banks, see Appendix F for classification purposes, excess capital represents 3.1% of required capital. Their relatively high capital ratio may be related to their good reputation, reflecting their desire to have high level of capital more than capital requirements imposed by the central bank. To achieve capital adequacy requirements, big banks miss to achieve large levels of profitability, inducing them to invest in high risky instruments, causing the need to increase their capital to compensate the higher risk levels. Excess capital represents 1.44% of the required capital of small banks, and around 1% of middle banks. Both middle and small banks are focusing on the domestic market, leading to less diversified banking products. Further, as predicted by the buffer theory, Table (3) indicates U-shape relationship between the level of excess capital and its volatility as measured by the standard deviation.

Table (4) provides descriptive statistics of variables embodied in this study. It became manifest that changes in capital level from *t* to *t-1* fluctuates from -58.3% to 61.5% with an average of 0.14%, implying oriented variations among banks toward increasing/decreasing their capital levels. Moreover, the ratio of capital to weighted assets RCWA (lagged value of capital *t-1*) reached it maximum value at 44% and its minimum value at -1.29[10]. For REG (as dummy), it seems that most values are concentrated on 0, with an average around 0.06, indicating that most Jordanian banks are holding levels of capital more than the minimum legal level required[11]. Change in risk (as indicator of change level of risk between (*t, t-1*), varies between -0.13, and 1.14, with an average of 0.007, proofing variations among banks toward holding the risk instruments, indicating that some banks desire to support and hold the most risky instruments, while other banks do the opposite. Additionally, looking at SIZE (as an indicator of bank size) we notice that average SIZE among Jordanian banks is 8.57, and attained its maximum value at 9.63 and minimum value at 7.64. The average of ROA "return on assets" come to 0.67 which fluctuates from 7.1 to 2.8. The SIZE variable is normally distributed according to Jarque-Bera normality test.

Table (3): Capital Data for Jordanian banks (1990-2003)*

Excess Capital (As Percentage of Required Capital)		Stand. Deviation of Excess Capital
Big Banks	3,140,126,157	0,950166756
Middle Banks	0,999,989,813	0,580406214
Small Banks	1,448,094,717	0,2280712
All Banks	1,618,073,731	0,26824413

* Simulations from Ediz *et al*. (1998)

Table (4): Descriptive statistics of the variables: change in capital at *t* period *(*Δ*CAP*), lagged value of capital (CAP_{t-1}), regulation pressure (*REG)*, change in risk at t period *(*Δ*RISK*), bank size or total assets in log (*SIZE*),return on assets (*ROA*), loan loss provisions (*LLP*), lagged value of risk *(*$RISK_{t-1}$*)*. The sample includes 159 observations of 12 cross sections for the period from 1990 to 2003.

	Mean	Median	Maximum	Minimum	Std. Dev.	Jarque-Bera
ΔCAP	-0.001443	-0.001490	0.615255	-0.583339	-0.583339	7.724.652
CAPt-1	0.281157	0.271722	0.4492	-1.299.210	0.253914	8.814.628
REG	0.056604	0.000000	1000000	0.000000	0.231814	1.463.295
ΔRISK	0.007188	0.001869	1.148.444	-0.133435	0.096166	1.03883.8
SIZE	8.575.843	8.505.369	9.638.166	7.648.163	0.446686	2.959.814
ROA	0.007600	0.009290	0.028012	-0.071843	0.011187	2.354.506
LLP	0.004999	0.003250	0.061724	0.000000	0.007572	4.733.251
RISKt-1	0.252117	0.266495	0.406378	0.000000	0.081861	6.922.528

4. EMPIRICAL RESULTS

In this section, as first stage of the empirical test, we report the regression estimation that is implemented by using the OLS, and the FEM and REM, models[(12)]. As we observe in Table (5), as in the capital equation, the lagged value of capital *cap* (*t-1*) is negative and has a significant coefficient at levels (1%), by using the three models, implying that increasing capital within the last year would decrease the change in capital in the following (current) year. The variable (*REG*) has a positive and significant impact on the ratio of capital to risk-weighted assets. Ceteris paribus, banks within one standard deviation (*SD*) of the regulatory minimum ratio by 0.13% percentage points more than other banks. The *SIZE*, as proxied by the log of total assets, enters positively with high degree of significant coefficient at the 1%, indicating that large banks increased their ratio of capital-to-risk weighted assets more than other banks. Analogously, return on total assets (ROA), or current earnings, is statistically significant and has a positive influence on the level of capital, indicating that profitable banks can more easily improve their capitalization through return earnings. Yet, there is a negative and significant relationship between change in capital and change in risk based on the first definition of capital (capital to risk-weighted assets).

In the risk equation, the regulatory pressure variable has a positive and significant impact on banks risk, which means there is a cause–effect (increase regulatory pressure will increase level of risk), implying that increased a regulation and directive specifically capital requirements induce banks to increase its level of

capital, in addition to increase its level of risk in order to compensate the unfavorable effects from additional capital. The *SIZE* brings significant and positive effect on the banks' level of risk which implies that large banks crave to preserve high level of risky assets such as expansionism in credit facilities, loans, risky portfolio investments, and off-balance sheet items, more than smaller banks. The Loan Loss Provisions (*LLP*) has negative and significant impact on risk level, which points out that increasing provisions and allowance in banks reduces the level of risk, especially credit risk. $RISK_{t-1}$ (lagged level of risk) rationally has a negative and significant effect of risk change at *t* time, because the increased level of risk in the last year will decrease change in risk in current year.

It is worth mentioning that these results are consistent with the findings of Shrives and Dahl (1992), and Rime (2001) models. The results show that there is a positive and significant effect of both (regulatory, and ROA) on banks capital. Some of our results are incompatible with the earlier results. They concluded that regulation has no effect on the level of risk, which contradicts our findings.

The second stage of the empirical test is based on the ratio of capital to total assets (*RCTA*). Table (6) presents the results for the Jordanian banking system based on the capital to total assets (*RCTA*). Once again, in capital equation, we obtain that REG has a positive and has a high level of significant effect on the ratio of capital to total assets; subsequently level of capital. Ceteris paribus, banks which close to the legal minimum requirements increased their capital by 0.61% more than other banks. The *SIZE* is significant with a positive impact on capital. The *RCTA* (lagged value of capital cap *t-1*) variable has a negative perfectly significant coefficient at all the levels of (1%, 5%, and 10%), by using the FEM, REM and the Common, as well. We observe a positive and imperative relationship between changes in capital and changes in risk, which means any increase in the level of capital causes an increase in risk. In risk equation, similar to the later results, the regulation pressure (*REG*) is positive with significant effects on the level of risk, indicating that tightly capital requirements inspire banks to increase their level of risky assets in order to generate more profit, to compensate additional capital negativity.

The last results are incompatible with the finding of Rime (2001), Jacques and Aggarwal (1998). Their results show that regulatory pressure coefficient is insignificant in its impact on the level of risk, and its effect restricted just on capital. Noting that, by using OLS model, the number of significant variables will be less for instance, *ROA, SIZE* and *REG*, while by employing the GLS methods (FEM and REM), REG, risk, SIZE, and ROA are significant with high degree of level[13]. While OLS model comprise autocorrelation, it produces biased results, so we adopt GLS, Fixed Effect Model (FEM), and Random Effect Model (REM), to generate consistence and efficient estimations of the parameters of interest. Consistency of GLS estimator depends on whether the form of autocorrelation and heteroscedasticity is known, because GLS can be viewed as OLS applied to transform data that satisfy the OLS assumptions[14].

5. SUMMARY AND CONCLUSIONS

In this study, we have examined empirically the Jordanian banks capital and risk behavior as a reaction to pressure during the period 1990-2003. The results are estimated by a model following Rime (2001), who modified a version of the model that is developed earlier by Shrieves and Dahl (1992). By using the three alternative models, OLS, the Fixed Effect Model (FEM), and Random Effect Model (REM), the regression results provide hand support to the theoretical hypothesis which reveals that there's strong positive effect of regulation toward the level of capital, stated by Shrieves and Dahl (1992), Rime (2001), and Ghosh *et al*. (2003). On the other hand, risk is significant with a positive coefficient affected by regulation, which is inconsistent with earlier findings, in which it was found that risk level is not affected by capital requirements, or there are negative effects.

The study concludes that when Jordanian banks are

close to the minimum regulatory capital requirements, they tend to increase both of their ratio of capital-to-risk weighted assets, and levels of risk. Furthermore, regulatory pressure has a positive and significant impact on RCTA (ratio of capital to total assets) and banks risk taking. This indicates that for Jordanian banks, responding to regulation increases their level of capital. But, in the contrary, in order to compensate the negative effects from its addition capital, they pursue to hold more level of risk. For instance, during the last few years, Jordanian banks witnessed an increase in the minimum capital requirements ratio to 12% instead of (8, 10%)[(15)], maintaining high level of capital more than the minimum level, linked with an expansion in banks credit facilities, portfolio investments, and off-balance sheet items.

As interception of the results and comparison with evidence provided in the Literature, we observed above that there is a positive and significant impact of regulatory pressure on the level of capital for both its parameters (RCWA, RCTA). The positive and significant impact on the risk level, implies that Jordanian banks improve their capital adequacy by increasing their capital (retained earnings, equity issues), in counter increasing their risk-taking. Aggrawal and Jacques (1998) found that under-capitalized banks reduced their risk-weighted assets more than adequacy capitalized banks. While on the contrary, Rime (2001) revealed that Swiss banks are close to the minimum regulatory capital requirements and tend to increase their ratio of capital-to-risk weighed assets, not by decreasing their level of risk. Ghosh *et al*. (2003) employed quarterly data about the balance sheet and profit and loss account for the public sector banks stretching over the periods (1997 through 1999). He also revealed that Indian banks prefer to maintain a buffer level of capital as response to regulation, without apparently distorting the lending choices of banks.

The implication of the positive significant relationship between changes in RWA and changes in RCTA is that in a regime of risk-weighted capital requirements, banks bounded by the capital standards have to adjust RWA and RCWA in the same direction to deep their RCWA constant. Shrieves and Dahl (1992) reported a negative relationship between RCWA and RWA. Aggrawal and Jacques (1998) also reported a positive relationships between RCTA and RWA, and negative relationship between RWA and RCWA. While Rime (2001) concluded that there is no significant relationship between RCWA and RWA.

Table (5): Results for the systems based on the Ratio of Capital to Risk-Weighted Assets (RCWA)

Regression results for the change on capital(ΔCAP), regulation pressure(REG), lagged capital (CAPt-1), change in risk(ΔRisk), total assets in log (SIZE), return on assets (ROA), loan loss provisions (LLP), lagged risk (Risk t-1) ($\Delta Cap = \alpha_0 + \alpha_1 REG + \alpha_2 ROA + \alpha_3 SIZE + \alpha_4 \Delta RISK_t + \alpha_5 CAP_{t-1} + \varepsilon,$) and $\Delta Risk = \alpha_0 + \alpha_1 REG + \alpha_2 LLP_{j,t} + \alpha_3 SIZE + \alpha_4 \Delta CAP_t + \alpha_5 RISK_{t-1} + v$, depending on first definition of capital : capital to risk-weighted assets (RCWA).

	common		*Fixed Effect Model(FEM)*		*Random Effects Model(REM)*	
Variables	*Δ Capital*	*Δ Risk*	*Δ Capital*	*Δ Risk*	*Δ Capital*	*Δ Risk*
Constant	*-0.005908*	*0.003610*			*-0.005172*	*-0.014423*
	-0.545413	*(0.002641)**			*-0.162187*	*(-0.421680)**
REG	*0.013705*	*0.049534*	*0.020608*	*0.066238*	*0.017324*	*0.082382*
	*(-3,087062)**	*(0.009414)**	*(2.247739)***	*(5.834197)**	*(-3.155064)**	*(2.418368)**
CAPt-1	*-0.134870*		*-0.235674*		*-0.171350*	
	*(-4.178247)**		*(-4.402633)**		*(-5.168129)**	
Δ Risk	*-0.182571*		*-0.180060*		*-0.210334*	
	*(-5.398427)**		*(-4.205788)**		*(-3.398341)**	
Size	*0.003537*	*0.004715*	*0.020300*	*0.011807*	*0.005912*	*0.011687*
	*(2.991240)**	*(0.000773)**	*(2.220935)***	*(8.072602)**	*-1.515.064*	*(2.400656)***
ROA	*0.915228*		*1.327.027*		*0.744030*	
	*(2.296789)***		*(4.806734)***		*1.305.881*	
Δ Capital		*-0.056034*		*-0.049677*		*-0.179044*
		*(0.013262)**		*(-4863191)**		*(-2.708880)**
LLP		*-0.819722*		*-1.142.000*		*-1.594.863*
		*(0.093861)**		*(-1049257)**		*(-1.685079)***
Riskt-1		*-0.151225*		*-0.333088*		*-0.283425*
		*(0.017309)**		*(-1077070)**		*(-2.737979)**
R squared	*0.432718*	*0.057229*	*0.560729*	*0.253394*	*0.202492*	*0.078030*
Adjusted R-squared	*0.415209*	*0.027951*	*0.514184*	*0.173756*	*0.177878*	*0.049397*

Note: significant effects are remarked by (*), (**) and (***) for %1, %5 and %10 significance levels, respectively, T-values are reported in parentheses.

Table (6): Results for the systems based on the Ratio of Capital to total Assets (RCTA)

Regression results for the change on capital(ΔCAP), regulation pressure(REG), lagged capital (CAPt-1), change in risk(ΔRisk), total assets in log (SIZE), return on assets (ROA), loan loss provisions (LLP), lagged risk (Risk t-1)

$\Delta Cap = \alpha_0 + \alpha_1 REG + \alpha_2 ROA + \alpha_3 SIZE + \alpha_4 \Delta RISK_t - \alpha_5 CAP_{t-1} + \varepsilon$, and $\Delta Risk = \alpha_0 + \alpha_1 REG + \alpha_2 LLP_{j,t} + \alpha_3 SIZE + \alpha_4 \Delta CAP_t - \alpha_5 RISK_{t-1} + v$, depending on second definition of capital : capital to total assets (RCTA).

	common		Fixed Effect Model(FEM)		Random Effects Model(REM)	
Variables	Δ Capital	Δ Risk	Δ Capital	Δ Risk	Δ Capital	Δ Risk
Constant	0.029816	0.077400				-0.164170
	1.484.038	(2.807820)*				(-1.605226)
REG	0.006111	0.033940	0.012416	0.027341	0.007099	0.054854
	(2.626134)*	(2.980437)*	(5.201463)*	(2.289946)**	(3.152063)*	(2.114423)**
CAPt-1	-0.172714		-0.358238		-0.150501	
	(-4.176681)*		(-5.590540)*		(-4.823129)*	
Δ Risk	0.008197		0.005363		0.006629	
	(4.050122)*		(9.315122)*		(3.830589)*	
Size	0.002772	-0.003745	0.011542	0.004332	0.000446	0.027580
	(-1.385980)	(-1.029484)	(4.946216)*	(-1.432318)	(1.938093)**	(2.443590)*
ROA	0.596861		0.549732		0.613266	
	(6.005680)*		(5.252994)*		(6.377474)*	
Δ Capital		0.096131		0.113878		-0.077099
		(1.668628)***		(2.608456)*		(-0.347222)
LLP		-0.383085		-0.546078		-0.507679
		(-3.268730)*		(-7.036840)*		(-0.440688)
Riskt-1		-0.160497		-0.532714		-0.247229
		(-7.752657)*		(-2.098688)*		(-2.553081)*
R squared	0.220103	0.127176	0.339516	0.337146	0.214749	0.078030
Adjusted R-squared	0.194617	0.098652	0.265095	0.262459	0.194353	0.049397

Note: significant differences are remarked by (*), (**) and (***) for %1, %5 and %10 significance levels, respectively, T-values are reported in parentheses

NOTES

(1) In 1988, Basel committee imposed (8%) minimum capital requirements that must be met by banks; with at least half should be met by Tire (1) capital. Tire (1) is essentially made up of the equity reported in the balance sheet (paid-in capital, retained earnings, general provisions), while Tire (2) includes additional items i.e., re-evaluation of premises under the case of real estate value changes and subordinated debt). In 1996, to cover market risk, Basel accord was amended to require banks to set aside capital to cover the risk of losses advising from movements in market prices. This amendment is defined as total qualifying capital or Tire (3) capital. For more structuring details, see Appendix A.

(2) Overall, this study is motivated by several aspects. Of which, as reported earlier, significant decline in banks capital ratio and the increase in the level of banks failure which led regulators in several countries, including Jordan, to issue explicit capital standards for banks. These standards require banks to hold a fixed percentage of their total assets as capital. Furthermore, the market risk such as foreign exchange, and traded equities augment through time which, in its turn, requires banks to preserve high levels of capital. Eventually, the above motivations contribute to enhance the stability of the financial sector in general and banks in particular.

(3) The motivation behind this result was that under binding capital requirements an additional unit of equity tomorrow is more valuable to a bank, and if raising equity is excessively costly, the only possibility to increase equity tomorrow is to increase risk today.

(4) equations (1,2,3) followed Ghosh *et al*. (2003)

(5) equations (4,5,6,7) followed Rime (2001)

(6) This measure is used earlier by shrives and Dahl (1992).

(7) See Viney (2000).

(8) Ediz *et al*. (1998).

(9) Ediz *et al*. (1998).

(10) This is attributed to the fact that the Gulf bank had reported a capital in mines signs during the period of study.

(11) When REG is equal to 1, the RCWA ratio is less than 8%, 0 otherwise.

(12) The Fixed Effect Model (FEM) is also referred to as the "least squares dummy variables LSDV" model. This estimates the intercept as a coefficient of dummy variables. The Random effect model (REM) treats the intercept as random variables rather than fixed constant. The Ordinary Least Squares (OLS) minimizes the sum of the areas of the squares drawn from the points (lie above or below the regression), which are employed in the previous literature using equations (6,7) depending on the ratio of capital to risk-weighted assets (RCWA) as measurement of bank capital, which is shown in Table (5).

(13) The Whites(1980) general test is used to test heteroscedasticity.

(14) To detect for autocorrelation, the Durbin-Watson test is used.

(15) According to the Jordanian Central Bank laws.

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ملاءمة رأس المال ومستويات المخاطرة وأثرها في سلوك البنوك: دليل عملي من واقع الأردن

*خالد الزعبي ومحمد العبادي وهنادي عفانة**

ملخـص

شهد القطاع المصرفي في الأردن خلال العقدين الأخيرين تغيراً كبيراً من حيث النمو والتوسع، إلى جانب انخفاض عام في نسب رؤوس أموال البنوك، كما ظهرت عدة حالات من إعسار وإفلاس للبنوك، مما أدى إلى ضرورة تطوير القيود والتعليمات المصرفية؛ خاصة النسب المفروضة على رأس المال وارتباط ذلك بمستويات المخاطرة المختلفة.

هدفت هذه الدراسة إلى اختبار سلوكيات البنوك تجاه التغيرات في متطلبات رأس المال المفروضة من قبل الجهات الرقابية على البنوك الأردنية خلال الفترة من عام 1990 إلى 2003. استناداً إلى النموذج المطور من قبل العالمين (Shrieves and Dahl) عام 1992، ولإثراء وتدعيم النتائج الإحصائية استندت هذه الدراسة إلى استخدام نموذج المعادلات الآنية التي من خلالها تم استخدام ثلاث طرق إحصائية هي: (Fixed Effects), (Random Effects), (Generalized Least Square). النموذج المستخدم يقوم في جوهره على دراسة أثر القيود والتشريعات في مستوى رؤوس أموال البنوك وفي حجم استثماراتها الخطرة. أظهرت النتائج الإحصائية وجود علاقة ايجابية بين اطار القيود والتشريعات ومستويات رؤوس الأموال للبنوك التي تحتاج إلى إعادة هيكلة (تدعيم) تمشيا مع مستويات المخاطرة للبنوك. وأظهرت النتائج أيضاً- نتيجة لاقتراب رؤوس أموال البنوك من المستويات الدنيا لمتطلبات رأس المال- دافعا لزيادة قاعدة رأس المال بما يتوافق مع مستويات المخاطرة للبنوك.

الكلمات الدالة: رأس المال، سلوك البنوك.

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تاريخ استلام البحث 2006/11/16، وتاريخ قبوله 2007/10/24.