The Impact of Basle Accord Regulations on Bank Capital and Risk Behaviour: 3D Evidence from the Middle East and North Africa (MENA) Region[#]

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Abstract

This paper aims to assess the impact of Basle Accord capital regulations on banks' capital and risk levels in the Middle East and North African (MENA) region. A simultaneous equation model is used to capture the relationship between bank portfolio risk and risk-based capital standards and to track the dynamic adjustments in bank capital and risk. The model is estimated and tested using three stage least squares (3SLS) procedures on a three dimensional panel of individual banks across 11 economies in the MENA region and across annual observations in the 1995-2003 period. It is found that the capital requirements significantly affect banks' capital ratio decisions and that regulatory pressure does not induce banks to increase their capital, but it did positively affects their chosen risk level.

JEL Classification Nos: G21; G28

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1. Introduction

Traditional approaches to bank regulation emphasize the view that the existence of capital adequacy regulation plays a crucial role in the long-term financing and solvency position of banks, especially in helping the banks to avoid bankruptcies and their negative externalities on the financial system (Dewatripont and Tirole, 1994). In general, capital or net worth serves as a buffer against losses and hence failure. Many developing countries have experienced banking problems requiring major reforms to address weak banking supervision and inadequate capital. It has been shown that in addition to deposit insurance (implicit or explicit), official capital adequacy regulations play a crucial role in aligning the incentives of bank owners with depositors and other creditors; see, for example, Berger, Herring and Szego (1995), Kaufman (1991), Stevens (2000), Furlong and Keeley (1989) and Keeley and Furlong (1990).

However, it is not altogether clear whether the imposition of capital requirements actually reduces risk-taking incentives. It is extraordinarily difficult - if not impossible – for regulators and supervisors to set capital standards that mimic those that would be demanded by well informed, undistorted private-market participants. For instance, banks may respond to regulatory pressure by increasing their risk exposure. Indeed, Kahane (1977), Koehn and Santomero (1980), Lam and Chen (1985), Kim and Santomero (1988), Flannery (1989), Genotte and Pyle (1991), Rochet (1992), Besanko and Katanas (1996), Blum (1999), Alexander and Baptista (2001) note that actual capital requirements may increase risk-taking behavior.[1] In a guarded assessment, Thakor (1996) shows the conditions under which risk-based capital requirements increase credit rationing, with negative implications for economic growth. Also, Thakor and Wilson (1995) argue that

[1] In contrast with this idea, Furlong and Keeley (1989) and Keeley and Furlong (1991) state that capital adequacy requirements reduce incentives to increase risky assets, thus decreasing the probability of the bank's bankruptcy.

higher capital requirements may induce borrowers to shift to capital markets and in the process impair capital allocation, while Gorton and Winton (1999) show that raising capital requirements can increase the cost of capital. Thus, theory provides conflicting predictions on whether capital requirements curtail or promote bank performance and stability.[2]

The underlying argument is that the safety and soundness of the banking system is important not only because it limits economic downturns related to financial panics but also because it avoids adverse budgetary consequences for governments, which often bear a significant part of the costs of the bailout. Prudential regulation is meant to protect the banking system from these problems by inducing banks to invest prudently. One form of prudential regulation is capital requirements, typically using the Bank of International Settlements (BIS) standards of the Basle Accord. Capital requirements force banks to have more of their own capital at risk so that they internalize the inefficiency of gambling or investing in high-risk assets While investing in a gambling asset can yield high private returns for the bank if the gamble pays off, it imposes costs on depositors if the gamble fails, where the probability of failure is high. In contrast, investment in a prudent or low-risk asset yields higher expected returns.

In addition, capital requirements reduce gambling incentives and moral hazard by putting bank equity at risk. However, they also reduce banks' franchise values, thus encouraging gambling or "betting the bank". It follows that capital-requirement regulation is not enough to yield Pareto-efficient outcomes. Adding other forms of regulatory instruments can achieve Pareto-efficient outcomes if they facilitate prudent investment by increasing franchise values.[3]

[2] For a recent review of bank capital regulation, see Santos (2001).
[3] Just as Dewatripont and Tirole (1994) show for risk-based capital requirements, it is possible theoretically that with risk-based deposit insurance a higher risk premia will induce greater risk-taking behavior. However, Kane and Kaufman (1992) argue that even in Australia, where no deposit insurance is provided, the possibility of claims on the government is a legitimate concern of public policy.

The aim of this paper is to empirically investigate the impact of Basle Accord regulations on bank behavior across a broad cross section of countries while controlling for bank specific factors and cross-country differences in macroeconomic and financial sector conditions. A bank-level dataset across 11 countries and over 98 banks is used. This sample includes great diversity in terms of bank margins, other bank characteristics, bank regulations, macroeconomic and financial conditions, and national institutions. To examine bank regulation, we focus on regulations concerning bank entry, reserve requirements, restrictions on bank activities, and an overall index of regulatory restrictions on banks. Thus, we use an assortment of information on the degree to which regulations may impede bank operations and competition.

The rest of this paper is organized as follows. Section 2 presents the previous contributions on the impact of capital adequacy regulations (CARs) on bank behavior. In Section 3, an overview of bank regulation in the Middle East and North Africa countries is outlined in order to provide an institutional context for the study. In Section 4, an empirical model is specified as a system of simultaneous equation system, and the econometric methodology is discussed. Section 5 reports the estimation and the testing results. Section 6 concludes.

2. The Impact of CARs on Bank behavior: What do we know?

Existing literature suggests that capital adequacy rules have an impact on bank behavior in two main ways.[4] First, it is argued that the introduction of capital adequacy rules will normally strengthen bank capital and, thus, improve the resilience of banks to negative shocks. A second order of effects concerns banks' risk behavior. If, as it happens, capital adequacy rules establish higher capital standards for loans to the private sector than for credits vis-à-vis the public sector (e.g. treasury securities), the introduction of these rules,

[4] For general discussion, see Dewatripont and Tirole (1994) and Freixas and Rochet (1997)

might cause a shift in banks' balance sheets from the former to the latter assets. It cannot be excluded, either, that a perverse risk shifting pattern, by which banks in order to finance new and higher capital requirements may move along the efficiency frontier towards potentially more profitable, but riskier loans.[5]

In general the question is whether banks fulfill the CARs mainly by reducing risk-weighted assets (the denominator) or by increasing capital (the numerator), the latter course being impaired by shallow domestic capital market in developing countries.[6] A second question concerns more specifically whether higher capital standards lead banks to contract their supply of loans – as an effective way of reducing risk- weighted assets – again with potentially larger effects in developing countries where bank loans represent a large share in the corporate sector's external finance.

In the US the possible link between stiffening capital adequacy requirements and contraction in bank loans has debated at length in the efforts of explaining the early 1990s recession. By historical standard such recession was rather mild and yet recovery was extremely slow. Various authors attributed such tardy recovery to the capital crunch that is to a credit crunch supposedly precipitated by the introduction in the US of the new Basle Committee capital adequacy standards.[7]

Various authors, using different methodologies, contribute to this interpretation. Some of the relevant papers have used cross-sectional bank level data. Bernanke and Lown (1991) show that loan growth at individual banks between 1990:Q2 and 1991:Q1 was positively linked to initial in 1990-1992 for less-capitalized banks, but do not detect a

[5] The substitution toward riskier loans can take place in anticipation of future and higher capital requirements. Unfortunately, lack of data on future CAR enforcement anticipation makes it impossible to test this alternative interpretation.

[6] Some authors show that banks shift away from high risk-weighted assets when capital requirements are binding for them: e.g. Dahl and Shrieves (1990), Aggarwal and Jacques (1997), and Jacques and Nigro (1997). Others try to assess whether negative shocks to capital induces Japanese banks to restrict loans: e.g. Kim and Moreno (1994), Ito and Sasaki (1998), and Peek and Rosengren (1997).

[7] Following the 1988 Basel Committee rules, loans to the private sector require the bank to post a minimum of 8% in qualifying capital equivalent, whereas credits on the state sector bear to zero requirements. In the US, Basel Committee capital standards were formally approved in 1989 and phased in at the end of 1990.

sensitivity of loan expansion to capital ratios higher than the one observed during the recession of the early 1980s. Peek and Rosengren (1995) introduce an influential method to address the issue of identification of supply-induced effects. It is argued that capital-unconstrained banks should react to negative shocks to capital by intensifying deposit taking, thus, when banks are not capital constrained, one should expect a negative relationship between shocks to capital and deposit taking. On the contrary, it is found that a positive link exists between shocks to capital and the dynamics of deposits in 1990. It is concluded that this evidence suggests that the capital constraints for banks were pervasive and the impact of new Basel Committee ratios was larger for banks having lower initial capital ratios. All in all, most researchers support the hypothesis that the capital crunch adversely affected loan expansion in the US at the beginning of the 1990s.

The Basel Committee on Banking Supervision (1999) surveys the evidence for G-10 countries on the response of banks to the enforcement of the 1988 CARs. It is found that "there is some evidence that bank capital pressure during cyclical downturns in the US and Japan may have limited bank lending in those periods and contributed to the economic weakness in some macroeconomic sectors". However, it is also argued that for G-10 countries these effects "may well have reflected both regulatory and market pressure on banks to maintain ratios at least as high as minimum" (Basel Committee on Banking Supervision, 1999, p.2). In recent analysis, the Basel Committee on Banking Supervision (2000) has argued that – other things being equal- risk-sensitive capital requirements tend to increase the pro-cyclical nature of capital ratios and this therefore may exert an impact on macroeconomic cycle. The analysis goes on to note that although the empirical evidence is mixed, the relevance of the impact is likely to be highly dependant on historical and institutional factors and, more specifically, on the presence of an important bank credit channel in the economy.

3. Overview of Bank Regulation in the MENA Region

The Basel Committee on Bank Supervision, International Monetary Fund, and World Bank all now promote an extensive list of "best practices" to be adopted by each and every country for the regulation and supervision of banks. There is a strong sense that if only policymakers in countries around the world would implement particular regulatory and supervisory practices, bank "safety and soundness" would improve, thereby promoting growth and stability. Below, we present an overview of bank regulation in the Middle East and North Africa (MENA) region (namely Egypt, Israel, Jordan, Lebanon, Morocco, Oman, Qatar, United Arab Emirates, Saudi Arabia, and Tunisia) in order to provide an institutional context of the empirical analysis undertaken in this paper.

In Egypt, the main regulatory reforms are introduced and implemented by the Central Bank of Egypt (CBE). The CBE is responsible for, inter alia, regulating and managing the banking and monetary system; it is also the supervisory authority for deposit-taking banks, with wide powers vested in it by the banking law. Prior to reforms in the early 1990s, the banking sector was heavily regulated through credit controls and portfolio restrictions. The banks' minimum capital requirements vis-à-vis their risk weighted assets were increased to 8 percent along the lines of Basle Committee on Banking Supervision. Capital was defined to consist of two components: primary capital, which includes paid-up capital and reserves; other capital, which includes provisions for general banking risks and subordinated long-term loans of at least five-year maturity. As a general rule, one-half of the capital adequacy ratios would be met from primary capital. In addition, the provisions for general banking risks would account for no more than 1.25 percent of the risk weighted assets, and the subordinated loans should not exceed 50 percent of primary capital. The CBE decision for the (8 percent) capital adequacy ratio was taken in January 1991. Banks whose capital did not comply with the new regulations at the time were allowed gradual

compliance. For banks with capital adequacy ratio between 7 percent and 8 percent at end-December 1990, they were required to comply with the new regulations by end-December 1992. For banks with capital adequacy ratio below 7 percent at end December 1990, they were required to comply with the new regulations by end-December 1993. The CBE has agreed with these banks which are small, accounting for nearly 3 percent of banking asset on a schedule for compliance.

In Morocco, the Banking Law of July 1993 unified the legal framework and supervisory regime for all credit institutions. The Central Bank has the authority to apply sanctions for violations of the Banking Law. To date, none of the crisis resolution mechanisms provided for in the Banking Law, including the deposit insurance system, has been tested. The BAM may, as needed, require a bank restructuring plan and may call upon the institution's principal shareholders to correct any financial imbalance. If a bank fails to meet its financial obligations, the bankruptcy and compulsory liquidation provisions of the Commercial Code come into play. The Banking Law itself does not contain any specific procedures on the bankruptcy and liquidation of banks. The law also does not contain preventive signals, such as financial indicators, that would trigger the Central Banks or the Ministry of Finance's intervention for banks facing financial difficulties.

Banks are subject to a minimum liquidity ratio of 60 percent of short-term liquid assets to demand liabilities. Commercial banks must also maintain a monetary reserve in the form of non interest-bearing deposits with *Banque Al-Maghrib* (Central Bank of Morocco, BAM), equal to 10 percent of their demand deposits. The risk-weighted capital asset ratio of the banking system stood at 12.6 percent at the end of 1998, increasing from 9.1 percent in 1992 and exceeding the Basle Committee's minimum ratio of 8 percent. The larger Moroccan banks (the CPM and the publicly traded banks) have solvency ratios close to those of international banks. For banks listed on the stock exchange, solvency ratios reached

between 9.1 and 13 percent, which is a clear improvement over 1992, when they were between 7 and 8 percent. Despite this favorable trend for the sector as a whole, the CNCA *Caisse Nationale de Credit Agricole* (a farm credit agency) has seen a sharp deterioration in its capital base, with a capital asset ratio falling from 13.3 percent in 1992 to 2.1 percent in June 1997 and then rising to 8.2 percent at the end of 1998. These ratios must, however, be viewed with caution, taking into account the reorganization under way of the overdue loans of the CNCA, CIH *Credit Immobilier et Hotelier* (real estate and hotel sector credit), and BNDE *Banque Nationale pour le Developpement Economique* (National Economic Development Bank).

In Lebanon, the central bank is the sole custodian of public funds, supervises and regulates the banking system and is vested by law with the exclusive authority of issuing the national currency. Banque du Liban's primary role is to safeguard the currency and promote monetary stability, thereby creating a favorable environment for economic and social progress.

From March 1995, commercial banks were required to meet a minimum capital adequacy ratio of 8 per cent. in line with the Basle Accord. In September 1999, the Central Bank required banks to raise their capital adequacy ratios to 10 per cent by end 2000 and 12 per cent by end 2001. A law facilitating bank mergers by, among other things, making banks eligible for soft loans from the Central Bank, was passed in 1993 and renewed in 1998 until 2003. Recently, commercial banks' capital increased substantially, and at June 30, 1999, their average capital adequacy ratio was approximately 17.85 per cent.

In Israel, the Supervisor of Banks, who is responsible for maintaining the stability of the banking system, requires the banks to hold a suitable minimum of capital (relative to their total risk-weighted assets). The capital requirement for banks in Israel was 8 percent until March 1999, in accordance with the recommendations of the International Committee

on Banking—the Basle Committee. In March 1999 the Supervisor of Banks raised the minimum required capital ratio to 9 percent. In June 1999 the Basle Committee approved a proposal to issue new regulations on capital adequacy and intends to publish the final version during the year 2000.

The formal capital requirement in Israel is currently based on credit risk alone; and does not take into account other risks, such as market risks, operational risks and legal risks. Note in this respect that the Basle Committee's recommendations of January 1996 concerning holding additional capital against exposure to market risks will be applied in Israel in 2000. Under the Supervisor of Banks' regulations, the banks will also be required to include exposure market risks in the calculation of the ratio of capital to risk-weighted assets, with effect from the third quarter of 2000. The ratio of capital to risk-weighted assets of the five banking groups rose from 9.2 percent at the end of 1998 to 9.4 percent at the end of 1999. An increase in the ratio was recorded at the Discount and Hapoalim groups due inter alia to the Supervisor of Banks 'Regulations raising the minimum required capital ratio to 9 percent.

The increase in the ratio of capital to risk-weighted assets resulted from opposing changes in its components. The ratio of Tier 1 capital, which comprises the more stable part of the banks' capital, fell from 7.4 percent in 1998 to 7.1 percent in 1999, following a 1.5 percentage-point decline in 1998. The decrease in the ratio of Tier 1 capital was offset by a 0.6 percentage-point increase in the ratio of Tier 2 capital, which is less stable than Tier 2 capital. At the end of 1999, the ratio of capital to risk-weighted assets ranged from 9.06 percent at the Hapoalim group to 10.2 percent at the First International group.

The ratio of capital to risk-weighted assets in a sample of banks abroad was higher in absolute terms than the major banks in Israel, and averaged 11.2 percent. This suggests that banks abroad have a more conservative risk-management policy, which may be partly

dictated by the supervisory authorities. Although the ratio of Tier 2 capital at banks abroad is higher than that of banks in Israel, it has been declining for several years. Since the capital ratio is obtained by dividing total capital by total risk-weighted assets, the development of the ratio is a function of the development of these two elements. Total capital for the purpose of calculating the ratio of capital to risk-weighted assets includes Tier 1 capital and Tier 2 capital less investment in companies included on an equity basis. The total capital for the purpose of calculating the capital ratio of the five banking groups increased by 13.1 percent during 1999. The rise derived mainly from a notable 47 percent rise in the five banking groups' Tier 2 capital. This followed increases of 104 percent in 1998 and 30 percent in this capital in 1997.

The ratio of Tier 2 capital has grown in recent years at the expense of the ratio of Tier1 capital, and at the small banks the proportion of subordinated notes to total Tier 1 capital is close to reaching the Supervisor of Banks' upper limit of 50 percent. The increased proportion of Tier 2 capital resulted from the decision of the banks' managements to improve their capital adequacy by raising subordinated notes. The total risk-weighted assets of the five major banking groups increased by 10.6 percent during 1999 this increase reflect the growth in the banks' financial intermediation activity, and are largely the result of a rise in balance-sheet credit risk.

In the United Arab Emirates (UAE), the Central Bank of the United Arab Emirates, which began its operations in December 1980 in accordance with the Union Law (No. 10) of 1980, regulates and supervises the banking sector within the UAE. The Central Bank Law establishes five principal categories of institutions in the UAE - commercial banks, investment banks, financial establishments, financial intermediaries, and monetary intermediaries - all of which must be licensed by both the Central Bank and the local licensing authorities. In addition to these five categories, current practice in the individual

Emirates permits the licensing of financial or investment consultants. These consultants are not required to obtain a Central Bank license. Central bank regulations announced on April 5, 1993, set the minimum capital to risk-weighted asset ratio at 10 percent, which is 2 percent higher than the minimum level recommended by the Basel Concordat committee on banking supervision. The reduction of higher risk assets may cause concomitant declines in UAE bank profits, but it is anticipated that this will strengthen the banking industry.

In Tunisia, the Central Bank of Tunisia (CBT) is governed by Organic Law No. 58-90 of September 19, 1958. Banks face significant exposure to credit risk and stress tests suggest that the level of risk-weighted capital adequacy ratio is sensitive to credit risk shocks. Requiring higher provisioning for nonperforming loans, including ones that are backed by real estate collateral would cause the level of the capital adequacy ratio to decline significantly. Also, most banks would suffer a significant decline in their capital adequacy ratios if NPLs were to increase even moderately. In the last decade, The BCT has made importance progress in the overall effectiveness of its banking supervision. Bank capitalization and provisioning have improved significantly and steps have been taken to clean up banks' loan portfolios. Nevertheless, the level of nonperforming loans continues to be high by international standards, and some areas of banking supervision need to be strengthened. The banking law and the central bank legislation clearly define the roles and responsibilities of the various entities involved in banking supervision with BCT playing a central role in licensing and enforcing regulations. The BCT has sufficient resources to carry out its mission but it is independence could be enhanced by specifying grounds for removal from office of members of governing body. Financial institutions licensed for banking activities and subject to banking supervision are clearly defined. Licensing criteria are described in the banking law and are largely adequate. The banking law or prudential regulations establish the minimum capital requirements and a capital adequacy ratio, and

actions or sanctions that may be taken based on levels of capital shortfall. However, the capital adequacy ratio would need to be calculated on conciliated basis. The BCT requires banks have appropriate internal controls and audit systems, and the new banking law has further strengthened the obligations imposed on banks in this regard. Legal provisions to prevent money laundering need to be established. Although the BCT has adequate powers to bring about appropriate correction actions when banks fail to meet prudential requirements, the power are not systemically used. The BCT should make every effort to use its powers in a more systematic manner. Tunisian banks have limited activities in foreign territories. Foreign banks in Tunisia are subject to local prudential regulations. The relations maintained by supervisory authorities with their counterparts abroad are however informal.

The Saudi Arabian Monetary Agency (SAMA) is the central bank of the country and plays a crucial role in promoting growth and ensuring the soundness of the financial system. Saudi Arabian banks are among the top-rated ones in the industry, based on capital adequacy, liquidity, provisioning norms and profitability. SAMA has set up a strong prudential system which, since its genesis, has encouraged high levels of capital adequacy, liquidity and reserve requirements for its banks. has also taken the lead in encouraging Saudi banks to adopt international accounting standards and meet the most rigorous transparency and disclosure requirements. The domestic banks financial ratios speak for themselves, with capital adequacy at about 20%, all of it in core capital, liquidity ratio at 50%, NPLs at less than 5% of gross loans, loan loss provisions exceeding 100%, return on equity 20% and return on assets 2%.

Saudi Arabia's regulatory system matches the international standards for banking supervision. Banks are meeting accounting and disclosure standards prescribed by SAMA, which are in line with International Accounting Standards. SAMA's policy of maintaining

solid prudential regulations and corporate governance has resulted in well-regulated and well-managed banks.

The Central Bank of Oman (CBO) raised the minimum capital requirement for branches of foreign banks from RO3 million to RO5 million in 2003. Accordingly, a foreign bank establishing a branch (s) in Oman would have to allocate a minimum capital of RO5 million. The decision comes after the apex bank's board of governors reviewing local and international banking scenarios. Foreign banks already having branches in Oman with less than RO5 million capitals would have to comply with the new directive on or before December 31, 2005. In accordance with the capital and leveraging requirements of the CBO, minimum capital requirement applied to local banks has been raised over the years from RO500, 000 to RO1 million and to RO10 million, and stood at RO20 million by the end of 2003.

Similarly the amount of capital that foreign bank branches are required to bring in has been increased gradually. A capital deposit requirement has also been imposed on commercial banks which oblige each bank to place with the apex bank an amount equivalent to 0.1 per cent of global resources subject to a maximum of RO500,000.

In Qatar, the responsibility of regulating the banking system rests with the Qatar Central Bank (QCB), which is an independent legal entity that operates in accordance with the Decree Law No.15 of 1993 and its amendments.

The Central Bank of Jordan (CBJ) is the entity responsible for regulating and overseeing all banking and money market activities. The CBJ has wide ranging powers and autonomy from the central government, and supervises banking system requirements. The CBJ first adopted the Cooke ratio for capital adequacy in 1992, while in 1993 the EU Second Banking Directive was fully implemented. The aims of such a directive were to decrease barriers to trade, increase the freedom to set up offices and provide services and to

encourage the free movement of capital. The CBJ also carefully reviews the adequacy of provisioning; requiring monthly banking returns and also publishes a monthly statistical analysis, which is regarded to include more details and to be more transparent than other central banks in the region. The regular controls undertaken by the CBJ focus particularly on liquidity, credit or asset quality and capital adequacy.

The failure of Petra Bank in 1989 has prompted the CBJ to be very strict as regards to capital adequacy. The CBJ is keen not to see a repeat of the financial and banking crisis, which had been brought about by the Petra Bank collapse, and believes that BIS capital adequacy ratios should be set at a higher minimum level than the required 8%. The current BIS capital adequacy ratio has been set at 12%, after having stood briefly at 10%, and has not been emulated as yet in the rest of the region. At the end of 1997, the CBJ imposed a minimum capital of JD20 million (US$28.2 million) for all banks. This was introduced to encourage consolidation, and there are serious considerations by the CBJ to increase that amount significantly (towards JD50 million or US$70.5 million). The capital to deposit ratio was also set at a minimum of 7.5%. Banks are not to make loans to companies in which they hold more than 10% of the capital. Commercial banks have to place 14% of their deposits in an interest free account at the CBJ, while investment banks are required to place only 9% of their deposits.

Hence, notwithstanding some local variations, all the sample MENA countries discussed above have adopted the Basle capital adequacy regulations. What is not clear from the anecdotal trends presented above is how these regulations have influenced the capital and risk levels of banks in each country and in the region. To obtain such insight, we need to undertake some empirical analysis.

4. The Empirical Model and Methodology

4.1 The Empirical Model

A simultaneous model with a partial adjustment framework for capital and risk is used to assess how the banks in the MENA region react to requirements placed by the regulator on their capital. It builds on the work on US banks by Shrieves and Dahl (1992) and in its extensions (Jacques and Nigro, 1997; Aggarwal and Jacques, 1998; Ediz, Michael and Perraudin, 1998; and Rime, 2000).

An important aspect of this model is that it recognizes that changes in both capital and risk have an exogenous as well as an endogenous character. Hence, the present study differs from previous studies in three main areas. First, bank capital and risk behavior is modeled explicitly. Second, it takes account of the regulatory pressure implied by the minimum capital requirements. Finally, it examines the most comprehensive number of banks in the MENA region, namely those that were in existence throughout the estimation period. It should be stressed that the MENA banking market has not reached a high level of development and hence sophisticated financial instruments, are not widely available.

To allow for the possibility that capital ratio and risk decisions are determined simultaneously, the analysis of banks' capital behavior is based on the simultaneous equations model developed by Shrieves and Dahl (1992). In that model, observed changes in banks' capital and risk levels consist of two components, a discretionary adjustment and a change caused by factors exogenous to the bank. Hence:

$$\Delta CAP_{j,t} = \Delta^{d} CAP_{j,t} + E_{j,t}\,; \qquad (1)$$

$$\Delta RISK_{j,t} = \Delta^{d} RISK_{j,t} + S_{j,t}\,; \qquad (2)$$

where $\Delta CAP_{j,t}$ and $\Delta RISK_{j,t}$ are the observed changes in capital and risk levels, respectively, for bank j in period t. The $\Delta^{d} CAP_{j,t}$ and $\Delta^{d} RISK_{j,t}$ variables represent discretionary adjustments in capital and risk, and $E_{j,t}$ and $S_{j,t}$ are exogenously- determined

factors. In any period, banks may not be able to adjust their desired capital and risk levels instantaneously. Thus, following Shrieves and Dahl (1992), the discretionary changes in capital and risk are modeled using the partial adjustment framework such that changes in capital and risk are proportional to the difference between the target levels and the levels existing 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 and $0 < \alpha, \beta < 1$. Substituting equations (3) and (4) into equations (1) and (2), the observed changes in capital and risk can be written:

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

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

Thus, the 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. The target levels of capital and risk are not observable, but are assumed to depend upon some set of observable variables.

We argue that the target capital ratio CAP^{*} is influenced by a number of explanatory variables including: the size of the bank (*SIZE*), *SIZE* is measured as the natural log of bank's total assets, (*ROA*) return on assets. Academic experts have come up with a number of financial performance measures such as return on assets (ROA) to find out the relationship between the banks process performance and financial performance. D1 dummy variable define the banks included in each country and D2 define the country and changes in risk ($\Delta RISK_{j,t}$). In a similar fashion, the target risk ratio ($RISK^{*}$) is influenced by size,

(*LLOSS*) approximated with the ratio of new provisions to total assets, D1, D2, and the changes in capital ($\Delta CAP_{j,t}$). Most of these variables were taken from Shrieves and Dahl (1992).

Furthermore, the exogenous factor which could influence bank capital ($E_{j,t}$) or risk ($S_{j,t}$) is a change in regulatory capital standards, in this case modeled as the degree of regulatory pressure brought about by the risk-based capital standards. Specifying variables to explain changes in capital and risk, the model is written:

$$\Delta CAP_{j,t} = \alpha_0 + \alpha_1 SIZE_{j,t} + \alpha_2 ROA_{j,t} + \alpha_3 REG_{j,t-1} + \alpha_4 \Delta RISK_{j,t} + \alpha_5 CAP_{j,t-1} +$$

$$\alpha_6 D1 + \alpha_7 D2 + E_{j,t}\ ; \qquad (7)$$

$$\Delta RISK_{j,t} = \beta_0 + \beta_1 SIZE_{j,t} + \beta_2 LLOSS_{j,t} + \beta_3 REG_{j,t-1} + \beta_4 \Delta CAP_{j,t} + \beta_5 RISK_{j,t-1} +$$

$$B_6 D1 + B_7 D2 + S_{j,t}\ ; \qquad (8)$$

The endogenous variables $\Delta CAP_{j,t}$ and $\Delta RISK_{j,t}$ have been included to recognize the possible simultaneous relationship between changes in capital and changes in risk. Empirical estimation of equation (7) and (8) Empirical estimation of equation (7) and (8) require measures of both bank capital and portfolio risk.

The main emphasis of this study is on the regulatory pressure variable, denoted *REG*. We focus on the response of banks to the 8% risk-based capital standard. We have estimated the model using two measures of regulatory pressure. First, within the probabilistic approach following Aggarwal and Jacques (1998) using the prompt corrective action (PCA) classification between adequately capitalized and undercapitalized institutions. In this method, I consider banks with risk capital weighted assets of less than 8% as undercapitalized. Within this approach the regulatory pressure variable REG is unity if the bank's capital ratio is within one standard deviation of the minimum capital

requirements and zero otherwise. Second, Following Jacques and Nigro (1997), the regulatory pressure variable REG which I will denote it in this method RPG equals (1/8 – 1/CAP) for all banks with total risk based ratio greater than or equal 8%, 0 otherwise. Although banks with risk- based capital ratio in excess of 8% were not explicitly constrained by the regulatory minimum, the risk based standards may have significantly influenced their capital ratio or the risk in their portfolio of assets. Because these banks hold capital in excess of the regulatory minimum, they may reduce their capital ratios or increase their level of portfolio risk. Alternatively, as Hancock and Wilcox (1992), Furlong (1992), and Bear and McElravey (1993) noted, these banks may increase their capital ratios as a buffer against shock to equity.[8] Because banks must meet the regulatory minimum standards on a continuous basis, the risk-based capital standards may cause these banks to increase their capital ratios or reduce portfolio risk as insulation against any uncertainty regarding whether the bank meets the regulatory minimum. In addition, increasing capital ratios or reducing risk for these banks may serve as a signal to both the market and bank regulators that these banks are in compliance and, in dong so, may lead to reduction in regulatory costs.

4.2 Measurement of Capital and Risk

Two alternative definitions of banks' capital are used: the ratio of total capital (Tier1+ Tier 2) to risk-weighted assets (RCRWA) and the ratio of capital to total assets (RCTA). Shrieves and Dahl (1992) used the RCRWA definition; which has become more widely used since the introduction of R-RCARS and has been used by Jacques and Nigro (1997), Aggarwal and Jacques (1998) and Ediz, Michael and Perraudin (1998). Hence, *CAP* is measured as the ratio to total capital (Tier1 + Tier2) to total risk weighted assets.

[8] There are other reasons why banks may choose to hold capital above the regulatory minimum. For example, Buser et al. (1981) discussed regulatory cost as a motive while Orgler and Taggart (1983) discussed tax considerations.

The measurement and definition of banks' 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 (RWATA) as proposed by Shrieves and Dahl (1992) and used subsequently by Jacques and Nigro (1997) and Aggarwal and Jacques (1998). The rationale for using this measure is that portfolio risk is primarily determined by the allocation of assets across the different risk categories. Hence, the ratio of risk-weighted assets to total assets has been used to measure *RISK*.

4.3 Measurement of Variables which Affect Changes in Banks' Capital and Risk

In Equations (5) and (6), 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. Next, possible explanatory variables for $\Delta CAP_{j,t}$ and $\Delta RISK_{j,t}$ are introduced and their expected impact on banks' capital and risk is discussed. All these variables have been used by Shrieves and Dahl (1992), with the exception of the current profits variable, emphasized by Aggarwal and Jacques (1998). The variables are bank size, current profits, current loan losses, regulatory pressure,

Bank size may influence target risk and capital levels due to its relationship with risk diversification, investment opportunities and access to equity capital. The natural log of total assets (SIZE) is included in the capital and in the risk equations to capture size effects. SIZE is expected to be inversely related to changes in capital and risk.

Current profits (measure here as return on assets (ROA)) may effects banks' capital if financial institutions prefer to increase capital through retained earnings, rather than through equity issues which may convey negative information to the market about the bank's value in the presence of asymmetric information. ROA is included in the change of capital equation and a negative co-efficient is expected.

A bank's current loan losses affect the ratio of risk-weighted assets to total assets as they lead to a decrease in the nominal amount of the risk-weighted assets. These losses (LLOSS) are approximated by the ratio of new provisions to total assets and therefore included in the risk equation with an expected negative effect on the change in RISK.

Regulatory pressure has a number of aspects. The buffer theory (Calmen & Rob, 1996), 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, poorly capitalized banks may be tempted to take more risk in the hope that higher expected returns will help them to increase their capital ("gambling for resurrection"). Hence, regulatory pressure can be evaluated in several ways. Ediz et al. (1998) adopts a relatively refined approach that reflects the impact of the capital ratio's volatility on the probability of failing to meet the legal requirements. Aggarwal and Jacques (1998) measure regulatory pressure in the US using the aforementioned Prompt Corrective Action (PCA) classification between adequately capitalized and undercapitalized institutions. In line with the probabilistic approach, the regulatory pressure variable REG used here is unity for bank with risk capital weighted assets over 12% and zero otherwise. REG is expected to affect the change in risk equation positively, but with no significant effect in the capital equation.

4.4 Data

This study consists of a three dimensional panel of 98 banks in 11 countries (Egypt, Israel, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia and United Arab Emirates), for the period 1995 – 2002, representing a total of 784 observations spaced by country, bank and year. This is the most comprehensive panel in the existing literature on banks in the MENA region. However, a small amount of Arab countries were excluded

from the sample because of the scarcity of the information that related to capital requirements. All the variables are compiled from Bankscope data base.

[Tables 1 and 2 about here]

4.5 Estimation and testing procedures

Following Jacques and Nigro (1997), Aggarwal and Jacques (1998), and Rime (2000), to estimate the simultaneous system formed by equations (7) and (8). I used two–stage least squares procedure, which recognize the endongeneity of both bank capital ratios and risk levels in a simultaneous equations framework. Unlike ordinary least square (OLS), estimation by 2SLS provides consistent estimates of the parameters. Each equation that is part of recursive system can be estimated separately using OLS. But in practice, not many systems of equations will be recursive, so a direct way to address the estimation of equations that are from a true simultaneous system must be sought. There are many methods that can be used, indirect least square (ILS), two-stage least squares (2SLS). ILS involves estimating the reduced form equations using OLS, and then using them to substitute back to obtain the structural parameters. ILS is intuitive to understand in principle; however, it is not widely applied because (a) solving back to get the structural parameters can be tedious, for a large system, the equations may be set up in a matrix form, and to solve them may therefore require inversion of a large matrix. (b) Most simultaneous equations system is overidentified. And ILS can be used to obtain coefficients only for just identified equations. For overidentified systems, ILS would not yield unique structural estimates. ILS estimators are consistent and asymptotically efficient, but in general they are biased, so that in finite samples ILS will deliver biased structural form estimates. So the technique 2SLS is applicable for the estimation of overidentified systems, where ILS cannot be used. Two- stage least square (2SLS) is done in two stages: in Stage 1, we obtain and

estimate the reduced form equations using OLS, and save the fitted values for the dependent variables; in Stage 2, we estimate the structural equation using OLS, but replace any endogenous variables with their stage 1 fitted values.

There is another technique available for systems of equations. Three- stage least square (3SLS), which provides a third step in the estimation process that allows for non-zero covariance between the error terms in the structural equations. It is asymptotically more efficient than 2SLS since the latter ignores any information that may be available concerning the error covariences, and also any additional information that may be contained in the endogenous variables of other equations). But in this study I use 2SLS, because to calculate 3SLS estimates, the specification must satisfy the order condition for identification, which says that there must be at least as many instruments as there are coefficients in the equation.[9].

Cross section weights technique is used, which assumes the presence of cross-section heteroskedasticity. Cross-section weighted regression is appropriate when the residuals are cross-section heteroskedastic and contemporaneously uncorrelated. Where the technique SUR weighted least squares (sometimes referred to as the Parks estimator) is the feasible GLS estimator when the residuals are both cross-section heteroskedastic and contemporaneously. More detailed descriptions of these methods are provided in the Technical Discussion below. But there are a number of potential pitfalls associated with SUR/Parks estimation (see Beck and Katz (1995). Furthermore, it is impossible compute estimates for this model because the data consist of large numbers of cross-sections and a small number of time periods. The average number of periods used in estimation must be at least as large as the number of cross-section units.

[Table 3 and 4 about here]

[9] See Davidson and MacKinnon (1994) and Johnston and DiNardo (1997) for additional discussion.

5. Empirical results

In this study, the results of estimating equations (7) and (8) are presented in Table 5. The system based on the probabilistic measure of regulatory pressure gives the following results (left part of Table 1). In the capital equation, current earnings (**ROA**) have a significant and positive impact on capital, indicating the profitable banks can more easily improve their capitalization through retained earnings. **SIZE** has a negative and significant impact on capital, indicating that large banks increased their ratio of capital to **RWA** less than other banks; here, a possible explanation is that large banks have to compete on international markets with institutions that are, in general, less capitalized. Regulatory pressure (**REG**) has a negative and significant impact on the ratio of capital to **RWA**. In the risk equation, the regulatory pressure variable has a negative and significant impact on banks' risk, which indicates that banks increased or decreased the share of RWA in their portfolio to approach the minimum capital requirements. **SIZE** has no significant impact on risk. In the capital equation, there is a significant and positive relationship emerges between changes in capital and changes in risk, where is no significant relationship between changes in capital and changes in risk in risk equation. The estimates obtained using **RPG** measure of regulatory pressure (right part of table 1) indicate that the regulatory variable for undercapitalized banks has a positive and significant impact on capital but no significant impact on risk.

[Table 5 about here]

6. Conclusions

This chapter has provided new evidence on the effects of a stricter enforcement of minimum capital discipline on bank intermediation in less developed financial systems. In this respect, we have limited our attention to the simple revision of capital ratios but have also considered those measures — e.g. improving accounting standards, adopting rigorous

provisioning practices and more binding bankruptcy laws — which make capital requirement more sensitive to the change in the quality of banks' portfolios.

The paper offers a clear support to the general presumption that the credit crunch associated to a stricter enforcement of bank capital regulation is more pervasive in those countries where the credit channel is more important i.e. where alternatives to bank credit are less developed. This evidence suggests the relevance of a careful phasing in of new capital requirements in order to avoid undesirable macroeconomic side effects.

Notwithstanding the general recognition that capital regulation may have different macroeconomic effects according to the different institutional and developmental features of each economy, bank capital regulation has not yet clearly addressed the distinct needs of less developed economies.

The paper contributes to the ongoing discussion on the new Basel Capital Accord, stressing the fact that economies, which mostly rely on bank credit, may have to devote particular attention to the process of enforcement of a stricter bank capital discipline. The presence of different institutional constraints need not be read as an alibi for not modernizing capital regulation. It should instead motivate a timely revision of these constraints, on the part of the domestic authorities, and the definition of more suitable regulatory options for developing countries on the part of the international standard setters.

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Table1: The Sample

The sample size for each country		
Country	Number of Banks	Period
Egypt	5	1995-2002
Israel	13	1995-2002
Jordan	12	1995-2002
Kuwait	5	1995-2002
Lebanon	20	1995-2002
Morocco	6	1995-2002
Oman	5	1995-2002
Qatar	3	1995-2002
Saudi Arabia	7	1995-2002
Tunisia	10	1995-2002
UAE	12	1995-2002

Source: Constructed from BankScope in order to define the sample

Table 2: Descriptive Statistics for all Variables in the Model

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
SIZE	8.1226	12.4764	0.0000	1.9156	0.1335	2.4665
ROA	1.3187	19.1500	-11.3600	1.6873	3.0366	40.4810
REG	0.5344	1.0000	0.0000	0.4991	-0.1381	1.0191
DCAP	0.2130	40.0500	-42.0700	4.7877	0.3942	23.2752
CAP	17.5152	60.7800	0.0000	9.2641	1.6271	6.2420
RISK	11.6308	168.8960	0.0000	28.6905	2.6426	8.7739
DRISK	-0.1930	61.1362	-61.5237	5.9444	-1.1102	48.6649
D2	5.5510	11.0000	1.0000	3.3982	0.1421	1.8156
D1	6.2449	20.0000	1.0000	4.4774	1.0118	3.5284
RPG	2.0467	10.8547	0.0000	3.8118	1.3485	2.8785

Table 3: Correlation Matrix for all the Variables in the Model

	CAP	DCAP	RISK	DRISK	LLOSS	ROA	RPG	SIZE	D1	D2
CAP	1.0000									
DCAP	0.1440	1.0000								
RISK	-0.0298	0.0153	1.0000							
DRISK	-0.0360	-0.0548	0.0556	1.0000						
LLOSS	-0.1035	-0.0560	0.0280	-0.0336	1.0000					
ROAA	0.0995	0.0214	-0.1289	0.0047	0.0958	1.0000				
RPG	0.8343	0.0808	-0.0176	-0.0118	-0.1088	0.1050	1.0000			
SIZE	-0.1417	-0.0393	-0.3315	0.0004	-0.0359	-0.0274	-0.0988	1.0000		
D1	0.1908	-0.0198	-0.0035	0.0083	-0.0374	-0.0784	0.1883	-0.5778	1.0000	
D2	0.0496	-0.0069	0.5775	-0.0482	0.0917	0.0281	0.0475	0.0505	-0.2654	1.0000

Table 4: Correlation Matrix after Changing the Definition of Regulatory Pressure (REG)

	SIZE	ROAA	REG	DCAP	CAP	RISK	DRISK	D2	D1
SIZE	1.0000								
ROAA	-0.0274	1.0000							
REG	0.2248	-0.0432	1.0000						
DCAP	-0.0393	0.0214	-0.0173	1.0000					
CAP	-0.1417	0.0995	-0.4396	0.1440	1.0000				
RISK	-0.3315	-0.1289	-0.1887	0.0153	-0.0298	1.0000			
DRISK	0.0004	0.0047	-0.0092	-0.0548	-0.0360	0.0556	1.0000		
D2	0.0505	0.0281	-0.2130	-0.0069	0.0496	0.5775	-0.0482	1.0000	
D1	-0.5778	-0.0784	-0.1655	-0.0198	0.1908	-0.0035	0.0083	-0.2654	1.0000

Table 5: **Results for the systems based on the ratio of capital to risk-weighted assets using two alternative measuring regulatory pressures**

1) Probabilistic measure of Regulatory Pressure					2) RPG measure of Regulatory Pressure			
ΔCAP			**ΔRISK**		**ΔCAP**		**ΔRISK**	
	Coefficient	***p-value***	***Coefficient***	***p-value***	***Coefficient***	***p-value***	***Coefficient***	***p-value***
C	2.8634*	0.0000			5.5582*	0.0000	-0.0237	0.7201
CAP(-1)	-0.1159*	0.0000			-0.2936*	0.0000		
ΔCAP			-0.0022	0.2113			-0.0023	0.982
ROA	0.1048*	0.0140			0.1004*	0.0176		
SIZE	-0.0917*	.0071	0.0028	0.2658	-0.2116*	0.0000	0.0027	.6817
RISK(-1)			-0.0528*	0.0001			-0.0409*	0.0045
ΔRISK	-0.0322*	0.0583			-0.0189	0.1789		
LLOSS			0.0069	0.4093			-0.0032	0.7197
REG(-1)	-0.5301*	.0042	-0.0426*	0.0061				
RPG					0.5593*	0.0000	-0.0016	0.3467
D1	-0.0024	0.9061	0.0025*	0.0438	-0.0348*	.06068	0.0039*	0.0364
D2	-0.0123	0.5501	0.0045	0.0803	0.03365*	0.0432	0.0017	0.5361
Adj.R^2	0.1		0.065		0.3127			0.0272

* Represents statistical significance.

Appendix table A1: Capital Adequacy in Some Arab Banks

Country	Present Level	Date of enforcing the 8% level
Egypt	8%	1993
Jordan	8%	1992
Morocco	8%	1992
Oman	8%	1992
Tunisia	5%	1995

Source: AMF, Techniques of Banks.