THE EFFECTIVENESS OF BANK CAPITAL ADEQUACY REQUIREMENTS: A THEORETICAL AND EMPIRICAL APPROACH

Víctor E. BARRIOS (*)

Juan M. BLANCO

University of Valencia

December 2000

We gratefully acknowledge the comments and suggestions made by Antonio Argandoña, Santiago Carbó, Teresa García Marco, Ignacio Mauleón, José Antonio Novo, José Miguel Rodriguez, Ezequiel Uriel and specially Francisco Pérez.

(*) Victor Barrios is very much obliged to the people of IRES (Université Catholique de Louvain) for their hospitality and facilities has been him provided during the development of this project. Financial support provided by Education Council of Valencian Government (Consellería de Cultura, Educación y Ciencia de la Generalitat Valenciana) and University of Valencia is also gratefully acknowledged.

Departamento de Análisis Económico
Universidad de Valencia
Av. de los Naranjos s/n.
Edificio Departamental Oriental.
46022 VALENCIA, SPAIN
Telephone 34- 963828246, Fax 34-963828249
E-mail: Victor.E.Barrios@uv.es
E-mail: Juan.M.Blanco@uv.es.

ABSTRACT

The aim of this paper is to analyse how banking firms set their capital ratios, that is, the rate of equity capital over assets. In order to study this issue, two theoretical models are developed. Both models deal with the existence of an optimal capital ratio; the first one for firms not affected by capital adequacy regulation, the second one for firms which are. The models have been tested by estimating a disequilibrium model using data of Spanish savings banks.

Key words: Capital Ratio, Capital Adequacy Regulation, Disequilibrium Model.

JEL Classification: G-21, G-28, C-34.

1. Introduction

Although capital generally accounts for a small percentage of the financial resources of banking institutions, it plays a crucial role in their long-term financing and solvency position and therefore in public credibility. In the event of a crisis, the lower the leverage ratio is, the lower the probability that a bank will fail to pay back its debts. This fact would justify the existence of a capital adequacy regulation in order to avoid bankruptcies and their negative externalities on the financial system although banks may respond to this regulation by increasing their risk exposure[1]. On the other hand, too tight a regulation may lead banks to reduce their credit offer and, as a result, give rise to a fall in productive investment[2]. All these arguments justify studying the way banks set their capital to assets ratio.

This topic is of special interest in Spain where from the late 1980s an important process of financial deregulation has coexisted with a supervisory re-regulation. In fact, it was not only 1985 that risk- based capital adequacy requirements were introduced in Spain. The severe banking crisis suffered during 1978-1983 together with the international trend towards the application of risk-based capital rules seem to lie behind the 1985 risk- based capital legislation. The Spanish Capital Adequacy Regulation Act of 1985 imposed two simultaneous minimum capital ratios: a global or generic ratio and a selective or risk- based capital ratio. The former stated that capital had to be a minimum percentage of total investment net of provisions and depreciation. The latter stated a risk-weighted capital requirement, where capital had to be superior to the sum of different assets or off-balance sheet exposures, weighted according to their relative risk, making this last requirement specific for each bank.

This legislation may have affected Spanish banking institutions (private banks, savings banks, credit co-operative societies) in different ways depending on their capital structure. This paper focuses only upon the analysis of the effectiveness of capital adequacy regulation on Spanish saving banks, which account for over 30% and 44% of total assets and deposits, respectively, of the Spanish banking sector during 1988-1992.

[1] See Koehn and Santomero (1980), Lam and Chen (1985), Lackman (1987), Kim and Santomero (1988) and Rochet (1992). 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.
[2] See Santomero and Watson (1977).

Spanish savings banks, as non-profit foundations, hold a principle of management based on social and economic criteria. They are subjected to strong supervision by public authorities and their earnings are destined to ensure the future of the institution and to raise a fund called the Social Work Fund. Local governments, corporations, depositors, founding members and employees make up their executive organs (General Assembly). In spite of this important presence of public institutions in these executive organs the evidence suggest that Spanish savings banks has not escaped the discipline of external market test of their comparative efficiency and performance. The greater competition in the Spanish banking sector has made that variables like managerial quality and productive efficiency are relevant indicators for these institutions.

Spanish savings banks were characterised by providing its clients with traditional banking products (retail banking), the proximity to the client through a wide network of branch offices being one of its main strategies. With regard capital regulation, this seems to have been stricter for Spanish savings banks than for private banks in terms of the capital instruments that both type of institutions can employ[3]. They do not have share equity and the main source of their capital is constituted by accumulated reserves. This implies that in a period of recession too tight a regulation can reduce the growth- rate of these institutions, since it decreases the level of retained earnings. Other components of bank capital are hybrid debt-capital instruments and subordinated debt[4]. The increasing importance of subordinated debt can be observed from its contribution to savings banks capital that has grown from 1.7% of total capital in 1985 to 11.2% in 1993. In this context, savings banks management has less legal possibilities for increasing capital than in the case of private banks, which in turn, also reduces the leeway that this management has with regard to augmenting capital.

The purpose of this study is to determine whether regulatory capital requirements induce banks to hold higher capital ratios that would have otherwise been the case. In the literature, several studies on the effectiveness of capital requirements on US banks answer this question including in empirical models a proxy for regulatory capital[5]. Variables such as the ABC ratio (ratio of observed accounting capital to the amount of the capital desired by the regulator) or binary variables (1 for

[3] See Carbo (1993).
[4] The hybrid debt-capital instrument for Spanish saving banks called participation capital was introduced in 1988. However, no saving banks had issued any participation capital during period of study.
[5] See Peltzman (1970), Mingo (1975), Heggestad and Mingo (1975), Dietrich and James (1983) and Marcus (1983). Carbo (1993), following the methodology of Dietrich and James (1983) presents a similar study in the context of Spanish banking system.

savings banks with adequate capital and 0 otherwise) are examples of this regulatory pressure. In the case of being statistically significant the capital regulation will be effective[6]. Conversely, Wall and Peterson (1987, 1995) speculate on whether the adoption of fixed minimum capital requirements led US bank holding companies (BHCs) to maintain higher capital ratios than those market forces would have led to. Both works propose the classification of institutions into two regimes: a regulatory regime and a market regime. If regulatory guidelines exceed market requirements, then the regulation is binding and the bank is operating in the regulatory model. Otherwise, the bank is operating in the market model. The disequilibrium estimation technique is used in both works. Following this approach this work will present two models called the market and the regulatory regimes. However, novelties in relation to Wall and Peterson works are very substantial. They will be presented throughout this paper.

Does an optimal market capital ratio for banks exist?. There are two different answers from two alternative theoretical approaches. The Modigliani -Miller theorem[7] (henceforth MM) has shown that, provided competitive capital markets and in the absence of bankruptcy costs, corporate income taxation or other market imperfections, the value of a firm is independent of its financial structure. On the other hand, the classic thesis states that, restoring one or more of these excluded conditions, the value of the firm may reach an internal maximum with positive equity in its financial structure. In supporting the idea of an optimal capital ratio for banking institutions, some authors have contemplated several exceptions to the theorem of MM: bankruptcy and agency costs, liquidity services and operations costs associated to deposits and deposit insurance. In those situations they have shown that the market value of a bank is not independent of the way it is financed; in the absence of regulation an optimal capital ratio may exist. Nevertheless, even accepting such optimal market capital ratio, banks are obliged by regulation to keep a minimum capital ratio to mimimize the social cost derived from a banking crisis. This constraint is binding only for banks with an optimal market capital ratio lower than the minimum standard, it being irrelevant for banks with optimal capital positions above the regulatory minimum. These two situations allow us to classify banks in two different models or regimes: the market model and the regulatory model. As far as there are banks operating with capital positions above the regulatory minimum (capital regulation is non-

[6] These types of proxies introduce some problems in the estimation model. For a more detailed explanation see Jackson and others (2000).
[7] See Modigliani and Miller (1958).

effective) one can suspect that market forces are at work undermining the dominance of insured deposits over equity as a source of financing.

This paper is organised as follow. In section 2 two theoretical models (the market and the regulatory regimes) analysing banks behaviour in setting capital ratios are developed. Both models demonstrate the existence of an optimal capital ratio and point out the variables determining it. In section 3 an econometric model for markets in disequilibrium is proposed to distinguish between these two regimes. The empirical results (using data of Spanish Savings Banks during the period 1985-1991) are showed in section 4. Section 5 presents a summary and concluding comments.

2. Theoretical background: the determinants of capital structure decisions.

In this section we develop two theoretical models to explain the way banks set their capital to assets ratio in a context in which the authorities establish a (minimum) capital adequacy regulation and enforce the rule by means of sanctions. In both models the existence of a desired capital to assets ratio will be shown. The first one describes the behaviour of firms not affected by regulation as they have optimal market capital to assets ratios higher than the regulated one. This model synthesizes in a theoretical formulation the issues proposed in the banking literature to justify an optimal capital structure (liquidity premium, operations costs associated to deposits and deposit insurance). Conversely, Wall and Peterson (1987, 1995) built an empirical model based on factors discussed by their contemporary authors. The second model explains the behaviour of banks whose optimal capital ratio lies below the minimum one: their decision will consist in maintaining not just the minimum regulated ratio but one a bit higher (capital cushion). The idea of a capital cushion, established as a caution against contingencies, was mentioned initially in Wall and Peterson (1987) although these authors provide only an intuitive explanation of this phenomenon. We show below that banks will set this cushion whenever the capital ratio is not totally controllable (or stochastic) and when important sanctions to enforce the capital rule exist. In this case, banks would maintain this cushion to prevent the stochastic capital ratio from reaching values below the permitted minimum in order to avoid being sanctioned.

2.1 Market model

The assumptions are the following:

S1 Savings banks, as foundations, are the investment project of a group of investors called founding members and depositors. Investors are wealthy risk neutral agents who can invest in personal account at the risk free rate (r_f). In the event of bankruptcy their responsibility is limited to the value of their investment in the firm, which is protected by the standard limited liability provision of contracts. They seek to maximize the expected present value of a savings bank in one period economy. This value is defined as the sum of the expected present value of the savings bank for capital owners and the accounting value of deposits.

S2 The liability side is made up of deposits (D) and capital (K). Thus, the balance sheet is A=D+K.

S3 Savings banks can increase their capital ratios by either reducing assets or increasing capital. However, since we are interested in obtaining an optimal capital structure for each value of the firm we will assume initially that the assets level is fixed. Consequently, the savings bank can only modify its capital ratios by changing capital.

S4 Capital is stochastic. It evolves by

$$\tilde{K} = K^* + \tilde{u} \tag{1}$$

where K* is under control of the bank and $\tilde{u}$ (capital shocks) is a stochastic disturbance term normally distributed $\tilde{u} \sim N(0, s_u^2)$. The uncertainty of saving banks' retained earnings (extraordinary losses, variability of interest rates) is the source of randomness of capital. Since the assets level is given, deposits are stochastic too:

$$\tilde{D} = A - \tilde{K} = A - K^* - \tilde{u}\,. \tag{2}$$

S5 Saving banks assets yield a gross revenue X= R_a A (interest and principal repayments), where R_a is the gross return of the risky assets portfolio.

S6 Deposits are fully insured (principal and interest promised to depositors) by a deposit insurance agency. They yield a rate r_d that does not depend on default risk. At the end of the period deposits generate liabilities to the amount [$\tilde{B} = (1 + r_d)\,\tilde{D}$].

S7 In addition, deposits cause the savings bank to incur in two other costs: the deposit insurance premium ($\tilde{Z}$) and operations costs[8] [$C(\tilde{D})$]. Both are paid at the end of the period. Insurance premium ($\tilde{Z}$) is an under-priced proportion of the payments to depositors in the event of bankruptcy

[8] Intermediation costs due to the provision of transaction services attached to deposits.

($\tilde{Z} = b\,\tilde{D}$), b being a variable rate premium that is a negative function of (K*/A). On the other hand, operations costs depend on deposits such that $[C(\tilde{D}) = c\,\tilde{D}]$, c being a positive linear function of the mean of deposits:

$$c = c_1\, \overline{D} = c_1\, (A - K^*) \tag{3}$$

The existence of these operations costs allows deposits to be raised in equilibrium at interest rates below (r_f), even if market is perfectly competitive and agents are risk neutral. The difference between both rates ($\mu = r_f - r_d$) consists in a liquidity premium paid for liquidity services provided by intermediaries. This premium represents what depositors are willing to renounce in terms of profitability in exchange for liquidity services.

S8 In practice, in the event of bankruptcy, the deposit insurance agency will pay for all debts and losses of saving banks[9].

Risk neutrality and the probability of investing in personal account at the risk free rate allow investors to maximize the expected present value of the savings bank (4). For analytical convenience we will define all variables as ratios per unit of assets in equation (4):

$$\begin{aligned} E(V/A) &= (1 + r_f)^{-1}\left\{R_a + \mu\ [1 - (K^*/A)] - c_2\ [1 - (K^*/A)]^2\ - E(\tilde{G}/A)\right\} = \\ &= E(V^u/A) + (1 + r_f)^{-1}\left\{\mu\ \ E(\tilde{D}/A) - E\left\{[C(\tilde{D})]/A\right\}\right\} - V(\tilde{G}/A) \end{aligned} \tag{4}$$

where E( ) is the expectation of each variable and $c_2 = c_1\, A$ is a constant parameter.

The expected present value (per unit of assets) of a levered savings bank $E(V/A)$ can be expressed as the sum of the expected present value of an unlevered savings bank $E(V^u/A)$, plus the expected present value that depositors assign to liquidity services $\{(1+r_f)^{-1}\ [\,\mu\ E(\tilde{D}/A)\,]\}$, plus the expected present value of the deposit insurance subsidy net of premium $[-V(\tilde{G}/A)\,]$, minus the expected discounted value of operations costs per unit of assets $\{(1+r_f)^{-1}\ E\left([C(\tilde{D})]/A\right)\}$.

The value (per unit of assets) of the deposit insurance $[-V(\tilde{G}/A)\,]$ depends on the quantity insured ($\tilde{B}$), on other payment commitments $[C(\tilde{D})\,]$ in the event of bankruptcy, on the probability

[9] The history of Spanish Deposit Insurance Corporation (SDIC) is full of this type of interventions. Only recently in very few cases (only small private banks) did the SDIC paid off the bank´s insured depositors.

of bankruptcy F(s), on the insurance premium $(\tilde{Z})$ when the saving bank is solvent and on the expectancy of assets recovery after bankruptcy $\int_{-\infty}^{s} R_a \ \boldsymbol{f}(\tilde{u}_1)\, d\tilde{u}_1$. Therefore:

$$-V(\tilde{G}/A) = (1+r_f)^{-1}\left\{\int_{-\infty}^{s}\left[\{(\tilde{B}+C(\tilde{D}))/A\} - R_a\right]\boldsymbol{f}(\tilde{u}_1)\, d\tilde{u}_1 - \int_{s}^{\infty}(\tilde{Z}/A)\ \boldsymbol{f}(\tilde{u}_1)\, d\tilde{u}_1\right\} =$$

$$= (1+r_f)^{-1}\left\{\int_{-\infty}^{s}\left\{\left[1+r_d + c_2\{1-(K^*/A)\}\right](\tilde{D}/A) - R_a\right\}\boldsymbol{f}(\tilde{u}_1)\, d\tilde{u}_1 - b\int_{s}^{\infty}(\tilde{D}/A)\ \boldsymbol{f}(\tilde{u}_1)\, d\tilde{u}_1\right\} \tag{5}$$

where $s = [1-(K^*/A)] - \{1+r_d + b + c_2\ [1-(K^*/A)]\}^{-1}\ R_a$ define a critical value such that net worth of the savings bank is positive if and only if $\tilde{u}_1 = (\tilde{u}/A) \geq s$.

Rewriting equation (5) we can obtain expression (6):

$$-V(\tilde{G}/A) = (1+r_f)^{-1}\left[\int_{-\infty}^{s}\left\{\left[1+r_d + b + c_2\left\{1-\frac{K^*}{A}\right\}\right](s-\tilde{u}_1)\ \boldsymbol{f}(\tilde{u}_1)\, d\tilde{u}_1\right\} - b\left\{1-\frac{K^*}{A}\right\}\right] \tag{6}$$

which is positive since we have assumed that the deposit insurance premium is under-priced[10] (assumption S7).

From expression (4) we can deduce that present value of a savings bank is not independent of its capital structure. However, this is not enough to demonstrate the existence of an optimal market capital ratio. The first order condition for a maximum in (V/A) establishes that the capital to assets ratio (K*/A) will be increased until marginal revenue equals marginal cost (7). Consequently, the diminution in operations costs and the insurance premium derived of a greater solvency as result of a smaller leverage[11] is compensated by a lower deposit insurance subsidy and liquidity premium, that is

$$\frac{\partial\left\{-E\left[\tilde{G}/A\right] - E\left[C(\tilde{D})/A\right]\right\}}{\partial(K^*/A)} - m = 0 \tag{7}$$

or equivalently,

$$2\,c_2\{1-(K^*/A)\}\,[1-F(s)]-c_2\,\boldsymbol{s}^2_{u_1}\,\boldsymbol{f}(s)+\left(b-\frac{\partial b}{\partial (K^*/A)}\{1-(K^*/A)\}\right)[1-F(s)]$$

$$+\frac{\partial b}{\partial (K^*/A)}\boldsymbol{s}^2_{u_1}\,\boldsymbol{f}(s)\;=\;\boldsymbol{m}+(1+r_d)\,F(s) \qquad (7')$$

where $\boldsymbol{f}(\,)$ and F( ) are symbols of density and distribution function and $\boldsymbol{s}^2_{u_1}$ is the variance of $\tilde{u}_1$.

By second order condition, marginal costs should increase faster than marginal revenues. In order to guarantee this result the model should verify one of these conditions or both jointly: parameter b (deposit insurance premium per unit of cover) and the expected value of operations cost per unit of assets are both decreasing and convex functions of the expected capital ratio[12]. (K*/A). Therefore:

$$\frac{\partial^2 (V/A)}{\partial (K^*/A)^2}=\;(1+r_f)^{-1}\left\{-\frac{\partial^2 b}{\partial (K^*/A)^2}\int_s^\infty \frac{\tilde{D}}{A}\,\boldsymbol{f}(\tilde{u}_1)\,d\tilde{u}_1-2\,c_2\,[1-F(s)]\right.$$

$$\left.-(1+r_d+b)\,\boldsymbol{f}(s)\frac{\partial s}{\partial (K^*/A)}+\left[1+r_d+b+c_2\{1-(K^*/A)\}\right]\boldsymbol{f}(s)\left(\frac{\partial s}{\partial (K^*/A)}\right)^2\right\} \qquad (8)$$

where $[\partial s/\partial (K^*/A)]<0$.

Even under the previous conditions, expression (8) fails to be negative for all parameter values. However, by carrying out a simulation exercise on first and second order conditions with quadratic operations costs, flat rate premium (Spanish case) and parameter values similar to those of Spanish banks we observe expression (8) remains negative. Moreover this simulation allows us to approximate the first order condition to the following linear equation which can be estimated:

$$(K/A)^* = -\gamma_0+\gamma_1\,b-\gamma_2\,r_f+\gamma_3\,r_d+\gamma_4\,c_2-\gamma_5\,(c_2)^2+\gamma_6\,\boldsymbol{s}^2_{u_1} \qquad (9)$$

where γ_i are positive parameters.

---

[10] An actuarially fair premium will cancel out this expression.

[11] Remember that assumption S7 states that b is a negative function of (K*/A).

[12] First and second derivatives with respect to the expected capital ratio (K*/A) are negative and positive, respectively. It can be shown that if $\{C(\tilde{D})/A\}$ is a constant proportion of deposits, that is, $\{C(\tilde{D})/A\}=c\,\tilde{D}$, where c is a constant parameter and the deposit insurance premium is flat, the saving bank maximizes (V/A) increasing its leverage to the limit.

Optimal market capital ratio increases with b, r_d, c_2 and $\sigma^2_{u_1}$. It decreases with r_f. This fact reflects that a high level of banking demand for capital will be associated with high costs of deposits and a high variability of capital ratio. For a given risk-free interest rate, the higher the deposit interest rate is, the lower will be the liquidity premium depositors are willing to pay. This would reduce for banks the incentive to capture debt. Operations costs are a good indicator of efficiency and probability of bankruptcy (Berger 1995). The sign of the variability of capital ratio indicate that the greater dispersion of retained earnings (main source of capital in saving banks) of the company is, the greater the issues of other capital instruments (subordinated debt, hybrid debt- capital instruments) in order to avoid the firm becoming bankrupt.

2.2. Regulatory model

Assumptions are the following:

R1 Optimal market capital to assets ratio (K/A)* is below the regulatory minimum capital R.

R2 In order to enforce the rule, two types of sanctions payments are established if (K/A)< R (graph 1): a fixed one (J) if the bank operates below the regulation and a variable one which is proportional to the square of the difference between regulated and actual capital ratio[13]. As a result, the value of a savings bank per unit of assets (V/A) moves away from the pure present value of the firm when the capital ratio moves away from the regulatory minimum to the left $(V/A)_i$. On the contrary, it remains unchanged when the capital ratio moves away to the right $(V/A)_d$.

R3 Banks cannot control totally (K/A) since it is stochastic and can diverge from the regulatory minimum in a random way.

(GRAPH 1)

Under these conditions, the value of the bank per unit of assets will be:

$$V/A = \begin{cases} (V/A)_d = (1+r_f)^{-1}\left\{(V/A)_R - \delta\,\left[(K/A)-R\right]^2\right\} & \text{if } (K/A) \geq R \\ (V/A)_i = (1+r_f)^{-1}\left\{(V/A)_R - J - \theta\,\left[(K/A)-R\right]^2\right\} & \text{if } (K/A) < R \end{cases} \qquad (10)$$

[13] The sanctions scheme in Spain is similar to that pattern.

where:

$(V/A)_R$= the value of the saving bank per unit of assets when capital ratio equals R.

δ, θ are positive parameters and $\delta \le \theta$

The actual (ex-post) capital ratio (K/A) will be the sum of the desired capital ratio $(K/A)^*$(R) plus a stochastic disturbance term ($\tilde{\varepsilon}$)[14]. Conversely to the market modelin this model we assume that the randomness of the capital to assets ratio is focused on the quotient (11), not only on capital. The divergence of the optimal market capital to assets ratio respect the regulatory minimum can be a consequence of the uncertainty of earnings (extraordinary losses, the variability of interest rates) of the firm or due to a great variability in its assets (a more or less aggressive strategy in capturing loans).

$$(K/A)=(K/A)^*(R) + \tilde{\varepsilon} \qquad \text{where } \tilde{\varepsilon} \sim N(0, \sigma_\varepsilon^2) \tag{11}$$

The capital ratio target in the regulatory model is the amount of capital required to satisfy the capital guideline R plus a possible capital cushion as a caution against contingencies H.

$$(K/A)^*(R) = R + H \tag{12}$$

Substituting equations (11) and (12) into (10) the present value per unit of assets of the savings bank (V/A) may be rewritten as:

$$V/A = \begin{cases} (V/A)_d = (1+r_f)^{-1}\left\{(V/A)_R - \delta H^2 - \delta\tilde{\varepsilon}^2 - 2\delta\tilde{\varepsilon}H\right\} & \text{if } \tilde{\varepsilon} \ge -H \\ (V/A)_i = (1+r_f)^{-1}\left\{(V/A)_R - J - \theta H^2 - \theta\tilde{\varepsilon}^2 - 2\theta\tilde{\varepsilon}H\right\} & \text{if } \tilde{\varepsilon} < -H \end{cases} \tag{13}$$

and, taking expectations

$$\begin{aligned} E(V/A) = (1+r_f)^{-1}\big[(V/A)_R &- \delta H^2[1-F(-H)] - \theta H^2 F(-H) - \delta E[\tilde{\varepsilon}^2]_{-H}^{+\infty} \\ &- \theta E[\tilde{\varepsilon}^2]_{-\infty}^{-H} - 2\delta H E(\tilde{\varepsilon})_{-H}^{+\infty} - 2\theta H E(\tilde{\varepsilon})_{-\infty}^{-H} - J F(-H)\big] \end{aligned} \tag{14}$$

[14] Capital shocks that affect savings banks in the market model and in the regulatory model cannot be identical, hence the need to attach different institutions to each one of the two regimes.

The level of the capital cushion per unit of assets which maximizes the expected present market value will be[15]:

$$\mathrm{H} = \frac{s_e \{f[(-\mathrm{H})/s_e]\}[q-d]}{d+\Phi[(-\mathrm{H})/s_e][q-d]} + \frac{\mathrm{J}\{f[(-\mathrm{H})/s_e]\}}{\{2d+2\Phi[(-\mathrm{H})/s_e][q-d]\}s_e} \tag{15}$$

where ϕ and Φ are distribution and density functions of a standard normal random variable. The optimal capital cushion will depend on J and on σ_ε (capital ratio volatility). Three special cases are worth pointing out: i) if $\theta>\delta$, H is positive (even if J=0), ii) if $\theta=\delta$ and J=0, H will be zero and iii) if $\theta=\delta$ and J>0 expression (15) is reduced to:

$$\mathrm{H} = + \frac{\mathrm{J}\{f[(-\mathrm{H})/s_e]\}}{2ds_e} \tag{16}$$

Comparative static exercises show that H will be higher, the higher J, σ_ε and $\theta > \delta$ are. However, since the distribution function is normal and its integration limits depend on H, an explicit function of H cannot be obtained: it is necessary to use simulation techniques. We further assume (in order to simplify and without great loss of generality) that $\theta = \delta$ (expression 16). This allows for a reduction in the number of parameters to 2 (σ_ε and J/δ). As a result of the simulation exercise, we obtain that optimal capital cushion can be approximated to:

$$\mathrm{H} = -\alpha_1 + \alpha_2 (\mathrm{J}/\delta) - \alpha_3 (\mathrm{J}/\delta)^2 + \alpha_4 \sigma_\varepsilon - \alpha_5 \sigma_\varepsilon^2 + \alpha_6 \sigma_\varepsilon^3 \tag{17}$$

where α_i are positive parameters. Therefore, the desired capital ratio can be estimated by using the following linear equation:

$$(\mathrm{K/A})^*(\mathrm{R}) = \mathrm{R} - \alpha_1 + \alpha_2 (\mathrm{J}/\delta) - \alpha_3 (\mathrm{J}/\delta)^2 + \alpha_4 \sigma_\varepsilon - \alpha_5 \sigma_\varepsilon^2 + \alpha_6 \sigma_\varepsilon^3 \tag{18}$$

3. Empirical results

3.1 Specification

[15] The second order condition is always met.

Accepting that changes in capital ratios involve some costs (transaction costs associated to issue of capital instruments and the costs of adjusting capital position to equilibrium level) and assuming these to be quadratic, the dynamic behaviour of banks in both regimes can be described by the following partial adjustment equations[16]

$$(K/A)_{i,t}\,(m) = \Phi_1\,(K/A)^*_{i,t} + (1-\Phi_1)\,(K/A)_{i,t-1} + \tilde{w}_{i,t} \qquad \tilde{w}_{i,t} \to N(0, \sigma^2_w) \tag{19}$$

$$(K/A)_{i,t}\,(R) = \Phi_2\,[R_{i,t} + H_{i,t}] + (1-\Phi_2)\,(K/A)_{i,t-1} + \tilde{e}_{i,t} \qquad \tilde{e}_{i,t} \to N(0, \sigma^2_e) \tag{20}$$

where the subscript "i" refers to firms while subscript "t" refers to time period and $0<\Phi_i<1$ (i=1,2) are the rate of adjustment coefficients to desired capital-to-assets ratios in both regimes. By assumption we consider that the disturbance terms are uncorrelated. Next, by plugging equation (9) and (18) into (19) and (20) respectively and allowing for pure individual and pure time effects in the market model we obtain:

$$\begin{aligned}(K/A)_{i,t}\,(m) = {} & -\Phi_1\gamma_0 + \gamma_1\,\Phi_1 b + (1-\Phi_1)\,(K/A)_{i,t-1} + \Phi_1\eta_i - \gamma_2\,\Phi_1\,(r_f)_t + \Phi_1\eta_t + \\ & \gamma_3\Phi_1\,(r_d)_{i,t} + \gamma_4\Phi_1\,(c_2)_{i,t} - \gamma_5\,\Phi_1\,(c_2^2)_{i,t} + \gamma_6\Phi_1\,(s^2_{u_1})_{i,t} + \gamma_7\,\Phi_1\,X_{i,t} + \tilde{w}_{i,t}\end{aligned} \tag{21}$$

(if bank i belongs to the market model)

$$\begin{aligned}(K/A)_{i,t}\,(R) = {} & -\Phi_2\,\alpha_1 + (1-\Phi_2)\,(K/A)_{i,t-1} + \Phi_2\,R_{i,t} + \Phi_2\,\alpha_2\,(J/\delta)_{i,t} - \Phi_2\,\alpha_3\,(J/\delta)^2_{i,t} + \\ & \Phi_2\,\alpha_4\,(\sigma_\varepsilon)_{i,t} - \Phi_2\,\alpha_5\,(\sigma_\varepsilon^2)_{i,t} + \Phi_2\,\alpha_6\,(\sigma_\varepsilon^3)_{i,t} + \tilde{e}_{i,t}\end{aligned} \tag{22}$$

(if bank i belongs to the regulatory model)

where γ_7 is a vector of parameters and $X_{i,t}$ a vector of variables, η_i and η_t represent individual and time effects respectively.

Individual effects allow the control of some non-observable specific characteristics of each bank. These are assumed to be constant over the time but variable across individuals. Time effects allow to control for macroeconomic variables such as the evolution of interest rates, output, employment and changes in banking legal rules (apart from capital regulation). As variable r_f is constant across firms but not over time, it will be included into time effects. On the other hand, variable b is also constant over time and so it will be part of the constant term. We allow regulation

[16] The origin of this methodology can be found in the seminal paper of Peltzman (1970). This has been used in almost all of the research on effectiveness of banking capital regulation.

($R_{i,t}$) to show both cross-section and time series variability. The value of $R_{i,t}$ is approximated by the maximum between two minimum capital ratios imposed in the Spanish Capital Adequacy Regulation Act of 1985: the global or generic ratio and the selective or risk asset ratio. The former is defined as the minimum percentage (4% until 1987, 5% after) of capital on total assets. The second is calculated by first obtaining for each savings bank the necessary minimum capital to cover the selective ratio (numerator) and afterwards dividing this quantity by total assets (denominator). This last requirement is specific for each savings bank because the numerator is the regulatory minimum capital ratio times the different categories of assets or off- balance sheet exposures weighted according to their relative risk. The value of R presented in estimations will be the maximum between the generic ratio R_t (constant across individuals) and selective ratio $R_{i,t}$ (variable across individuals and over time). It is obvious that the risk strategy of the savings bank is present in the definition of $R_{i,t}$, which can change capital requirements by modifying its risky assets portfolio[17].

Vector $X_{i,t}$ includes some other variables used in previous research on effectiveness of capital adequacy regulation[18]. This allows us to reflect more accurately the Spanish reality and to relax some of the assumptions of the theoretical models, such as constant assets level and one-period economy. These variables are: bank size TE (proxied by natural log of total assets), expected rate of return on assets ER (proxied by its current rate), the ratio of loans over assets CR, provisions for loans default to total loans ratio PC, liquidity risk AC (proxied by the ratio of cash accounts over total assets) and, finally, tax rate PF (proxied by the ratio of taxes over incomes lagged one period).

Bank size is present in the market model in the parameter c_2 of the operations costs function[19]. Furthermore, it may have a negative impact on capital levels due the fact that a larger size can guarantee greater possibilities of diversification and of access to capital markets or because the "too big to fail" policy guarantees the bail out of large banks that run into trouble[20]. With respect to ER, the larger this variable is, the smaller the capital necessary to safeguard these banks from insolvency crises[21]. CR and PC are both publicly available measures of loan portfolio quality. The credit risk level is positively correlated with the bankruptcy probability so the effect of both variables

---

[17] On the other hand, Wall and Peterson (1987, 1995) and Carbo (1993) include in their estimations only the generic or global ratio.

[18] See Peltzman (1970), Mingo (1975), Heggestad and Mingo (1975), Dietrich and James (1983), Marcus (1983), Dahl and Shrieves (1990), Shrieves and Dahl (1992), Carbo (1993) and Wall and Peterson (1987,1995).

[19] Remember $c_2=c_1$ A

[20] See footnote number 9.

on the capital ratio should be positive. Nevertheless, if we interpret the provisions as a positive indicator of the capacity of banks to generate incomes the sign of PC will be ambiguous. AC reflects liquidity risk. Non-liquidity, rather than the lack of capital per se, is a primary cause of banking crises, so we could say that a high liquidity level could reduce the need for capital. Finally, (PF) is a proxy for fiscal shield. By allowing interests on debt to be tax-deductible this fiscal shield provides an incentive for firms to substitute debt for equity in their financial structure. The expected sign of this variable is negative.

Other variables of equations (21) and (22) are proxied as follow: $s^2_{u_1}$ by the variance of return on assets in the previous five years, (r_d) by average financial costs, (c_2) by the ratio of operations costs over assets, (J/δ) by the natural log of total deposits, indicating that sanctions and penalties to enforce capital rule affect to a greater extent to big savings banks[22] and (σ_ε^2) by the variance of observed capital ratio in the previous five years. The use of different proxies for $s^2_{u_1}$ and σ_ε^2 is based on the fact that we have assumed randomness in the market model to be associated to earnings uncertainty and in the regulatory model to the quotient of capital ratio.

Traditional estimation techniques rely on single equation regressions (ordinary least squares, linear dynamic panel data). These methodologies assume implicitly that only one model describes all banking organisations' capital decisions, not allowing for regulation to be binding on some banks while market determines decisions of others. Disequilibrium estimation overcomes this problem since it allows each observation to come from one of the two regimes (regulatory and market model) without a priori classification. Moreover, the probability that an observation came from the first (or second) regime may be estimated[23]. This disequilibrium framework implies that we can only observe the dependent variable (K/A) which is the greater (maximum) value of both values obtained from each regime. This model's latent structure includes equations (21) and (22) while the observation mechanism is:

$$(K/A)_{i,t} = \max[(K/A)_{i,t}(m), (K/A)_{i,t}(R)] \tag{23}$$

[21] As Myers (1984) suggests: "capital instruments issues are more costly than funds raised internally".
[22] The bigger a saving bank is, the larger the systemic crisis in the banking system, if this savings bank were go to bankruptcy.
[23] See Maddala and Nelson (1974), Maddala (1983) and Wall and Peterson (1987) for a more detailed explanation of this methodology.

Thus, $(K/A)_{i,t}(m)$ and $(K/A)_{i,t}(R)$ are unobservable since we can only observe $(K/A)_{i,t}$. The crucial fact for this uncertainty is the existence of the above noted capital cushion since, otherwise, we would be able to identify all observations above the regulation as coming from the market model.

3.2 Results

Table (1) shows the results of the disequilibrium estimation. Equations are estimated in a time series and cross section framework (unbalanced panel data). Seventy-six Spanish savings banks were selected from 1985 through 1991 (annual data)[24]. The observable dependent variable is the capital to real and financial investments (net of provisions and depreciation) ratio. It is calculated in book terms to correspond to regulatory measures. Bank capital is defined as the sum of foundation funds plus accumulated reserves plus social work funds plus subordinated debt (until the permitted level maximum) plus current reserves obtained from retained earnings minus past and current losses. The dependent variable and the proxy for regulatory guidelines are calculated using exactly the same accounts of balance sheets. Not only is the denominator of the capital ratio in both variables total assets but also the definition of capital is the same. However, they differ because observed and required capital cannot be the same. In this way, the model can fully capture savings banks' capital adjustment towards their capital requirements.

(TABLE 1)

Coefficients indicating the rate of adjustment to desired capital levels (Φ_1 and Φ_2) are found to be significantly positive and below unity (stationary conditions) in both models. Furthermore, this speed of adjustment is higher in the market regime (Φ_1 around 0.8) in comparison to the regulatory regime (Φ_2 almost 0.3). This result can be explained by the fact that Spanish regulation allowed for a transitory period of adjustment to the regulatory minimum: savings banks were not forced to adjust their capital ratio immediately.

In the market model several variables are significant and present the expected signs. This is the case of operations costs (c_2), in its linear and quadratic form, loans to assets ratio (CR), liquidity

[24] The time period finishes in 1991 because of: i) available accounting information (balance -sheets and profit and loss accounts) changed presentation in 1992 and ii) a new capital adequacy regulation, that excludes the generic ratio, was introduced in 1993.

risk (AC) and bank size (TE). Provisions for loan default (PC) are significantly positive, a result coherent with the interpretation of provisions as a sign of bad management.

Coefficients of variance of return on assets ($s_{u_1}^2$) and financial costs (r_d) are significantly negative, contrary to expectations, while the lagged tax rate (PF) is negative but not statistically significant. The fact that the financial costs variable can be endogenous together with the possibility that (r_d) and (PF) can provide the same information (interests on debt are tax-deductibles) may help to explain this result. The expected rate of return on assets is significantly positive, contrary to expectations. This can be explained by the simultaneity between the proxy for (ER), current returns on assets and the dependent variable.

Time dummies are significantly positive and increasing over time. This result reflects the augmentation of capital demands during those years due to the increasing competition in the Spanish banking system what required of those organizations a greater solvency in order to prevent bankruptcies. The greater integration of international financial markets together with an important process of deregulation in those markets may have led to this result. As far as the regulatory model is concerned, coefficients generally present the expected signs. Furthermore, the regulatory equation meets the restriction predicted by the heoretical model: it cannot be rejected that the sum of the coefficient of variable $R_{i,t}$ and the coefficient of the lagged dependent variable is one.

All these results allow us to calculate the optimal capital ratio (market model) and the capital cushion (regulatory model).

$$(K/A)^*_{i,t}(m)=0{,}612 - 0{,}25\,(r_d)_{i,t} + 2{,}49\,(c_2)_{i,t} - 30{,}25\,(c_2^2)_{i,t} - 26071\,(s_{u_1}^2)_{i,t} - 0{,}05\,TE_{i,t}$$
$$- 0{,}0005\,(TE^2)_{i,t} + 0{,}013\,CR_{i,t} + 2{,}228\,ER_{i,t} + 0{,}08\,PC_{i,t} - 0{,}026\,AC_{i,t} - 0{,}0082\,PF_{i,t-1} + \eta_i + \eta_t$$

$$\hat{H}_{i,t} = -0{,}52 + 0{,}075\,(J/\delta)_{i,t} - 0{,}003\,[(J/\delta)^2]_{i,t} + 6831\,(\sigma_\varepsilon)_{i,t} - 60951\,(\sigma_\varepsilon^2)_{i,t} - 304640\,(\sigma_\varepsilon^3)_{i,t}$$

The average probability of belonging to each regime, market model and regulatory regime is 0.6 and 0.4 respectively. This classification scheme provides evidence of the dominance of the market model in our analysis. Nevertheless, the probability of belonging to the regulatory model is quite high, so we can deduce regulation had an important effect on the Spanish savings banks' behaviour. Table (2) shows the estimated probability of belonging to the market model according to level of observed capital ratio. As a proof of the model estimation adequacy, figures show that the probability for one observation to come from the market model is higher, the higher the observed capital ratio. This empirical result acts as a test to validate our theoretical model.

Although our conclusion that capital adequacy regulation could be effective for Spanish savings banks coincide with that of Carbo (1993) and Wall and Peterson (1987) there are very substantial differences among the three works. Carbo does not propose a theoretical model in his analysis of the effectiveness of capital regulation in the case of Spanish banks (private and savings banks). Moreover, the estimation technique used in his work does not allow us to distinguish exactly what percentage of capital ratio exceeds requirements as a consequence of market pressure or capital guidelines. On the other hand, he computes as regulatory guidelines only the generic ratio, so our results are not exactly comparable with those obtained in his work. With respect to Wall and Peterson, both authors suggest a very interesting empirical model that include as determinants those proposed in the literature to explain the evolution of the capital ratio. However, there is no theoretical proposal regarding this. Furthermore, while they analyze this problem in the case of big organizations (BCHs), which are more likely to be subject to market discipline, and using cross -section data, we study smaller institutions using a panel data. As in Carbo, they compute as regulatory requirements the generic ratio. Finally, our market model adjusts better to the data than the Wall and Peterson model does.

4. Conclusions.

Above, we have developed and estimated two models explaining the behaviour of banks when they choose their capital to assets ratios. The first one – the market model- showed that there exists an optimal capital ratio which maximises the market value of firms. Such a ratio depends on a set of variables (i.e. bank size, operations and financial costs, expectancy and variance of return on assets and credit and liquidity risks). However, banks with an optimal market ratio below a legal regulation cannot establish this optimal ratio. The second –the regulatory model- explains this behaviour. The optimal financial decision for these companies consists in setting a capital ratio that is the sum of the regulatory minimum plus a capital cushion. The aim of this cushion is to reduce the probability that a shock reduces the capital ratio to the extent that it drives it below the regulatory one. The amount of this cushion depends on sanction costs and on the current capital ratio volatility.

Both models are estimated using an unbalanced panel data of Spanish savings banks from 1985 to 1991. Since we cannot a priori distinguish banks following a market behaviour (those whose optimal capital ratio is above the regulatory minimum) from those following a regulation rule (those whose optimal capital ratio is below the minimum) a disequilibrium technique is used to estimate both equations. This method allows us to estimate jointly both models without a priori information about which regime the observations belongs to, but knowing that what can only be observed is the maximum value of the two.

The proposed partial adjustment model is validated by empirical results in both models. A higher adjustment speed to the desired capital ratio is observed in the market model than in the regulatory one. The determinants of the optimal market capital ratio (the market model) and the regulatory desired capital ratio (the regulatory model) are generally significant and, as expected, they have signs accorded with those predicted in the theoretical model. On the other hand, data show that banks affected by regulation would set a capital cushion above the regulated minimum. It is worth mentioning that the calculated average probability of belonging to the market model (0.6) is higher than the one of belonging to the regulatory model (0.4). Finally, a study of the estimated probabilities of belonging to the market regime according to the observed capital ratio allows us to validate the theoretical model proposed since the probability of coming from the market model turns out to be higher for banks with a higher observed capital ratio.

We can conclude that the regulatory constraint is one of the most important factors of capital augmentations in Spanish saving banks but not the only one. The pressure of market forces pressure has also made a relevant contribution to this process.

GRAPH 1

CAPITAL CUSHION

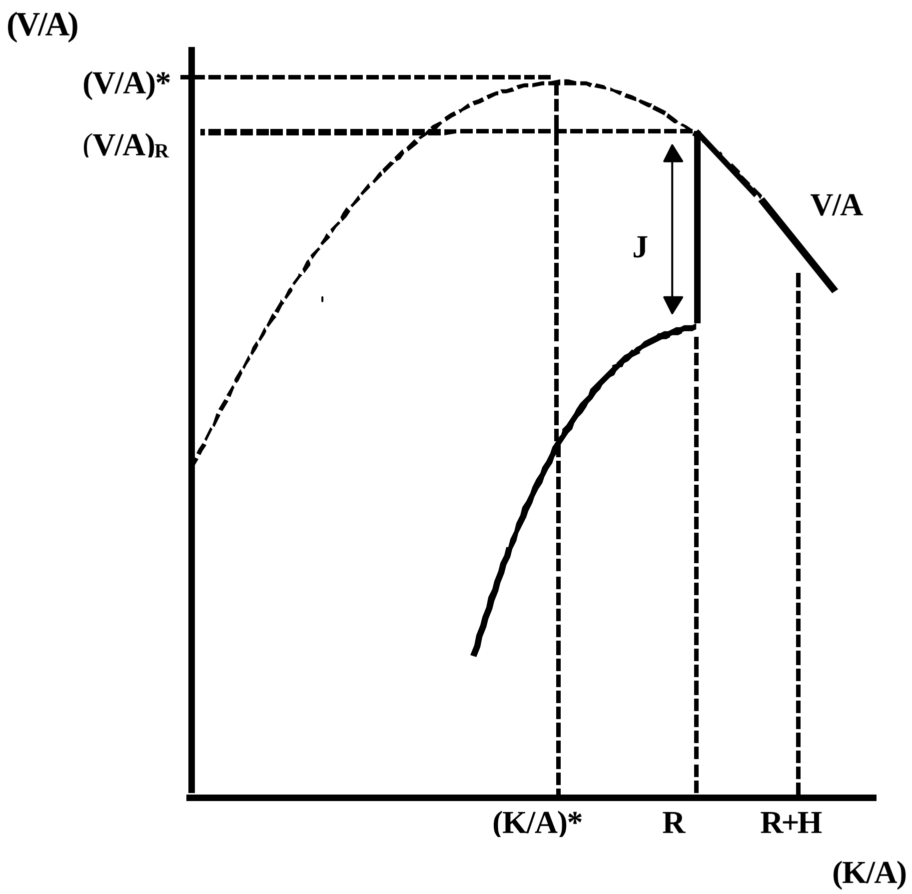

TABLE 1

DISEQUILIBRIUM MODEL ESTIMATION

MARKET MODEL (equation 21)	
Constant = $-F_1 g_0 + g_1 F_1 b$	0.4970(8.0)*
Lagged dependent variable $(K/A)_{t-1}$	0.1887(4.9)*
Financial costs (r_d)	–0.2016(–4.4)*
Operations costs (c_2)	2.020(3.2)*
Square of operations costs $(c_2)^2$	–24.534(–3.1)*
Variance of return on assets $S_{u_1}^2$	–21.144(–2.5)*
Log of total assets (TE)	–0.0418(–4.6)*
Square of the log of total assets $(TE)^2$	–0.0004(–1.0)
Total loans over assets (CR)	0.0103(1.9)**
Expected rate of return on assets (ER)	1.8069(14.6)*
Provisions for loans default (PC)	0.0661(2.6)*
Liquidity risk (AC)	–0.0210(–3.3)*
Lagged tax rate $(PF)_{t-1}$	–0.0067(–0.37)
Time dummies: Year 1987	0.008(11.9)*
Year 1988	0.014(10.1)*
Year 1989	0.025(12.8)*
Year 1990	0.032(14.9)*
Year 1991	0.038(14.3)*
REGULATORY MODEL (equation 22)	
Constant = $-F_2\ a_1$	–0.1394(–1.5)
Lagged dependent variable $(K/A)_{t-1}$	0.7332(14.9)*
Regulatory minimum capital ratio $(R_{i,t})$	0.5128(2.4)*
Log of total deposits (proxy for J/d)	0.0200(1.2)
Square of log total deposits [proxy for $(J/d)^2$**]**	–0.0009(–1.3)
Standard error of observed capital ratio (s_e)	1.824(1.7)**
Variance of observed capital ratio (s_e^2)	–16.274(–0.2)
Cube of standard error of observed capital ratio (σ_ε^3)	–813.39(–0.6)
s_u**: Estimated standard error of the market model**	0.002(15.0)*
s_e **: Estimated standard error of the regulatory model**	0.013(19.7)*
Pm: Average estimated probability of belonging to market regime.	0.60
Pr: Average estimated probability of belonging to regulatory regime	0.40
lnL: Log of likelihood function	1565
N: Number of observations	401

NOTAS: (a)Dependent variable is $(K/A)_t$. (b) The market model has been estimated with firms and time dummies.(c) t -student in parenthesis.(d) *=significant to 5%. **=significant to 10%.

TABLE 2

ESTIMATED PROBABILITIES OF BELONGING TO A MARKET MODEL ACCORDING TO OBSERVED CAPITAL RATIO LEVEL

	Average estimated probability of belonging to market model	**Number of observations**
0 £ Capital ratio < 0.04	0.456	23
0.04 £ Capital ratio < 0.05	0.589	56
0.05 £ Capital ratio < 0.06	0.591	124
0.06 £ Capital ratio < 0.07	0.595	90
0.07 £ Capital ratio < 0.09	0.637	75
0.09 £ Capital ratio	0.713	33

REFERENCES

Berger, A. N. (1995): "The Relationship between Capital and Earnings in Banking", *Journal of Money Credit and Banking,* 27 (2), 432-456.

Carbó, S (1993): "Bank Regulation and Capital Augmentations in Spain". Instituto Valenciano de Investigaciones Económicas. Working Paper- EC 6.

Dahl, D. and R.E. Shrieves (1990): "The Impact of Regulation on Bank Equity Infusions", *Journal of Banking and Finance*, 14 (6), 1209-1228.

Dietrich, J. K. and C. James (1983): "Regulation and the Determination of Bank Capital Changes: A Note", *The Journal of Finance,* 38 (5), 1651- 1658.

Furlong, F. and M. C. Keeley (1989): "Capital Regulation and Bank Risk Taking: A note" *Journal of Banking and Finance*, 13 (6), 883-891

Heggestad, A. and J.H. Mingo (1975): "Capital Management by Holding Company Banks", Journal of Business, 48 (4), 500-505

Jackson, P., C. Furfine, H. Groeneveld, D. Hancock, D. Jones, W. Perraudin, L. Radecki, M. Yoneyama (1999): "Capital Requirements and Bank Behaviour: The Impact of The Basle Accord", *Basle Commitee on Banking Supervision Working Papers*, 1, April.

Keeley, M.C. and F. T. Furlong (1991): "A Reexamination of Mean -Variance Analysis of Bank Capital Regulation", *Federal Reserve of San Francisco Economic review*, 0 (3), Summer, 40-48.

Kim. D. and A. M. Santomero (1988): "Risk in Banking and Capital Regulation", *The Journal of Finance*, Vol 43 (5), 1219-1233.

Koehn, M and A. M. Santomero (1980): "Regulation of Bank Capital and Portfolio Risk", *The Journal of Finance*, 35 (5), 1235-1243.

Lam, C. H. and A. H. Chen (1985): "Joint Effects of Interest Rate Deregulation and Capital Requirements on Optimal Bank Portfolio Adjustments", *The Journal of Finance*, 40 (2), 563-575.

Lackman,C.L. (1986): "The Impact of Capital Adequacy Constraints on Bank Portfolios". *Journal of Business Finance and Accounting,* 13 (4), 588-595.

Maddala, G. S. and Nelson. F. D. (1974): "Maximum Likelihood Methods for Models of Markets in Disequilibrium", *Econometrica*, 42 (6), 1013-1030.

Maddala, G. S (1983): *Limited- dependent and Qualitative Variables in Econometrics.* Cambridge University Press.

Marcus, A. J. (1983): "The Bank Capital Decision: A Time Series -Cross Section Analysis", *The Journal of Finance,* 38 (4), 1217-1231.

Mingo, J. H. (1975): Regulatory influence on Bank Capital Investment", Journal of Finance, 30 (4), 1111-1121.

Modigliani, F and M. H. Miller (1958): "The Cost of Capital, Corporation Finance and the Theory of Investment", *The American Economic Review*, 48 (3), 261-297.

Myers, S. C. "The Capital Structure Puzzle", *The Journal of Finance*, 39 (3), 575-591.

Peltzman, S. (1970): "Capital Investment in Commercial Banking and its Relationship to Portfolio Regulation", *The Journal of Political Economy*, 78 (1), 1-26.

Rochet, Jean Ch. (1992): "Capital Requirements and the Behaviour of Commercial Banks", *European Economic Review*, 36 (5), 1137-1170.

Santomero, A. M. and Watson. R. (1977): "Determining An Optimal Capital Standard for the Banking Industry", *The Journal of Finance*, 32 (4), pp. 1267-1282.

Shrieves, R. E. and D. Dahl (1992): "The Relationship between Risk and Capital in Commercial Banks", *Journal of banking and Finance,* 16 (2), 439-457.

Wall, L. D. and R.D Peterson (1987): "The Effect of Capital Adequacy Guidelines on Large Bank Holding Companies", *Journal of Banking and Finance,* 11(4), 581-600.

Wall, L. D. and Peterson D. R. (1995): "Bank Company Holding Capital Targets in the early 1990s: The Regulators versus the Markets", *Journal of Banking and Finance*, 19 (3-4), 563- 574.