Capital Requirements and Banks' Leniency

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ABSTRACT

We investigate the effect of changes in capital regulation on the strictness (leniency) of loan terms using a simple model of bank capital requirements and asset quality examinations. Banks offer different levels of "leniency" in the sense of willingness to offer automatic extensions of loans in the presence of temporary payment difficulties of borrowers. Banks offering lenient (less strict) loan terms must have higher initial levels of capital and charge higher loan rates. When capital requirements are increased, both strict and lenient banks hold higher levels of initial capital and they raise loan rates. As capital requirements increase the difference between initial capital levels and between interest rates of strict and lenient banks decrease. Thus, higher capital requirements in recessions tend to reduce the interest rate premium paid for leniency. If a recession is interpreted as an increase in the required return, the interest rate premium paid for leniency is increased in recession at a given level of required capital.

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Capital Requirements and Banks' Leniency

1. Introduction

This paper focuses on the effect of bank capital regulation and its enforcement on the supply of credit with more or less *strictness* in bank enforcement of loan repayment terms. A strict bank lends for one period and enforces the loan contract at the end of the period. *Lenient* banks may extend the loan period for projects in need of liquidity in the sense that the projects' cash flows at the end of the first loan period are insufficient to repay the loan although the project remains economically solvent. Leniency is affected by three aspects of the capital regulation that currently are of great policy interest: the level of capital requirements; their enforcement through asset quality examinations; and the classification policy for loans as non-performing. The three regulatory initiatives are mutually connected, since when loans are "classified" as non-performing by regulators, the book value of the bank's assets and, hence, measured capital are reduced. The bank may have to add to its loan loss reserves when asset values fall when the bank's assets are examined. We analyze how these aspects of capital regulation affect the supply of strict and lenient lending and focus on the effects of capital regulation by keeping the information structure very simple and exogenous: effort and monitoring are exogenous. Nevertheless, the three aspects of capital regulation jointly affect banks' incentives to offer strict one period contracts relative to more lenient contracts.

The model we develop stylizes the examination process for capital requirements by assuming that assets are examined one period after loan and capital decisions are made by bank managers. This assumption captures the time lag between loan decisions and examinations. At the time of examination the bank has obtained additional information about its loan projects. Borrowers have either succeeded or failed to repay. In the latter case, all projects are liquidated if the bank is strict, or loans are renewed if the bank is lenient and if the projects are expected to succeed after another period. In both cases capital is measured to reflect banks realized and unrealized losses on loans. Banks realize their loan losses by liquidating projects and reducing assets by the loss on project liquidation. Renewal of loans for one more period may take place when projects' second period expected returns are such that the loan has a higher value than its liquidation value, and if banks have sufficient measured capital taking into account unrealized losses.

At the time loans are made a bank's actual capital can differ from required capital without penalty, but at the time of examination the bank must have the regulatory minimum capital to continue in operation. In practice, of course, most banks have capital such that minor unexpected variations in earnings and/or loan quality can be absorbed, and examinations cannot be timed precisely as is assumed here. Nevertheless, the fact that examinations cannot take place continuously implies that banks can keep less capital than formally required at the time loans are made. The model makes clear how minimum capital requirements and loan quality examinations affect bank loan pricing and the willingness of some banks to work out loans by continuing rather than liquidating projects.

Thakor and Wilson (1995) examine bank capital requirements within a multi-period model of projects that succeed or fail after one period. If projects fail, they may pay off after one more period, similar to the projects in this paper. However, in Thakor and Wilson successful first-period projects become risk-free in periods two and three, while successful projects in our model are terminated (loans are paid off and new-one period loans are extended). They are analyzing project managers' multi-period financing choices and include competitive sources of funds from banks and capital markets, where we focus on bank loans with two possible loan terms (strict and lenient) that must provide the same return for the banks although they require different levels of initial capital.

Multi-period lending makes signaling of heterogeneous types of borrowers possible. In Stiglitz and Weiss (1983) credit rationing is affected by multi-period contracting. Such contracting can mitigate adverse selection problems as discussed in detail in Webb (1991). Moral hazard aspects are explored in Boot and Thakor (1994), who consider multiperiod contracts with endogenous effort. Although we do not focus explicitly on the mitigation of asymmetric information problems, multiperiod contracting in our model extends the supply of credit to a group of borrowers who could be cut off from credit as a result of capital regulation.

Deposit insurance or other bank liability guarantees require bank examination and limitations on investment authorities and capital standards to control the principal-agent problem inherent in shifting the risk of liabilities to the government or monetary authorities. Capital regulation has evolved over a tortuous history in the United States (see Vojta (1973) for a classic study of bank capital needs or Dietrich (1996) or Berger *et al* (1995) for surveys of capital regulation standards).

Global interest in capital regulation has intensified with capital and banking market integration in recent decades. The Cooke Committee working with the Bank for International Settlements (BIS) in 1988 worked out the so called Basel capital standards that have been adopted by most developed economies as a standard. The Basel approach is to assess minimum capital requirements as a ratio of *risk-weighted* assets, where the risk weights are determined by perceived credit risk of different but broad classes of loans. A new round of negotiations for revised capital regulation is now being conducted through the BIS framework with the new capital standards, the so-called Basel II capital requirements, scheduled for implementation by Group of 10 and other countries by 2006[1]. It is expected that Basel II will allow some banks to use internal risk ratings as a basis for the risk weights for different assets. It is not clear how these regulatory changes will affect the enforcement mechanism though examinations of assets. We return to this issue in the concluding section.

Capital regulation is controversial and changes in capital regulation or the strictness of the enforcement of capital requirements are debated actively. For example, in 1981, the face of earnings problems and increasing interest rates , capital requirements for thrifts in the United States were *lowered* from 6 to 3 percent of assets. With the adoption of the Basel capital standards and stricter enforcement of standards, asset quality, and closure rules in the Financial Institutions Reform, Recovery and Enforcement Act (FIRREA) (1989) and the Federal Deposit Insurance Corporation Improvement Act (FDICIA) (1991), stricter capital standards were applied to all deposit-taking institutions and regulatory forbearance of capital standards sharply circumscribed.

Substantial controversy surrounds the economic benefits of these changes in capital requirements and the strictness of capital regulation over the business cycle. Easing standards during the recession in the United States in the early 1980's was advocated as a way to allow deposit-taking thrift institutions to survive a temporary crisis. Restricting standards later in the decade was viewed as a necessary change to avoid future crises. However, increasing capital standards in the early 1990's was blamed for a drying up of bank credit, causing a so-called "credit crunch" and possibly exacerbating the recession of 1990 to 1992 in the United States. On the other hand, observers of banks in Asia, mainly

[1] See Bank for International Settlements (BIS), 2003, for the planned revisions of the 1988 capital standards.

Japan and China, argue that lax asset quality review and loss provisioning have prolonged their economic recoveries or inhibited growth in the late 1990's. Although we discuss cyclical implications of capital requirements, the focus of this paper is on the loan rate implications of rigid capital enforcement and asset quality review.

The need for capital regulation suggests that banks attempt to minimize capital. Many banks, however, have capital well above minimum capital requirements. For example, Brinkman and Horvitz (1995) document that many banks had capital levels well above regulatory requirements in 1990 even before the higher requirements were implemented. In general, many smaller banks have capital that exceeds regulatory guidelines. The model in this paper help explain why banks may have differing loan market strategies such that some banks prefer more capital than others given minimum required capital levels.

The relation between capital standards and liquidity has not been examined extensively. It is important to define what is meant by liquidity in this context. For example, Kashyap *et al* (2002) define liquidity in terms of making cash available to borrowers or depositors when needed on demand through demand deposit withdrawals or takedowns on loan commitments. The demand for liquidity can also be interpreted as the need for cash to make contractual payments but where the inability to realize the full value of assets through sale in the short term makes covering the cash needs costly. If payment can be delayed with the expectation of higher asset values in the future because the counterparty is willing to wait, the counterparty provides liquidity by not requiring the costly liquidation of assets. In this sense greater leniency of banks towards borrowers with temporary payment difficulties can be thought of as an increase in the supply of liquidity. Dietrich (2003) develops a model of capital regulation and its relation to lending which is applied in this study to the effects of changes on capital requirements on the provision of leniency. We analyze the relation between the loan rates banks must charge for leniency in lending under capital regulation.

The model presented in the paper does not allow for an analysis of the macro-economic trade-offs in capital regulation. Some previous analyses have touched on these issues in terms of socially optimal amounts of banks capital (e.g. Koehn and Santomero (1980)), but have not considered the effect of capital on liquidity in the sense of leniency in loan policy as discussed here.

In Section 2 the market for loans is characterized with the purpose of analyzing the effect of minimum capital requirements on lending policy. In the model borrowers differ in their willingness to pay for leniency, defined in line with the previous discussion as a willingness of a bank to not call a loan when projects do not pay off as quickly as hoped. We introduce minimum capital requirements on assets net of loan losses. These requirements are not continuously enforced and the banks adjust initial capital accordingly when loans are made. In Section 3 we solve numerically for the initial capital of strict and lenient banks, and the cost of extending lenient loans at different levels of required capital.. The numerical solution provides the basis for a discussion of cyclical effects of capital requirements and counter-cyclical policy in Section 4. In the concluding Section 5 we return to potential implications of Basel II.

2. A Model of Bank Optimal Capital with Two Types of Borrowers

It is assumed that there are two types of borrowers and that banks cannot distinguish between them ex ante. Banks can offer two types of loan contacts: a one-period (strict) loan with non-recourse by the lender to the borrower's assets beyond the project, and a (lenient) loan that is renewable for solvent but illiquid borrowers at the end of period one. All borrowers use 100 percent bank financing to invest in projects that pay a R_1 percent return on the investment in one period with probability (1-q) and the payoffs from the project are pledged to the bank. Risk in the model consists of the assumption that a fraction q of projects do not pay off after one period. However, some of the failed first-period projects may have economically viable payoffs in the second period as discussed below. Projects unsuccessful after one period can be liquidated by the lender for (1 - w) percent of the amount financed by the bank.

Neither borrowers nor lenders can determine which projects will pay off in one period at the time loans are made. However, they know whether a project that cannot pay back after one period has a high or low probability of paying back after two periods. If projects that do not pay off in the first period are allowed to continue for a second period they pay off either R_{21} or R_{22} percent, where $R_{22} \geq R_{21}$, at the end of the second period of the investment. The probability of the high payoff for failed first-period projects in the second period is (1-p). The probabilities (q and p) as well as the possible returns R_1, w, R_{22}, and R_{21} in both periods are known when projects are initiated.

We want to derive the borrowers willingness to pay interest on strict one-period – and lenient renewable loans. Given the above, expected borrower-investor's return, $E(R^1{}_B)$, for one-period loans is given by:

$$E(R^1{}_B) = (1-q)(R_1 - r^1{}_L) \qquad (1)$$

where $r^1{}_L$ is the loan rate on non-renewable one period loans. Borrowers contracting for two-period loans with lenders who do not call loans after one period, allowing projects to go one more period, have an expected return as follows:

$$E(R^2{}_B) = (1-q)(R_1 - r^2{}_L) + q[(1-p)(R_{22} - 2r^2{}_L) + p(R_{21} - 2r^2{}_L)] \qquad (2)$$

where r^2_L denotes the 2-period interest rate on the loan and $E(R^2_B)$ is the expected 2-period return for the borrower. A third possibility would be that a renewable loan is offered at one rate for the first period, and a different rate is offered for the second period if needed. This possibility is not considered further because it is the total interest payments over the two periods that matter for the borrower, and we will see below that the renewable first period loan rate charged by the bank must be higher than the strict bank's one period rate. We assume in our examples below that p and R_{21} are such that two-period borrowers default on the loan with the lower payoff, and that the bank liquidates the project in period two receiving $1+R_{21}$. Thereby equation (2) is simplified by dropping the final term.

Depending on expected returns in the two periods and loan rates there are borrowers who will prefer lenient loan conditions:

$$E[R^2_B] > E[R^1_B] \text{ if } q(1-p)(R_{22} - 2r^2_L) > (1-q)(r^2_L - r^1_L) + qp2r^2_L \qquad (3)$$

Borrowers with expected returns in the good state in excess of the two-period (lenient) loan rate are willing to pay a premium for renewable loans. The loan market equilibrium will be characterized by borrowers willing to pay different loan rates if some banks can make economic returns by offering renewable loans at higher rates than one-period loans. Clearly, if there are banks that can earn a sufficient return on renewable loans by charging a premium, more projects will be financed than if only one period loans are supplied. As equation (3) shows, some borrowers will be willing to pay lenders a higher rate of interest on loans to guarantee that loans will not be called and liquidated after one period. With a high enough probability (1-p) and high enough payoffs R_{22} some investor-borrowers would be willing to pay a higher loan rate to assure the completion of the project if it should not pay off after one period. For example, if R_1 = 40 percent, R_{22} = 40 percent, assuming the outcome R_{21} has a 0 percent return to the borrower, with q = .1

and p = .5, a loan rate r_L of 8.89 percent from the strict lender provides the same expected return (28 percent) to the investor as a 10 percent rate from the lenient lender. The rate differential of 1.11% in the example is a leniency premium on a loan with the option to be renewed at the same terms after one period.

We are interested in the effect of capital requirements on the ability of lenders to carry borrowers whose projects have not paid off after one period for one more period. Bank lenders committed to financing projects for up to two periods will be holding non-performing loans after one period subject to mandatory write-downs or additions to reserves required by regulators. These write-downs or additions to reserves reduce regulatory capital

Bank capital regulation is assumed to require a minimum amount of capital as a ratio to total assets, k^*, at the time loan portfolio quality is reviewed by regulators. Between examinations, banks may be above or below the required capital level but banks plan to meet their minimum capital at the time of examination. Banks finance the loans they make at period t, L_t in part with an infinitely elastic supply of deposits, D_t, at a fixed interest cost of r_D, and beginning-of-period capital K_t such that:

$$L_t = D_t + K_t \quad and \quad K_t = k_t L_t \qquad (4)$$

Bank managers' lending and leverage decisions at the beginning of the period then are summarized for period t:

$$L_t = \frac{1}{k_t} K_t \qquad (5)$$

where k_t represents bank management's choice of leverage at the beginning of the first period and, while capital will satisfy regulatory requirements when the bank is reviewed, initial capital can be $k_t \geq\leq k^*$.

In the following discussion, we will identify with the superscript s capital and loans from lenders that are "strict" with respect to loan terms in that if the project does not pay off after one period, the lender calls the loan and liquidates the project. The superscript l indicates that the lender is "lenient" and carries the borrower for one more period at the loan's original interest rate, allowing the borrower to realize the second period investment return R_{21} or R_{22}.

Given the risk characteristics described above, q percent of loan customers have payment difficulties after one period. Loan examiners qualify these loans as problem loans. Lenders following the strict policy call the loans, reducing their banks' income by the following Provision for Loan Losses[2]:

$$PLL_t = qw\, L_t \tag{6}$$

Where w is the loss in asset value relative to the original investment when the project is liquidated. The strict loan strategy implies a change in equity capital for banks following that strategy for its entire portfolio of loans as follows:

$$\Delta K_t^s = (1-q)\, L_t\, r_L - qwL_t - D_t\, r_D \tag{7}$$

The rate of return on equity invested in period t for strict banks, ρ^s_t, can be expressed in terms of the above-defined variables

$$r_t^s = \frac{\Delta K_t^s}{K_t} = \frac{1}{k_t}(1-q) r_L - \frac{(1-k_t)}{k_t} r_D - qw\frac{1}{k_t} \tag{8}$$

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[2] See Walter (1991) for a discussion of the practice in the United States.

Given the above, the strict lender's end-of-period measured capital ratio, $k_{t+1}^{m,s}$, is given by:

$$k_{t+1}^{m,s} = \frac{K_t(1+r_t^s(k_t))}{K_t(1+r_t^s(k_t))+K_t\frac{(1-k_t)}{k_t}} \geq k^* \qquad (9)$$

where the second term in the denominator equals D_t and k^* is the required capital ratio. In equation (9), r_t^s is a function of the initial capital ratio k_t. Using (9), the following relation between the return maximizing initial capital (producing the minimum measured capital at the end of the period) and the minimum required capital can be derived:

$$k_t + k_t r_t^s(k_t) = k^* + k^* k_t r_t^s(k_t) \qquad (10)$$

where k^* is the regulatory minimum capital ratio from above. Using equations (8) and (10) and simplifying, we obtain the initial capital ratio producing maximum returns following the strict loan policy:

$$k_t^s = \frac{k^*-(1-k^*)((1-q)r_L-r_D-qw)}{1+(1-k^*)r_D} \leq k^* \qquad (11)$$

The beginning-of-period capital for the strict lender is shown in the second column of Table 1 for various levels or regulatory capital shown in the first column and for different interest rates in the three panels, given parameter values shown at the bottom of the table. The table also shows also the rate of return for the strict lender in the third column. For example, at a regulatory measured capital requirement of 5% and a loan rate of 11%, the strict bank begins the period with capital 4.69% of assets and earns 6.87% net of losses on that investment[3].

[3] Write-offs are assumed equal to actual losses in the example.

In these expressions the initial capital is derived under the assumption that bank examinations take place at the end of each loan period. This assumption is obviously not entirely realistic since banks extend loans more or less continuously between examinations. The assumption tends to exaggerate the average difference between the initial capital and the required capital at the time of examinations but it captures the ability of banks to plan their capital ratio based on regulators' policies with respect to examinations, which are costly and therefore infrequent.

Lenient banks are assumed not to call loans to borrowers whose projects do not pay off in period 1. Regulators require the lenient banks write off the entire amount of the loans on unsuccessful projects that appear to be non-performing by regulatory definitions. A fraction (1 - p) of these loans will be successful in the second period, and the remainder will be liquidated by the bank at the low return, R_{12} (= 0 here) at the end of the second period. In order to compare returns for strict and lenient banks we must make an assumption about the lenient banks' use of the funds obtained from projects that are successful after one period. It is assumed that the banks issue (strict) one-period loans for the second period at the one period interest rate. Alternatively we could solve for a steady state solution with overlapping lenient loans. [4]. In this model all bank assets are liquidated at the end of the second period, and two-period projects that are unsuccessful at the end of second period are liquidated at $1+R_{21}$ times the loan amount

The measured return on capital of lenient banks for the first period after accounting for write-downs required by regulators can be written:

$$r_t^l = \frac{\Delta K_t}{K_t} = \frac{1}{k_t}((1-q)r_L - (1-k_t)r_D - q) \tag{12}$$

[4] Dietrich (2003) provides steady state solutions in such a model using a variety of assumptions for

In this case the q term is only a *recognized* loss, not a realized loss. In analogy with strict banks we can express the measured end-of-period capital ratio for the lenient bank, $k_{t+1}^{m,l}$, using expression (9), but substituting superscripts l for superscripts s. Inserting (12) into the expression, the required beginning of period capital ratio for the lenient bank can be derived:

$$k_t^{\,l} = \frac{k^* - (1-k^*)((1-q)r_L^{\,2} - r_D - q)}{1+(1-k^*)r_D} \tag{13}$$

As can easily be seen by comparing the above to the beginning capital for strict banks in expression (10), the initial capital for lenient banks is larger than or equal to initial capital for strict banks, because the asset write-off for the non performing loan is smaller for the strict bank recovering a fraction w of the loan.. Thus,

$$k_t^l \geq k_t^s \tag{14}$$

meaning that lenient banks in the two period analysis always have higher capital ratios than strict banks.

The lenient strategy only makes sense for banks if this strategy earns the same or a higher return than a strict policy over the two periods[5]. The average two period return with the lenient policy is:

$$\bar{r}^{\,l} = \frac{1}{2}\left[\frac{r_t^{\,l}k_t + q}{k_t^{\,l}} + r_{t+1}^{\,l}\right], \tag{15}$$

reflecting the fact that unrealized losses do not determine the bank's real return. Under our simple assumptions, the second period return consists of net earnings on non-performing

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model parameters. The solution is more complicated than is useful in this discussion.

[5] The examples below do not compound interest to keep the analysis as simple as possible. Clearly compounding could be incorporated and would not change the results.

loans from the initial period plus the returns on new one period loans leveraged with the minimum regulatory capital and including only *realized* losses on loans:

$$\overline{r}^{l}_{t+1} = \frac{r_t^{1}k_t^{1} + q + q((1-p)2r_L^{2} + p(1+R_{12})) + (1-q)r^{1}_{L} - (1-k^{*})r_D - qw}{2k_t^{l}}, \quad (16)$$

where we have expressed the two-period return as a return on first period capital that is assumed to be tied up for both periods. The two-period return from a lenient loan policy will be higher than that from the strict policy whenever the returns from holding the loans one more period balance the costs of the write-offs from calling loans.

Finally, it can be noted that it is not necessary to assume that the lenient bank charges the same rate for the two periods. It could have charged a first period rate taking into account that some loans must be written off as non-performing, and a second period rate based on the elements of the second period return in expression (16). The first period interest rate would have to be higher than the strict bank's interest rate in this case as well. Thus, borrowers would self-select strict and lenient loans based on expected returns in the two periods as in the case we have analyzed.

3. Numerical solution for capital and the cost of leniency

The last two columns of Table 1 provide values for the lenient lender's beginning-of-period capital and its rate of return using the same assumptions as for the strict lender. In all cases below the deposit interest rate is 9%, the probability of non-performance of the projects in period 1 (q) is .1, the probability of the bad state in the second period for renewed loans (p) is .8, the return on the project in the bad state in the second period is negative 100%, and the loss in asset value at liquidation after one period is 10% (w = .1). As can be seen from the table, the lenient lender must always have higher capital than the strict lender for the loan. In fact, initial capital is higher than regulatory minimums in order to absorb loan loss provisions as required by examiners. For future reference we note that the difference in initial capital, as well as the differences in returns, decline as required capital increases.

As demonstrated in the previous sections, higher levels of required capital or stricter enforcement of capital requirements changes the returns to strict and lenient banks and changes the difference in loan rates necessary to induce banks to be lenient. Providers of leniency must be compensated to be willing to wait for a turnaround in temporarily distressed assets. In this section, we examine changes in the level of required capital on the cost of liquidity reflected in the differential between one-period and two-period renewable loans. In order to make meaningful comparisons between the two types of banks and to assure that there is a supply of both types of loans, we assume that both types of banks set initial capital and loan rates with the same objective in terms of required return on initial capital.

Table 2 shows the initial capital ratios for strict and lenient banks that produce returns on bank capital of 20%. As before, strict banks always have initial capital less than the required capital at the time of examinations, while lenient banks have more capital in order to absorb loan write-offs. At a required level of .05 (5 percent) of assets in capital at the time of bank examination, strict lenders have initial capital of .0412, while lenient lenders require .227. As capital standards are increased, initial capital levels increase. Figure 1 illustrates the effects of increasing required capital on initial capital needs for strict and lenient lenders earning a 20% return using the numbers in Table 2. For example, at required capital of .20 of assets, strict banks' initial capital has quadrupled as a percent of assets to .1701, while lenient banks' capital increases relatively less to .338 of assets. The increase in initial capital as a percent of assets is 13% for strict banks (i.e.

from .0412 to .1701), while capital needs for lenient lenders increase by 11 percent of assets.[6]

Table 2 shows also the loan rates required to produce the 20% return on invested capital. At a required capital of .05 of assets, strict lenders require 16.07% average loan rate while lenient lenders will need 17.71% to cover their loan losses and carry non-performing loans one more period. The difference of 1.64% or 164 basis points represents a “leniency” premium; a charge by lenders for their willingness to carry loans one more period in this model. Figure 2 illustrates the relation between the level of loan rates producing a return on capital of 20% and required capital. The figure illustrates how, as required capital increases, the spread between rates required by strict and lenient lenders narrows with higher capital requirements, becoming approximately equal at around 20% of assets.

The return of the strict bank is generated by the interest rate spread between the loan rate and the deposit rate more than compensating for the decline in the asset value in the first period on a fraction (1-q) of the loans. For the lenient bank to earn a return on capital the interest rate spread must more than compensate for a greater (total) loss on a small fraction (1-q)(1-p) of its loans.

The declining leniency premium as capital requirements increase is partly explained by the observation above that the differences in initial capital declines as required capital increases. In Table 2, the loan rate is endogenous. The lenient bank holds a much larger initial capital ratio even at a very low required capital ratio in order to be able to write down asset values 100 percent on non-performing loans in the first period.

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6 For near-zero levels of required capital the strict bank is unable to plan initial capital levels relative to the time of supervisory review, assuming that the capital ratio cannot be negative.

When required capital increases the impact on the initial capital of the strict bank is larger than the impact on the initial capital of the lenient bank. Therefore, the greater the required capital ratio the smaller is the required increase in the interest rate spread to earn the required return on an additional unit of capital.[7]

4. Cyclical Aspects of Capital Regulation

The evidence on the relation between the enforcement of more stringent capital standards, asset quality review, and economic activity and/or bank lending is not clear over the business cycle[8]. Nonetheless, many credit market observers are convinced that stricter enforcement of bank capital standards reduces the supply of credit and liquidity during economic slowdowns. Furthermore, bank regulators are likely to increase capital requirements or the stringency of capital enforcement, including required write-offs, in bad economic conditions when the demand for liquidity is increasing because fewer projects are successful in one period.

One way of interpreting "more stringent enforcement" is that the supervisors' examinations become more frequent. In the model above, it was assumed that there was a one period lag between the beginning of the loan period and the examination. Banks were assumed to be able to plan their capital policy with respect to the timing of supervisory reviews. Since strict banks are able to hold less than required capital initially, we expect these banks to be affected more strongly by more frequent examinations. Thus, the stringency would reduce the cost of leniency relative to strictness. Increasing capital requirements in recession times would also reduce the relative cost of leniency. On the other hand, this increase would put pressure on loan rates at the precise time borrowers

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[7] Disregarding near-zero levels of required capital

[8] See, for example, Berger and Udell (1994) for a review of the evidence and literature on the relation

most require forbearance or leniency. Borrowers assessing long-term prospects to be good, that is, that projects will pay off, may not be able to justify project completion at higher loan rates. Abandonment of projects because of increased loan rates could exacerbate recession forces at play in the economy, possible delaying recovery. In our model, increased capital requirements put upward pressure on interest rates for both strict and lenient loans but relatively more for strict loans. Thus, the cyclical effect of increasing capital requirements is ambiguous.

To evaluate the cyclicality of the mentioned policy measure, we have calculated the minimum return in the good state in period 2 (R^{MIN}_{22}) that induces a borrower to choose the lenient bank. Equation (3) is used to estimate R^{MIN}_{22} using the parametric values shown in Table 2. The column R^{MIN}_{22} shows that the minimum return in the good state is declining. The explanation for this result is that the difference between the one and the two period loan rates must be compensated for by this return in the second period. The probabilities of the good and bad states (see eq. (3)) determine the magnitude of the required good-state return in period 2. It can be noted that the same pattern for R^{MIN}_{22} would be obtained even if p, the probability of the bad state in period 2, is much lower than the .8 in Table 2. This high probability of the bad state explains the very high level of R_{22}^{MIN} at any level of required capital.

The implication of this analysis for cyclicality is that a reduction of the difference between the one and the two period interest rates (the strict and the lenient lending rates) in a recession has a counter cyclical effect even if the two rates increase. Thus, both increased frequency of supervisory reviews and increased capital requirements in recessions tend to have counter cyclical effects.

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between the new Basel capital standards and credit availability during the recession of 1990 to 1992.

We may interpret a recession as an increase in investors' required returns on capital to compensate for higher economic risks, including bank investors. Figure 3 illustrates the impact of changing the required return on bank capital from 20% to 25% on the levels of loan rates for strict and lenient lenders at different levels of required capital. The figure demonstrates that the effect on loan rates of changes in required returns is not as great for strict as for lenient lenders. With this interpretation of recession forces, the leniency premium increases during recessions. This increase in the premium would have a pro-cyclical effect for reasons discussed above. However, this pro-cyclical effect could be offset by the increased stringency of capital requirements, since such an increase would reduce the premium.

5. Conclusions

Banks subject to capital regulation and loan quality review must anticipate that some borrowers will experience difficulties in repaying loans in the short run. Banks wishing to accommodate borrowers who have good long-run prospects no matter what happens in the short run must invest more capital in order to absorb write-offs required by capital regulation. Because of their higher capital investments and loan losses, lenient lenders providing a kind of liquidity service must charge higher loan rates to earn the same returns as lenders not providing these services.

The numerical solution of the model demonstrated that strict and lenient banks' loan interest rates increase with higher capital requirements. In this sense, the cost of leniency increases with the required capital ratio. On the other hand, the premium on lenient loan rates relative to strict loan rates is reduced with the consequence that the required return in the second period of the lenient loan falls. For this reason, higher capital requirements, as well as more frequent loan reviews cause a shift of loan demand in favor of lenient banks.

It was also shown that if a recession is interpreted as an increase in the required return on capital, then the impact of the recession is to increase the loan rates, as well as the leniency premium at a time when leniency would reduce the impact of the recession. In this sense, capital requirements are pro-cyclical, but this pro-cyclicality weakens when capital requirements are increased.

Another controversy in bank capital regulation concerns the effects of different capital requirements on different types of loans. The results can also be interpreted in terms of differential capital requirements on different classes of assets. If some projects are likely to require more time to be completed but are classified as riskier for purposes of capital regulation and result in interim write-offs due to not being successful within a regulatory mandated time frame, the model demonstrates that these projects will have higher costs of funds. This opens the possibility that regulatory classification of asset risk could have implications for the types of assets banks finance that go beyond simply the one-period probability of success.

The revised capital requirements being discussed for implementation as part of the Basel II capital requirement revisions will increase the number of bank asset risk categories to account for differences in perceived credit risk for loans of different types. For example, loans to business may have asset risk weights between .5 and 1.5 of the loan amounts[9]. Furthermore, "sophisticated" banks will be able to use internal risk ratings to determine risk weights. The importance of different capital requirements for different types of loans could be a very significant factor determining the amounts and terms at which credit is available for different sectors of an economy. If, for example, the risk weighting on loans with high short term risk but lower long term risk would be reduced, the cost of providing leniency would also be reduced.

Basel II does not address the main source of the problem associated with providing leniency identified in this paper. That source is the required write down of asset values on loans that are non-performing in a period although they may have good prospects in the longer term. This problem is aggravated by the ability of banks to plan capital ratios with respect to the timing of examinations of the loan portfolios.

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[9] See BIS (2003) for a discussion of capital requirements for different types of loans.

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Table 1

Capital Requirements, Measured Capital, and Returns of Strict and Lenient Lenders At Three Loan Rates*

	k^*	k^s	r^s	k^l	r^l
r_L = 11%					
	0.05	0.0469	6.87%	0.1257	12.90%
	0.06	0.0562	7.22%	0.1342	12.30%
	0.07	0.0655	7.47%	0.1427	11.90%
	0.08	0.0747	7.66%	0.1512	11.50%
	0.09	0.0840	7.81%	0.1597	11.10%
	0.10	0.0933	7.93%	0.1683	10.70%
	0.11	0.1027	8.03%	0.1768	10.40%
	0.12	0.1120	8.11%	0.1854	10.20%
	0.13	0.1214	8.18%	0.1940	9.90%
	0.14	0.1307	8.24%	0.2026	9.70%
	0.15	0.1401	8.29%	0.2112	9.50%
	0.50	0.4789	8.79%	0.5220	6.50%
r_L = 14%					
	0.05	0.0233	120.55%	0.102	29.60%
	0.06	0.0328	88.30%	0.111	27.70%
	0.07	0.0423	70.49%	0.120	26.00%
	0.08	0.0518	59.20%	0.128	24.50%
	0.09	0.0613	51.40%	0.137	23.20%
	0.10	0.0709	45.69%	0.146	22.10%
	0.11	0.0804	41.33%	0.155	21.10%
	0.12	0.0900	37.89%	0.163	20.20%
	0.13	0.0996	35.11%	0.172	19.40%
	0.14	0.1092	32.81%	0.181	18.70%
	0.15	0.1188	30.88%	0.190	18.00%
	0.50	0.4660	14.58%	0.509	9.50%
r_L = 17%					
	0.05	0.0154	235.82%	0.094	37.10%
	0.06	0.0250	149.08%	0.103	34.30%
	0.07	0.0346	110.28%	0.112	32.00%
	0.08	0.0441	88.28%	0.121	30.00%
	0.09	0.0537	74.12%	0.129	28.20%
	0.10	0.0634	64.23%	0.138	26.70%
	0.11	0.0730	56.94%	0.147	25.40%
	0.12	0.0827	51.35%	0.156	24.20%
	0.13	0.0923	46.91%	0.165	23.10%
	0.14	0.1020	43.31%	0.174	22.20%
	0.15	0.1117	40.33%	0.183	21.30%
	0.50	0.4617	16.58%	0.505	10.60%

Parameter values: r_D = 9%, q = .1, w = .1, p = .8, R_{12} = -100%

Table 2
Capital Ratios and Loan Rates Yielding 20% Return

k^*	k^s	r^s_L	k^l	r^l_L	R^{MIN}_{22}
0.05	0.0412	16.07%	0.227	17.71%	250.9
0.06	0.0496	16.21%	0.235	17.74%	246.3
0.07	0.0580	16.36%	0.242	17.77%	241.2
0.08	0.0664	16.51%	0.249	17.80%	236.1
0.09	0.0749	16.65%	0.257	17.83%	231.4
0.10	0.0833	16.80%	0.264	17.86%	226.3
0.11	0.0919	16.95%	0.271	17.90%	221.8
0.12	0.1004	17.09%	0.279	17.93%	216.2
0.13	0.1090	17.24%	0.286	17.97%	212.6
0.14	0.1176	17.39%	0.294	18.00%	207.5
0.15	0.1263	17.53%	0.301	18.04%	203.4
0.16	0.1350	17.68%	0.308	18.07%	198.3
0.17	0.1437	17.83%	0.316	18.11%	193.7
0.18	0.1525	17.97%	0.323	18.15%	189.6
0.19	0.1613	18.12%	0.331	18.18%	184.5
0.20	0.1701	18.27%	0.338	18.22%	179.7

Parameter values: $r_D = 9\%$, $q = .1$, $w = .1$, $p = .8$, $R_{12} = -100$

The column R^{MIN}_{22} shows the minimum required return in the good state in period 2 for borrowers to prefer the lenient bank.

Figure 1

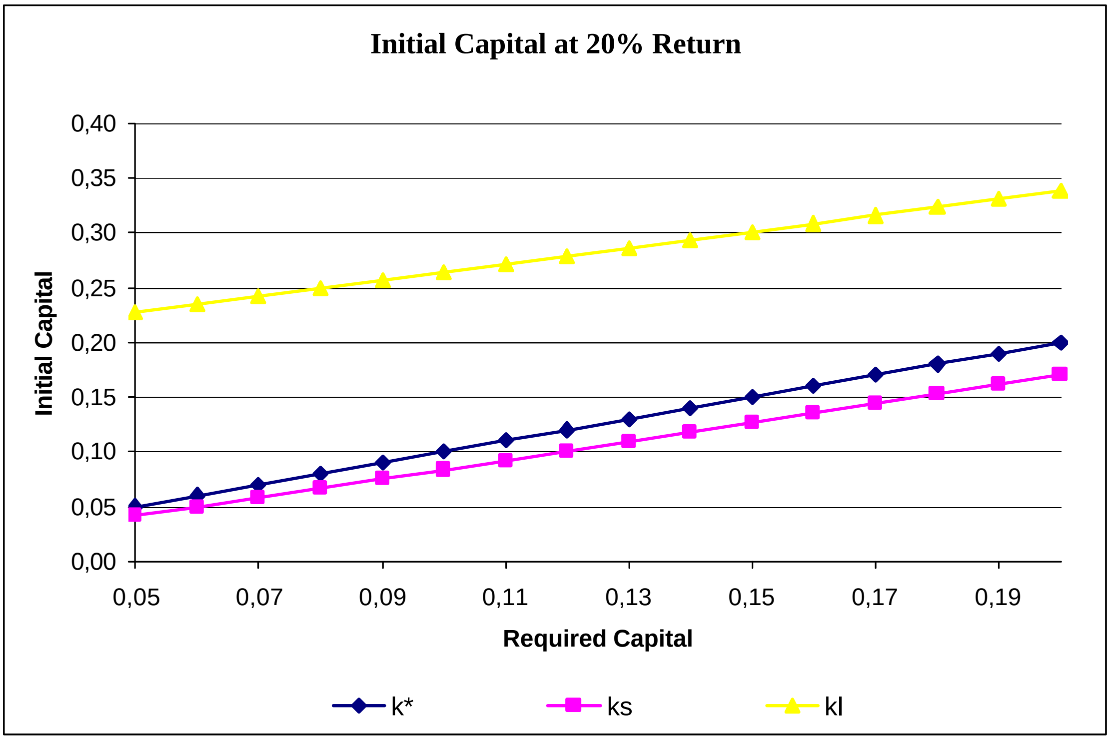
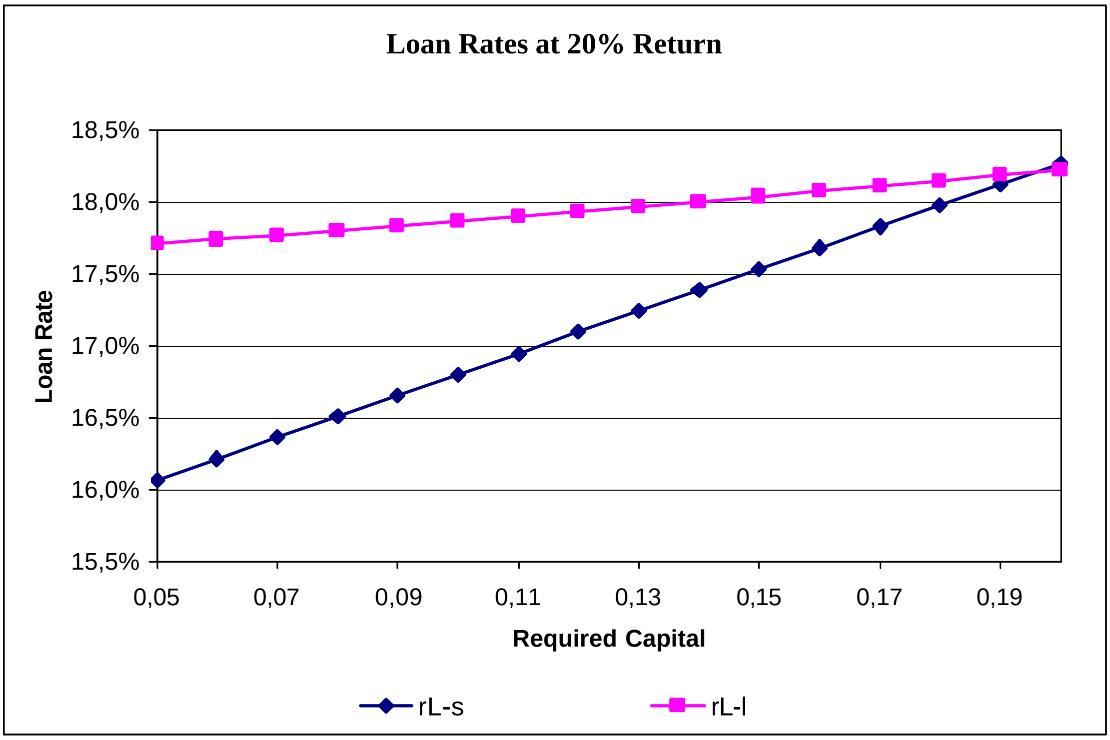
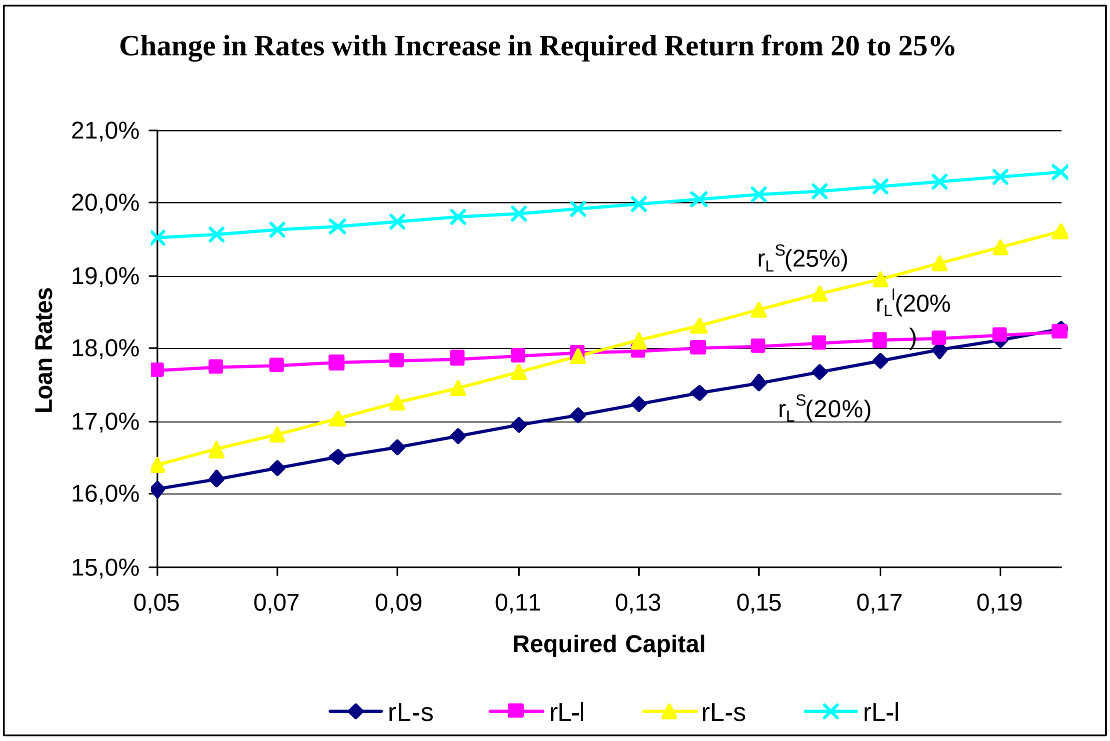

Initial Capital at 20% Return
Initial Capital
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
0,05
0,07
0,09
0,11
0,13
0,15
0,17
0,19
Required Capital
k*
ks
kl

Figure 2



Loan Rates at 20% Return
18,5%
18,0%
17,5%
17,0%
16,5%
16,0%
15,5%
Loan Rate
0,05
0,07
0,09
0,11
0,13
0,15
0,17
0,19
Required Capital
rL-s
rL-l

Figure 3


Change in Rates with Increase in Required Return from 20 to 25%
Loan Rates
21,0%
20,0%
19,0%
18,0%
17,0%
16,0%
15,0%
0,05
0,07
0,09
0,11
0,13
0,15
0,17
0,19
Required Capital
r_L^S(25%)
r_L^l(20%)
r_L^S(20%)
rL-s
rL-l
rL-s
rL-l