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RISK TAKING, LIMITED LIABILITY AND THE COMPETITION OF BANK REGULATORS

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ABSTRACT

Limited liability and asymmetric information between an investment bank and its lenders provide an incentive for a bank to undercapitalise and finance overly risky business projects. To counter this market failure, national governments have imposed solvency constraints on banks. However, these constraints may not survive in systems competition, as systems competition is likely to suffer from the same type of information asymmetry which induced the private market failure and which brought in the government in the first place (Selection Principle). As national solvency regulation creates a positive international policy externality on foreign lenders of domestic banks, there will be an undersupply of such regulation. This may explain why Asian banks were undercapitalised and took excessive risks before the banking crisis emerged.

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Banking Risks

Banking is not a safe business. Banks can have bad luck when they finance private investment and they can go bankrupt, inflicting a loss on savers who do not get their money back. To keep the risks under control, the banking business is heavily regulated in most countries, but not in all. Where the regulation is lax there tend to be problems. This paper provides a welfare analysis of banking regulation and studies the competitive forces affecting this type of regulation in systems competition.

The Asian banking crisis demonstrates clearly how important the risks resulting from loose banking regulation can be. The crisis began in Thailand. Foreign bank lenders went on strike when they witnessed that Thai banks were issuing excessively bad loans, and so the Thai bath depreciated strongly. In South Korea, Malaysia, Indonesia, Taiwan, Singapore and the Philippines the situation was no different, and the currencies of these countries soon followed similar paths, leaving a long trail of bankrupt banks behind. The Asian banking crisis propelled the Asian economies into a sharp recession in 1998, which had severe repercussions on economic growth in the rest of the world.

The Asian problems had been preceded by the S&L crisis in the United States and the Mexican crisis in the early 1990s. Both of these crises had a weaker impact on the world economy because they had been mitigated with generous loans by the US government and the IMF. However, they had paved the way for the Asian disaster by making financial investors aware of the risks they were facing.

While the various banking crises had many facets which cannot be discussed here, there seems to be a common element in that the banks were undercapitalised and had taken excessive risks in the capital market. For instance, in Korea the equity asset ratio fell from 9.5% in 1990 to 6.5% in 1996, the year before the crisis began, and in Mexico the ratio fell from 6.24 % in 1990 to 5.5% in 1994, the year of the crisis.[1] There are illustrative descriptions by Corsetti, Pesenti and Roubini (1998), Dekle and Kletzer (2001), Kane (2000) and Calomiris and Powell (2000), showing that in East Asia as well as

[1] OECD, Bank Profitability: Financial Statements of Banks, 2000.

Mexico, a substantial part of the problem had indeed been excessive risk-taking and the lack of domestic bank regulation. In Korea, Taiwan, Thailand, Malaysia and Singapore, banking regulation was fragmented between different regulatory agencies, and overall was too lenient or simply ignored in practice. In his Munich Lectures, Dornbusch (1998) argued that it was primarily the preceding liberalisation of bank regulation which had made the Asian crisis possible and led the world into a recession.[2]

Undercapitalisation not only makes a bank vulnerable in a crisis, it could even trigger off the crisis by inducing excessive risk taking when the bank enjoys the privilege of limited liability as all corporations do. When the equity base is low, limited liability effectively truncates the probability distributions of income among which a bank can choose and thus creates an artificial type of risk loving behaviour which was characterised (Sinn 1980, 1982) by the term "BLOOS rule", after the English proverb "You can't get blood out of a stone".[3] As will be clarified in a separate section below, this is basically the same as what was later called a gamble for resurrection or resuscitation.

Because of the Asian banking crisis, the issue of how sound banking behaviour could be assured has regained much attention in the public debate, including that between the IMF and the World Bank. Often this debate neglects the implications of the BLOOS rule, but the Basel I Accord of 1988 and the new Basel II Accord, which is currently being negotiated and is scheduled to be implemented in 2005, do reflect the concerns implied in this rule. Both accords define minimum equity requirements of banks, but Basel II allows for a fine tuning in that the banks are obliged to assess the risks of their borrowers and to allocate specific equity amounts to them in order to minimise the bankruptcy risk.

[2] The macroeconomic implications are not self-evident, though. Blum and Hellwig (1995) argued that banking regulation itself tends to bring about business cycle risks, because the solvency requirements imply particularly harsh credit constraints in a time of recession.

[3] "Sinn (1980)" refers to the German publication of the author's 1977 dissertation where the phenomenon had been called MAEHKMINN-Regel (Mehr als er hat kann man ihm nicht nehmen.) The term BLOOS rule was chosen in the translation that came out with North Holland in 1983, as cited in the references.

The Basel Accords can be seen as reactions to the failure of international systems competition in the context of banking regulation. If systems competition had functioned well, common minimum equity and risk assessment rules would not have been necessary. Instead, each country could have defined its rules unilaterally, and the international competition of such rules could then have shown which ones perform best. However, the various banking crises have created sufficiently serious doubts concerning the self-regulatory forces of international systems competition to warrant a closer scrutiny of the problem

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This paper studies the international competition of banking regulation in the context of a simple model of financial intermediation where investment banks collect funds from savers to lend them to risky enterprises. Systems competition has not been discussed in this context, to the best of the author's knowledge.

Lemon Bonds

A theoretical justification for the mistrust in systems competition can be found in the lemons problem. The potential lemon good that banks offer to their customers is bonds, the quality of these bonds being defined in terms of the probability at which banks do not go bankrupt and the amount of loan repayment they can ensure even if they do.

The bank's repayment or survival probability depends on the riskiness of the projects chosen, and the loan repayment in the case of bankruptcy depends on the equity the bank owns. The more risk the bank takes and the lower its equity capital, the lower is the quality of the bonds it issues.

If bond purchasers could observe the bank's investment decisions and make a judgement on the appropriateness of its equity base, they would punish any kind of opportunistic bank behaviour by requiring a sufficiently high rate of interest to compensate for the reduced quality of the bonds they buy or by not buying the bonds at all. The bank would therefore not be able to increase its expected profit by

deteriorating the bond quality. However, in the presence of asymmetric information, i.e. an imperfect visibility of an individual bank's risk choices, the bank may be able to get away with lowering the quality of the bonds by reducing the expected value of loan repayment without having to offer a higher rate of interest in return.

Such asymmetry in information is indeed realistic because banking is an extremely sophisticated and complicated enterprise, making it hard even for members of a bank supervisory board to keep sight of the risks their bank incurs.[4] The financial instruments that banks use for their business have become so sophisticated and so much business is happening outside the balance sheets that the assumption of well-informed savers would be heroic if not absurd. It is true that savers can observe the equity base of a bank and certain other characteristics, but in order to understand what they mean, they would have to be able to monitor the banks' off-balance sheet business and to become banking specialists. Even the close monitoring of a bank's history does not convey the necessary information because bankruptcy is not only a rare, but also a non-repeating event. The best the bank lenders can achieve is getting some idea of the average frequency of bank failures in general and of the amounts of funds normally repaid in such events.

The knowledge of the general market situation may prevent bank lenders from being systematically expropriated by the banks, because they will require, and be able to receive, a rate of interest sufficiently high to compensate for the possibility of non-performance. However, market knowledge does not provide the lenders with the information necessary to distinguish between good and bad banks and will therefore not be able to exclude opportunistic banking behaviour. Unregulated banks may get stuck in an inefficient equilibrium, where they all choose some degree of overly risky behaviour. A bank which decides to offer a safer product, i.e. a bond with a higher expected repayment value, may not be able to convey this information to its lenders and may therefore not be able to borrow at a lower

[4] The author is a member of the supervisory board of an international baking group.

rate of interest than its competitors can. Offering a safer bond would just increase its expected repayment and lower its expected profit.

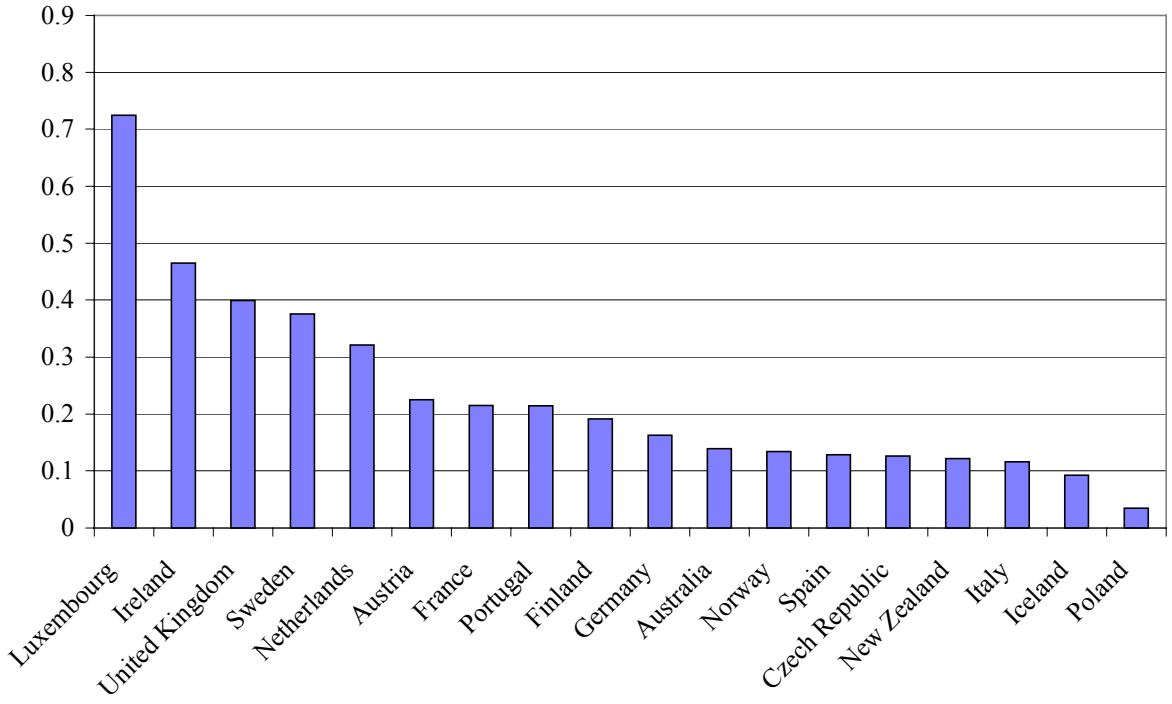
To help the bank lenders make better investment decisions, private rating agencies such as Moody's or Standard & Poor have developed systems that rank banks by the estimated safety of their business. However, as the S&L debacle and the Asian crisis have demonstrated, these agencies are far from perfect and unable to provide the market with timely ranking revisions in response to banks' actions. Only in retrospect did the investors become aware of the true riskiness of their engagements; the rating agencies had not been able to warn them in time. The crises showed that there was still substantial scope for opportunistic banking behaviour behind the public's back.

To protect bank lenders, often ordinary people who entrusted their lifetime savings to the banks, many governments have imposed solvency regulations on banks or insisted on tough self-regulation rules imposed by national banking associations. Some countries, such as Switzerland, Germany, and after the Asian crisis Japan, have imposed very strict regulations, such as minimum legal reserves and extensive creditor rights; others, like France, the United Kingdom or the United States, have placed more confidence in self-regulation.

While the national regulation decisions were normally designed in periods where the banks' lenders were predominantly nationals, globalisation has changed the situation substantially. International banking competition has become fierce, possible acquisitions by competitors have become a constant threat to banking managers, and cheap international refinancing has become the clue for banking success in all countries. Banks have internationalised faster than other institutions and firms, and in many countries the share of foreigners among their lenders has increased substantially over recent years. In

Germany, for example, this share doubled in the sixteen years from 1980 through 1996.[5] Figure 1 gives an overview of the situation prevailing among a selection of OECD countries in 1996.

Figure 1: *Share of Liabilities to Non-residents in 1996*



OECD (2000)Profitability: Financial Statements of Banks.

The increasing fraction of foreigners among the banks' lenders may change the national governments' attitudes towards banking regulation since part of the benefits from banking regulation spills over to foreigners while domestic banks may suffer from the constraints imposed upon them. This is the theme of this chapter, and we will see which theoretical basis can be laid.

[5] A clear upward trend was observable in 12 of 16 countries for which we had data. In the Scandinavian countries, Spain and Italy the trend was particularly pronounced. However, there were exceptions like Holland or France where the share remained constant during the period considered.

A Note on the Literature on Limited Liability and Risk Taking

Before undertaking the formal analysis, a note on the literature may be appropriate. While there seem to be virtually no studies on the competition of banking regulators, there is a literature showing that limited liability may imply excessive risk taking. As argued above, limited liability can result in excessive risk taking if the parties sustaining the potential losses are unable to negotiate for compensation before or while the risk-taking decision is made. In principle, there are at least three reasons why such negotiation may not be possible.

i) The party sustaining the losses has a binding contract with the firm, which is sufficiently incomplete to exclude the commitment to a cautious risk strategy. Thus the firm has no incentive to act cautiously even if the party sustaining the loss perfectly foresaw its actions at the time of signing the contract.

ii) The party sustaining the loss has no contractual relationship with the firm, and the potential loss is indivisible among a large number of disadvantaged people so that the public goods nature of the problem excludes private side payments along Coasian lines.

iii) The party sustaining the loss makes a contract with the firm when or before it chooses its risk strategy, but it is unable to monitor the firm's actions.

Jensen and Meckling (1976, pp. 130-33) studied an example with a sequential borrowing and investment decision of a firm which falls under category i).[6] Sinn (1980, 1982) investigated the artificial incentive for risk taking for the cases of Bernoullian and $\mu - \sigma$ preferences, using assumptions ii) and iii).[7] With regard to assumption ii) he referred to examples like nuclear power plants, chemical plants and automobile liability risks, and he applied assumption iii) to product liability risks in pharmaceutical products, air planes, cable cars, and the like. The BLOOS rule which was developed in this context, reappeared later under names like "gamble for resurrection" or "gamble for resuscitation". Authors like

[6] This is similar to Kydland and Prescott's (1977) theory of time consistency.
[7] See Sinn (1982, pp. 329-31).

Minsky (1991), Goodhard (1991, p. 15), Rochet (1992, pp. 1157-59), Dow (1996) and Gollier, Koehl and Rochet (1997) have made useful contributions along these lines.[8]

Jensen and Meckling's assumption i) has its merits when firms have taken long term loans and find themselves in an end-game situation. However, the repeated nature of the regular banking business and the fact that most securities issued by banks have a very short maturity reduces the practical relevance for this assumption in the banking context. When a bank's clients can perfectly monitor its actions, as the authors assume, and when there is no clear time structure with regard to the bank's risk choices and the continuous flow of newly issued bank securities, as is the case in reality, there is every reason to assume that the rate of return offered for these securities will fully reflect these choices and that the bank's investment decisions are undistorted. Thus assumption i) would not be a strong argument in favour of banking regulation and is hence not very well suited for a meaningful study of systems competition.

For the reasons explained, this paper studies the risk taking of banks under assumption iii), interpreting the lemon bond problem as a problem of product liability risks. The assumption that it is not possible to monitor the relevant actions sufficiently well to punish any kind of opportunistic behaviour by negotiating for better contract terms in exchange does indeed seem realistic in the banking context.

Banking with Unlimited Liability: The Basic Model

To investigate the information asymmetry between a bank and its lenders formally, a model of a market for bank intermediation is considered. For didactic purposes, the analysis begins with a simplified version of the model without limited liability. The discussion of this feature is delegated to the next section.

There is a capital market with three types of assets:

[8] Stiglitz and Weiss (1981) or Hellwig and Bester (1987), referred to related phenomena when they explained why banks can

i) Safe assets with a fixed rate of return $s - 1$ such as government saving bonds.

ii) Bonds issued by banks which promise, but will not necessarily pay, a rate of return $r - 1$.

iii) Business loans which pay a target rate of return $q - 1$ if the business is successful, which happens with probability p, $1 > p > 0$, but pay no return and incur the total loss of capital if the business fails.

In the model, s is exogenously given, but r and q will be explained endogenously.

Private households can directly invest in the first and second types of assets, but can channel their funds into the third type only indirectly, via the intermediation of private banks, because there are prohibitive transactions costs involved by lending directly. The model concentrates on investment banking, abstracting from deposit insurance.[9] There is a fixed number of competitive banks which face an inelastic demand for funds, F, by private firms. The target rate of return factor q can be chosen by the bank by controlling the type of business investment it wants to finance. There are options with high levels of q and low success probabilities p, and vice versa. In general we assume that the set of efficient return-probability tuples available to the bank can be described by a function $p(q)$, $p' < 0$. All agents are risk neutral and banks do not diversify their lending risks, specialising on lending to a selected client or clients whose risks are perfectly correlated. The risks among the clients of different banks are uncorrelated, but each of the identical competitive banks faces the same choice set of attainable probability distributions.

If the risks among the various types of business firms are uncorrelated, the lenders' risk neutrality can be justified with the assumption that they diversify their risks among the various bank bonds, and the banks' risk neutrality (with regard to the legal wealth distributions it faces) can be explained by their owners' perfect diversification among bank shares and other assets. The assumption that banks

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avoid the opportunistic behaviour of their clients by imposing credit constraints.

[9] The bonds introduced above can also be interpreted as interest bearing deposits. Note, however, that while deposit insurance is common among OECD countries, none has an insurance for bank bonds and other financial instruments that the banks use to collect their funds. Deposits and deposit insurance are essential ingredients of savings banks, but otherwise they are of limited importance.

specialise on just one firm or one class of perfectly correlated risks can, in turn, be justified by prohibitive information costs or the fact that the BLOOS rule is operative and induces a maximum of risk taking for any given value of expected legal profits.[10]

Consider first the case of unlimited liability where banks will always keep their promises. Here, bank bonds are safe assets and arbitrage in the capital market assures that they generate the same return as government bonds.

(1) $$s = r \, .$$

Consider a representative bank. The expected profit of the bank choosing a project with a target return of size q is

(2) $$\mathrm{E}\,\pi = \left(p(q)\,q - r\right)\cdot F \, .$$

The optimal risk strategy maximises the expected return from business lending. It is given by the return-probability tuple at which the marginal expected revenue from business lending is zero:

(3) $$p'(q)\,q + p(q) = 0 \, .$$

[10] Strictly speaking this assumption will only be justified within the model set up in the next section where the BLOOS rule is operative. The BLOOS rule implies that the indifference curves in $\mu - \sigma$ space are concave when the true degree of risk aversion is sufficiently small or the legal probability distributions of wealth extend far enough into the negative range (see Sinn 1980), which may be the case when the bank's investment in risky assets exceeds its equity capital. Concave indifference curves clearly imply that that the bank prefers not to diversify its risks.

Lemon Banking and the BLOOS Rule

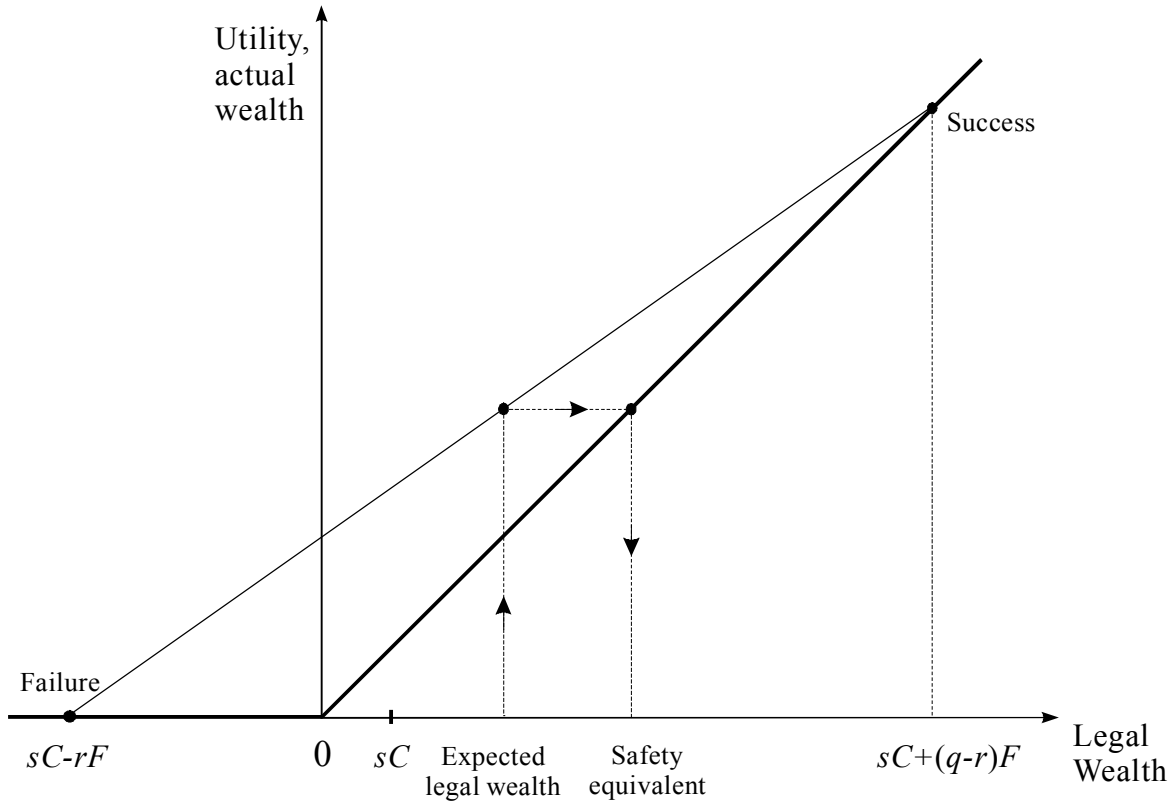
In the model set up thus far, bonds are not lemon goods because unlimited bank liability ensures that the lender gets exactly what the bank promises. However, unlimited liability is far from being realistic, given that no one can lose more than he has. You cannot get blood out of a stone (BLOOS rule). If the bank's equity capital is exhausted, bank lenders will not be able to collect the promised return and they may even lose part of the loan capital they provided.

Let C be the equity capital the bank owns at the beginning of the period and assume it invests this capital at the safe rate of return $s - 1$, using the proceeds from bond issues, F, for the business investment it finances. If the business project is successful, the bank will be able to service the bonds it issued and its value will be $s \cdot C + (q - r)F$. If, on the other hand, the business project fails, the value of the bank will be $sC - rF$ or 0, whichever is higher. This is what the BLOOS rule implies. Multiplying the possible states of bank value with their probabilities and subtracting the end-of-period value of the initial equity capital gives the following expression for the representative bank's expected profit:

$$\text{(4)} \qquad \mathrm{E}\pi = p(q)\left(sC + (q - r)\cdot F\right) + \left(1 - p(q)\right)\cdot \max\left(sC - rF,\ 0\right) - sC\,.$$

If the bank's equity capital exceeds its repayment obligation, $sC > rF$, this expression coincides with (2). The limited liability constraint is not binding and the same type of equilibrium emerges as was discussed above. If, on the other hand, the bank's equity is insufficient to satisfy its repayment obligation, $sC < rF$, the BLOOS rule becomes operative and creates an artificial risk preference which may change the bank's behaviour. This is the case on which the subsequent analysis will concentrate.

Figure 2: *Kinked Utility and the BLOOS Rule*



The nature of the artificial risk preference resulting from the BLOOS rule can be illustrated by means of the kinked utility curve as introduced in Sinn (1980, p. 165; 1982) and represented in Figure 2. The diagram refers to the alternative states of nature "success" and "failure". The abscissa shows the bank's "legal" end-of-period wealth if liability were unlimited, and the ordinate shows the actual end-of-period wealth given that it is, in fact, limited. Because of risk neutrality, actual wealth can be taken to be the bank's (or the bank owners') utility. Without business lending, legal and actual wealth would be sC. With business lending, legal wealth obtains two possible states: $s \cdot C + (q - r)F$ in the case of success and $sC - rF$ in the case of failure. Because of the BLOOS rule the utility curve is effectively horizontal for negative legal wealth levels. No matter how strongly negative legal wealth becomes, utility and

actual wealth cannot fall short of the level which is obtained in the case of zero legal wealth. Thus, even though $sC - rF$ is negative, actual wealth is zero in the case of failure.

Consider now the bank's expected utility and the safety equivalent of the legal wealth distribution. Expected utility is a linear combination of the utility levels obtained in the two states of nature, $s \cdot C + (q - r)F$ and zero, with the weights p and $1 - p$. As expected legal wealth is a linear combination of $s \cdot C + (q - r)F$ and $sC - rF$ with the same weights, expected utility can be constructed graphically by moving from expected legal wealth on the abscissa upwards to the cord between the two possible points on the utility curve. The safety equivalent is defined as that safe level of wealth which generates the same utility as the probability distribution under consideration. The safety equivalent can therefore be constructed by continuing the move from the cord horizontally to the utility curve and from there back to the abscissa, as is illustrated with the arrows. It is obvious from the diagram that the effective convexity of the utility curve following from the BLOOS rule implies risk loving behaviour in the sense that the safety equivalent of the bank's legal wealth distribution is above the bank's expected level of legal wealth, and the risk premium is negative. In its choice between safe and risky strategies, the bank is willing to sacrifice expected legal wealth in exchange for the possibility of taking more risks, because, given the rate of return promised to lenders, more risks will generate more expected actual wealth and hence more expected utility.

Of course, however, the rate of return promised to lenders may not be given but depend on the actions of the bank. Lenders will know from their general market observation that the repayment promise of banks cannot be taken for granted. Thus the promised rate of return on bank bonds will have to be sufficiently high to compensate for the reduced payment in the case of bankruptcy. Risk neutrality implies that a capital market equilibrium is characterised by the equality between the expected repayment of a bank bond and the repayment of a safe asset. As the repayment of a bank bond is equal to

the bank's promise in the case of success and equal to its equity capital in the case of failure, the equilibrium condition can be taken to be

(5) $$p(q)\cdot rF + \big(1 - p(q)\big)\cdot sC = sF \quad \text{for } rF \geq sC\,.$$

The important question is, whether and to what extent the constraint imposed by equation (5) will affect the behaviour of banks. The answer depends on which of two possible interpretations of this equation, a narrow one or a wide one, is correct. The narrow one is that equation (5) applies to an individual bank's actions and shows how the lender's required rate of interest reacts to the bank's policy choices. The wide interpretation is that equation (5) is only an equilibrium condition, determining the market rate of interest paid by banks without implying that the single bank can affect this rate through its own policy decisions.

If the narrow interpretation is true, the BLOOS rule will have no behavioural implications relative to the model set up in the previous section. Inserting equation (5) into (4) gives again equation (2) when account is taken of (1), and this is true even if the BLOOS rule is operative. As the bank is unable to manipulate the expected rate of interest paid to its lenders, this rate being equal to the one on safe assets, $s - 1$, it will still aim at maximising the expected return from business lending as is ensured by marginal condition (3).

However, for the reasons explained above, the extent of household information of the bank's actions may not go far enough to justify the narrow interpretation. If bank lenders are unable to monitor the individual bank's actions ex ante and are therefore unable to anticipate these actions with an appropriate interest demand, the bank's decision problem is no longer compatible with a maximisation of equation (2), because the bank does not have to alter the promised rate of return, $r - 1$, when it changes its risk policy, given that the other banks stick to whatever policies they choose. To understand

the bank's incentives in the case of constant *r* and the BLOOS rule being operative, rewrite equation (4) in the form

(6) $$\mathrm{E}\pi = \big(p(q)\cdot q - r\big)F + (rF - sC)\big(1 - p(q)\big) \quad \text{for } rF \geq sC$$

and compare with equation (2). The first item on the right-hand side again is the expected profit in the case of success provided that the bank services its bonds under all circumstances. However, the second item measures the advantage resulting from the fact that the bank does not fully service its bonds under all circumstances but only in the case of survival. In the case of bankruptcy the bank can avoid that part of the promised loan repayment which exceeds its equity capital, $rF - sC$, and this advantage contributes to the expected profit to the extent of the probability that it happens, $1 - p(q)$. There is a negative marginal externality imposed on the bank's lenders which may distort the bank's decisions.

The single bank will try to maximise (6) for a given *r*, notwithstanding the fact that *r* is determined by the equilibrium condition (5). The bank's choice variables are the target return in the case of success, *q*, including the corresponding success probability, *p*(*q*), and the amount of equity capital, *C*. Assuming that equity capital is constrained from below, $C \geq \varepsilon \geq 0$, the Lagrangean of the bank's decision problem can be written as

$$L = \big(p(q)\cdot q - r\big)F + (rF - sC)\big(1 - p(q)\big) + \lambda(C - \varepsilon) \quad \text{for } rF \geq sC,$$

where λ is the Kuhn-Tucker multiplier. The resulting optimality conditions are

(7) $$p'(q)qF + p(q)F - p'(q)(rF - sC) = 0 \quad \text{for } rF \geq sC,$$

(8) $$\lambda = s(1 - p(q))$$

and

(9) $$\lambda \cdot (C - \varepsilon) = 0 .$$

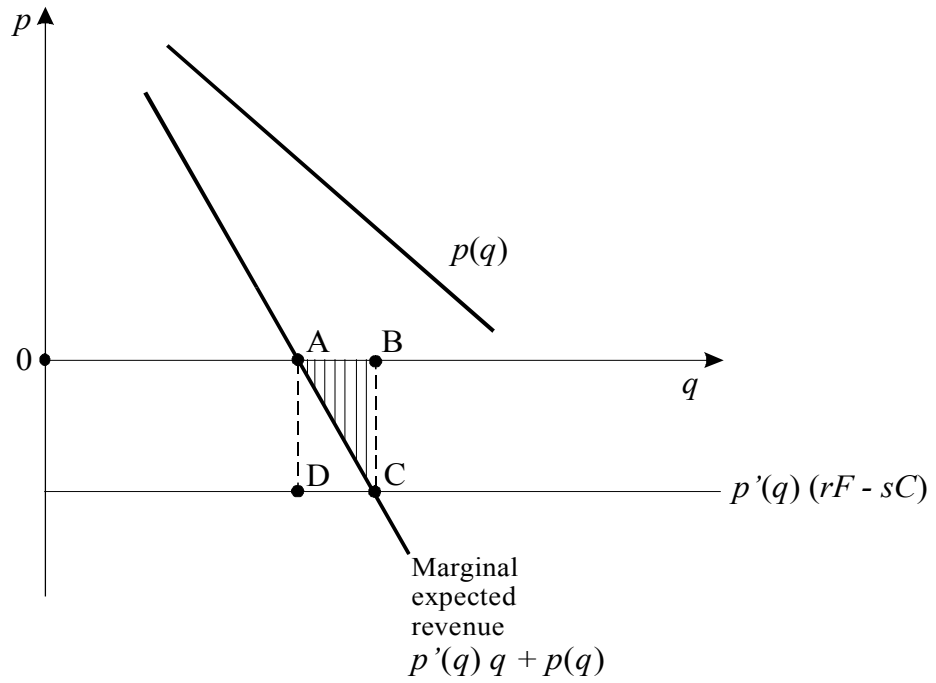
A comparison between optimality conditions (3) and (7) reveals that the bank's risk choices are indeed distorted. The first two items in (7) give the marginal expected revenue from seeking a higher rate of return. With unlimited liability they sum up to zero since the bank goes to the point where the increase in the target rate of return from business lending is outweighed by the corresponding reduction in the probability of success. With limited liability this policy is no longer optimal since increasing the target rate of return has the additional advantage that the state of nature where the lenders will have to satisfy themselves with the bank's equity capital, sC, rather than the promised repayment *rF*, becomes more probable, the marginal increase in the probability being measured by $-p'(q)$.

The bank's optimum now lies beyond the point of maximum expected revenue from business lending because there is a negative marginal externality it can impose on its lenders by reducing the probability of success. Given the expected return from business investment, a high target return which accrues with a low probability is better than a low target return with a high probability, because the expected loan repayment is lower. Thus, choosing a lower survival probability and a higher target return may be better for the bank even if this implies a somewhat lower expected return to business lending.

Figure 3 illustrates the distortion in the bank's decision problem. The upper of the two downward sloping curves is the graph of the function $p(q)$, i.e. the probability of successful business lending as a function of the target return factor, and the lower one shows the bank's marginal expected revenue from business lending. Formally, the relationship between the two curves is similar to that between a demand curve and a marginal revenue curve, but of course, this is nothing but a formal similarity. The point of maximum expected revenue is where the expected marginal revenue curve cuts the abscissa (A), but the

bank's optimum is where the expected marginal revenue is sufficiently negative to compensate for the advantage of being able to impose a negative marginal externality on its lenders. In the diagram this marginal externality is measured by the distance between the abscissa and the horizontal line below it. Thus the point of intersection between this line and the marginal expected revenue curve, C, is the firm's optimum in the case where the BLOOS rule is operative.

Figure 3: *The bank's optimal risk choice under the BLOOS rule*



While there is an interior optimum for the bank's risk choice, there is a corner solution for its equity capital. As equation (8) reveals that λ is positive, it follows from (9) that

(10) $$C = \varepsilon;$$

i.e. the bank will choose as little equity as possible for its operations. This is a straightforward implication of the BLOOS rule. The higher the equity capital, the higher is the payment to lenders in the case of failure, and the higher is the expected refinancing cost. Clearly, therefore, the bank prefers to operate with as little equity as possible and takes only the quantity which it must.

The result contradicts the Modigliani-Miller theorem according to which a firm's debt-equity choice is indeterminate.[11] However, that theorem was derived by abstracting from limited liability and asymmetric information. In the present context, equity capital is more expensive than debt capital for the banking firm since an increase of equity capital increases the payments to lenders in the case of bankruptcy which ignorant lenders will not honour with a lower interest requirement. From a practical perspective, the fact that equity capital is much more expensive than debt capital is obvious for any banking business. Bank managers are eager to spare equity capital whenever they can and to run their banks with as little equity as possible, certainly far less than necessary to be able to cover all the risks they incur.

The result of this section can be summarised as follows.

[11] Modigliani (1961 and 1982) and Miller (1977).

Proposition 1: *The combination of limited liability (BLOOS rule) and incomplete information of its lenders induces the banks to minimise their equity volumes and to choose riskier strategies of business lending than in the case of unlimited liability. Banks choose to offer their lenders lemon bonds which will not be serviced with certainty.*

Welfare Implications and Optimal Regulation

From a social perspective, the bank's risk taking is excessive. It is true that risk taking often is productive in the sense that it enables people to make use of the opportunities nature offers them. Risk consolidating devices such as insurance and stock markets can be seen as augmenting one of the economy's most important factors of production (Sinn 1986) and to have significant growth effects. However, in the present context, risk taking may be excessive because it is induced by an externality which the bank imposes on its lenders rather than a consolidating activity.

Assume that s measures the true social opportunity cost of bank lending, that q and 0 denote the true social returns from business lending in the cases of success and failure, and that the probability p is both the subjective and objective probability of success. Then welfare W is given by the difference between the expected social return of business lending and the alternative return which savers could have earned had they invested their funds in the capital market:

$$W = \left(p(q)\,q - s\right)\cdot F \quad . \tag{11}$$

The optimal amount of risk taking as measured by the target return and the optimal success probability follow from the first-order condition of a maximum of (11),

$$p'(q)\,q + p(q) = 0\,. \tag{12}$$

Obviously, it coincides with the bank's optimum in the case of unlimited liability, as defined by equation (3).

The social optimum is given by point A in Figure 3. The welfare loss from choosing point C instead of A is given by the shaded area ABC between the marginal expected revenue curve and the abscissa. The area shows by how much the expected revenue from business lending declines due to the banks' attempts to reduce the expected loan repayment to its lenders.

Interestingly enough the banks burn their own fingers with this policy, because it is they alone who bear the welfare loss resulting from their opportunistic behaviour. Because of (5), lenders will be able to receive a fair compensation for the bankruptcy risk in a market equilibrium. The welfare loss shows up exclusively in terms of a reduction of bank profits and hence a corresponding decline in the value of banking firms. Households suffer no loss although they buy the lemon bonds.

The irony of the result can be seen most clearly in Figure 3. Suppose for a moment, all banks choose point A. By moving from A to C, the single bank can increase its profit by an amount given by the area ACD, because it reduces its expected loan repayment to its lenders by an amount equal to the area ABCD which is more than the decline in the expected return from business lending, ABC. However, if all banks behave that way, different lending conditions will emerge where the banks' lenders will be able to fully avoid a disadvantage. If all banks operate at point C instead of A, they are unable to reduce the expected loan repayment, and hence their profits fall by the area ABC. This can be summarised as follows.

Proposition 2: *The risk-taking resulting from the BLOOS rule and asymmetric information is too large from a welfare perspective. The welfare loss will be borne by the banks alone and result in reduced banking profits.*

The remedy to cure the market failure is some sort of collective action which imposes constraints on the single bank's behaviour. This could be an agreement among the banks, or it could be banking laws that exclude misbehaviour. The national solutions differ in this regard. There is a multitude of constraints which the countries impose on their banks, but the imposition of bank solvency rules in the sense of setting minimum equity requirements seems to be common to all major countries.

The model set up above shows that this is indeed a useful approach. Let ε be the minimum amount of equity capital required by law. From equations (7) and (10) it follows that it is possible to reduce opportunistic behaviour by increasing this minimum. The higher ε, the lower is the marginal externality distorting the bank's behaviour, and the lower is the extent of risk-taking as represented by the size of the target return:

$$\frac{\mathrm{d}q}{\mathrm{d}\varepsilon} = \frac{-\,p'(q)\cdot s}{\mathrm{d}^2\mathrm{E}\pi/\mathrm{d}q^2} < 0 \quad \text{for} \quad rF \geq s\varepsilon . \tag{13}$$

Here

$$\frac{\mathrm{d}^2\mathrm{E}\pi}{\mathrm{d}q^2} = 2p'(q)F + p''(q)\big((q-r)F + s\varepsilon\big) < 0 \quad \text{for} \quad rF \geq s\varepsilon$$

is the second-order condition for the bank's optimisation problem, which is assumed to be satisfied. It is even possible to induce firms to behave optimally. If $s\varepsilon \geq rF$, it follows from (7) that there is no distortion at all because the equity capital is large enough to prevent the BLOOS rule from becoming operative.[12] This can be summarised as follows.

[12] Under realistic conditions, the bank's probability distribution has a very long, but thin lower tail. To ensure that this tail lies completely in the range of positive legal wealth levels, a very large equity stock could be necessary, but such a strict interpretation of the model would make little sense. If only part of the tail of the probability distribution lies in the range of negative legal wealth, the firm's risk preferences may still be fairly normal and may not imply a pathological degree of risk-taking. See Sinn (1980, Chapter III, Section B1).

Proposition 3: *With the imposition of minimum equity requirements it is possible to reduce and even avoid the welfare loss from excessive risk-taking which is implied by the BLOOS rule.*

The Competition of Banking Regulation

While it is in the national, and even the national banks', interest to impose minimum equity requirements when all competing banks are governed by them, things may be different, of course, in an international context. Although the banks themselves have tended to lobby for strict national banking rules, their interest in such rules has been fading away with the rapid globalisation of recent years. The argument used by banking representatives is that the unilateral imposition of tough banking rules is unfair since these rules increase the national cost of the banking business and imply a competitive disadvantage relative to the rest of the world.

The argument would make little sense if it could be assumed that international lenders reward tough national banking laws by sufficing themselves with lower rates of interest, knowing that the bonds they buy have a higher quality than those of other countries. But obviously, the banking representatives do not believe that international lenders behave this way. While it is true that the refinancing rates differ to some degree according to the assessment of the rating agencies, there is the widespread fear that the observable differences by no means reflect the true differences of the risks imposed on lenders. The bank lobbies' pressure on national governments not to impose stricter banking rules than do competing countries is therefore overwhelming, and in fact the pressure goes in the direction of national liberalisation. The Asian banking crisis, which in the opinion of many observers could have been prevented with stricter banking laws, may have been the result of a competition of laxity in regulation.

Suppose for a moment that this view is wrong and that bank lenders are able to assess the meaning of national banking laws even though they are unable to monitor a single bank's risk-taking behaviour. In this case, lenders from at home and abroad would be able to infer from the national banking law which target rate of return and which success probability the domestic banks will choose, and they would use equation (5) to determine the rate of interest they require from the banks of a particular country. The national government would then likely take the behaviour of savers and banks into account when choosing its banking law. As national and international savers would receive an expected rate of return equal to the given world market rate of interest for safe assets, $s - 1$, the government's policy choice would be irrelevant for households, but would affect the national banks' profit. National welfare maximisation would therefore be identical with the profit maximisation of a single bank with well-informed lenders. Integrating (5) into (6) would result in equation (11), and obviously it would be in the national government's interest to induce the domestic banks, by way of setting ε, to choose a target return which satisfies (12) and to maximise the expected return from business lending.

Though logically possible, this scenario is not really convincing since it contradicts the Selection Principle.[13] The Selection Principle says that it is unlikely that systems competition will work since governments have concentrated on those economic activities where markets failed. Re-introducing the markets through the back door of systems competition is likely to bring about the same kind of market failure which induced the governments to become active in the first place. In the present context, the Selection Principle could imply that that international bank lenders are not only unable to assess a single bank's choices under risk but also that they cannot easily distinguish between the various national banking laws. There are currently 205 countries in the world, and there are nearly as many banking laws.

[13] See Sinn (1997).

To assume that savers know what they get if they entrust their money to a bank in Fiji Islands, Madagascar or Turkmenistan would be courageous to say the least.

Thus, the situation of a national government may be similar to that of a single bank that faces ignorant lenders. If the government imposes a tough banking law which prevents or reduces opportunistic banking behaviour, it will not be able to convince lenders of the better quality of national bank bonds and will therefore not be able to reduce the rate of interest which the lenders request. The government will therefore have to take into account that the imposition of a minimum equity requirement makes domestic banks worse off and their lenders better off. If it were equally interested in both bank profits and the well-being of lenders, it would impose an equity requirement sufficient to satisfy the closed economy welfare maximum as defined by (12). However, given that many lenders come from abroad, it certainly is not that impartial.

Being elected by domestic residents, the domestic government will only take their situation into account and neglect foreigners, thus imposing a policy externality on other countries. In principle, there can be foreign bank owners and foreign lenders. Thus there may be two types of policy externality. The first one results from asymmetric information and is inflicted on foreign bond holders; it is basically the lemons externality analysed in the context of the introductory banking model. The other one results from a sequencing or time inconsistency effect similar to the one analysed by Jensen and Meckling (see literature section, case i). It is inflicted on the bank's foreign shareholders who bought the shares knowing that they would have to bear the consequences of subsequent policy changes without being able to require a differential compensation. The asymmetry among these policy externalities reflects the fact that bank securities will be revolved regularly while shares are eternal contracts. Bank bonds are therefore assumed to be bought after, or simultaneously with, the government regulation decision, and shares are assumed to be bought before.

Let α be the share of domestic residents among the people lending to domestic banks and β the share of the domestic banks owned by domestic residents. Using the expected utility of bank lenders,

$$\mathrm{E}U = prF + (1-p)s\varepsilon - sF \quad \text{for} \quad rF \geq s\varepsilon,$$

and, from (4), expected profit,

$$\mathrm{E}\pi = p(q-r)F - (1-p)s\varepsilon \quad \text{for} \quad rF \geq s\varepsilon,$$

national welfare in the open economy can be written as

$$W = \alpha \mathrm{E}U + \beta \mathrm{E}\pi.$$

The competitive government will try to maximise W by choosing its policy parameter ε (the required minimum equity) appropriately. The government knows from the BLOOS rule (4) that a marginal variation of ε will affect the market outcome when $s\varepsilon \leq rF$ but not when $s\varepsilon > rF$. Taking account of the national banks' profit maximising reaction to a change in ε as given by (13), the government calculates the derivative of national welfare with regard to its policy parameter:

$$\frac{\mathrm{d}W}{\mathrm{d}\varepsilon} = (\alpha-\beta)(1-p)s + \alpha \left.\frac{\mathrm{d}q}{\mathrm{d}\varepsilon}\right|_{(13)} \left[p'(q)(rF - s\varepsilon) + \frac{\beta}{\alpha}\frac{\mathrm{d}\mathrm{E}\pi}{\mathrm{d}q} \right]$$

which simplifies to

(14) $$\frac{dW}{d\varepsilon} = (\alpha - \beta)(1-p)s + \alpha \left.\frac{dq}{d\varepsilon}\right|_{(13)} p'(q)(rF - s\varepsilon)$$

since $dE\pi/dq = 0$ will hold in the bank's optimum as defined by (7) - (9). Equation (14) shows that the sign of the derivative of national welfare with regard to the required minimum equity depends on two items. The first one represents the redistribution from banks to lenders which is brought about by a marginal increase in the equity requirement, given the bankruptcy probability $1-p$. If the share of domestic lenders exceeded the share of domestic bank owners, $\alpha > \beta$, this welfare effect would be positive, but it is negative if the share of domestic bank owners is larger, i.e. $\alpha < \beta$. The second item reflects the fact that a higher equity requirement induces the banks to take fewer risks, i.e. to reduce the target return q and the corresponding bankruptcy probability $1-p$. This helps the domestic lenders to the extent that the banks' equity capital falls short of the promised loan repayment, $s\varepsilon < rF$, and to the extent that there are such lenders as measured by α. In principle, banks are hurt by a similar effect, but, at the margin, and in the banks' optimum, the disadvantage is exactly outweighed by the increase in the expected return from business lending. So only the effect on lenders has a net impact on welfare.

The overall impact on welfare of an increase of ε is ambiguous, depending on the factors mentioned. Consider a few special cases which all refer to the range where the BLOOS rule is operative, i. e. $0 \le \varepsilon \le rF/s$.

(i) There are no domestic lenders and no foreign bank owners:

$$\alpha = 0,\ \beta = 1 \Rightarrow \frac{dW}{d\varepsilon} = (1-p)s < 0 \ \Rightarrow\ \varepsilon_{opt} = 0.$$

The competitive government does not impose any equity requirements on banking firms.

(ii) There are only domestic lenders and only foreign bank owners:

$$\alpha = 1,\ \beta = 0 \Rightarrow \frac{\mathrm{d}W}{\mathrm{d}\varepsilon} = (1-p)s + \left.\frac{\mathrm{d}q}{\mathrm{d}\varepsilon}\right|_{(13)} p'(q)(rF - s\varepsilon) > 0 \Rightarrow \varepsilon_{opt} \geq \frac{rF}{s}\ .$$

The competitive government imposes an equity requirement large enough so that the banks can always keep their repayment promises.

(iii) Both domestic resident shares are positive, but the share of domestic lenders is at least as high as that of domestic bank owners. In this case, the first item in (14) is non-negative and the second is strictly positive as long as $s\varepsilon < rF$. It follows that

$$\alpha \geq \beta > 0 \Rightarrow \frac{\mathrm{d}W}{\mathrm{d}\varepsilon} > 0 \text{ for } \varepsilon > \frac{rF}{s} \Rightarrow \varepsilon_{opt} \geq \frac{rF}{s}\ .$$

Once again it is optimal for the national government to impose an equity requirement large enough so that the banks will be able to repay their loans even in the case of bankruptcy.

(iv) Suppose finally that the share of domestic lenders is positive, smaller than the share of domestic bank owners, and large enough to make sure that the second item in (14) outweighs the first one when $\varepsilon = 0$, i.e. $\alpha \left.\mathrm{d}q/\mathrm{d}\varepsilon\right|_{(14)} p'(q)rF > (\beta - \alpha)(1-p)s$. This is the case of an interior solution, because $\mathrm{d}W/\mathrm{d}\varepsilon > 0$ when $\varepsilon = 0$ and $\mathrm{d}W/\mathrm{d}\varepsilon < 0$ when $\varepsilon = rF/s$. From the first order condition $\mathrm{d}W/\mathrm{d}\varepsilon = 0$ we get, after a few manipulations:

$$0 < \alpha < \beta \Rightarrow \varepsilon_{opt} = \frac{rF}{s} - \left(\frac{\beta}{\alpha} - 1\right)\frac{1-p}{p'(q)\left.\frac{\mathrm{d}q}{\mathrm{d}\varepsilon}\right|_{(13)}} \quad \text{where } 0 < \varepsilon_{opt} < rF/s\ .$$

The national government imposes some regulation on the banks, but remains nevertheless too lax to completely prevent the BLOOS rule from becoming operative and inducing banks to take more risks than in the case of informed lenders or unlimited liability.

It is not entirely clear, which of these cases prevails most frequently in reality. However, it seems that the cases where banks are predominantly owned by nationals and borrow funds worldwide seem to be particularly relevant. While comparative international statistics are not available, the example of Germany confirms this impression. Foreigners possess only little more than 3% of the existing equity capital of German financial institutions,[14] but they hold 17% of the German banks' outstanding bonds and liabilities (see Figure 1).

When bank bonds are more widely distributed internationally than bank shares, systems competition would be described by case (iv) or could even be close to case (i) so that a corner solution with $\varepsilon = 0$ prevails. Both cases characterise a lax regulatory behaviour of national authorities. In fact, the regulation would be *too* lax, for it is clear that the national regulatory optimum for the closed economy which results from $\varepsilon \geq rF/s$ and was characterised with (12), is also the optimum for the whole world. A proposition summarises the results.

Proposition 4: *International competition among bank regulators will not, in general, be efficient when regulators maximise national welfare, lenders are unable to monitor bank behaviour, and there are foreigners among the lenders and/or bank owners whose preferences are not taken into account by the regulators. If the share of domestic residents among the bank's owners exceeds the share of domestic residents among the bank's lenders, regulation will be too lax in the sense that national authorities do not, or not fully, exclude the opportunistic risk-taking behaviour resulting from the BLOOS rule.*

Again the different roles of lenders and firm owners and the nature of the effects imposed upon them must be emphasised. The effect on foreign lenders results from asymmetric information and the inability of these lenders to recognise variations in the risk of repayment. It is independent of the time period for which the bonds are issued and arises even with short term securities issued repeatedly by the banks. The effect on the bank's foreign owners instead results from the mere fact that an ownership title is a permanent link to a firm which then inevitably implies that the owners are affected by regulatory changes. It is possible that the profit implications of such changes were anticipated by foreigners before they acquired shares of a bank. In that case, these implications will have been capitalised in share prices and the foreigners will just earn the normal rate of return on their ownership titles. However, this is irrelevant for the regulator's incentives, as long as he cannot commit to a regulatory policy before the foreigners buy the shares. Whatever was anticipated in the share price, the regulator will know that foreigners are affected by marginal variations in his policy according to the size of the foreign share ownership then prevailing, $1-\beta$, and this will distort his policy choice as modelled above. It would not even matter if foreigners could sell the bank shares after a policy move because the profit consequences will then certainly be capitalised in share prices and not affect the returns that purchasers can earn.

Things are different when policy-makers can commit themselves to a certain regulatory policy before bank shares are bought by foreigners. In that case, all profit implications even of marginal decisions will accrue to domestic residents only, and in the above model it would be necessary to set $\beta = 1$ to depict this case. This would mean that either case (iv) applies with a lower value of ε or that there is even a corner solution with $\varepsilon = 0$, similar to case (i). The concern that systems competition will result in an overly lax regulation would be strengthened. In general, what counts is the share of domestic residents among the banks' owners at the time the regulatory decisions are made or firmly announced, and this is how the parameter β should be interpreted.

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[14] According to the Bundesbank, foreigners hold 18.087 DM billion of equity and direct participations. This is 3.2% of the

The Basel Committee and EU on the Right Track

You can't get blood out of a stone. This wisdom explains why decision-making under risk is often distorted in the direction of excessive risk-taking when decision makers face possible losses, whose size exceeds their wealth or that part of their wealth which will be made liable for compensation. A bank's loan repayment liability is an example of this. When banks can choose between high target returns in business lending that occur with a low probability and low ones that occur with a high probability they may prefer the high target returns even though a lower expected return results. The reason for this type of risk preference is that higher probability of bankruptcy means a higher probability that ignorant lenders who are unable to monitor the bank's actions will not be able to collect the promised repayment. Lenders buy lemon goods and banks enjoy lower financing costs.

To avoid a market for lemon bonds national governments usually impose solvency constraints on domestic banks. However, in the process of globalisation where an increasing fraction of the banks' lenders come from abroad, the incentive for the national governments to impose tough solvency constraints diminishes, since part of the benefits of such constraints accrue to foreigners while a comparatively large fraction of the resulting increase in banking costs is borne by domestic residents. Thus there is the risk that systems competition will in fact be a competition of laxity where the problem of lemon bonds, which brought in the national governments in the first place, reappears on the international level. Once again, the Selection Principle is operative in systems competition.

In such a situation, an international harmonisation of solvency requirements seems appropriate. As mentioned in the introduction, more than a decade ago, the Basel Committee on Banking Supervision (1988) introduced its Capital Accord known as Basel I. Since then, the business of banking, risk management practices, supervisory approaches, and financial markets each have undergone significant

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total stock of equity reported by the OECD.

transformation, and many of the old provisions have proved to be no longer adequate. Thus, in June 1999, the Basel Committee on Banking Supervision issued a proposal for a new bank capital adequacy framework, Basel II, to replace Basel I. At this writing, the consultation process is still under way, and it is expected that the new Accord will be applicable not before the year 2005.[15]

The rationale for the Basel II Accord can be summarised by aiming at more flexibility and more risk sensitivity with regard to individual loans given out to private business. Banks have more choices, but they have to evaluate their borrowers more carefully and to underlay each individual loan with a specific amount of equity, depending on the risk class to which the borrower belongs. There is more emphasis on the combination of effective bank-level management, market discipline, and supervision in contrast to the focus on the single risk measure that was used in Basel I. Basel II intends to provide approaches which are both more comprehensive and more sensitive to risks than Basel I, while maintaining the overall minimum equity requirement of 8% of equity capital to risk-weighted assets. Unlike before, however, external credit assessments will be used to properly evaluate the true risk of business lending.

Basel II also aims at bolstering market discipline through enhanced disclosure by banks. Effective disclosure is essential to ensure that market participants can better understand banks' risk profiles and the adequacy of their capital positions. It reduces the lemons problem discussed in this chapter by informing lenders about the true risks they incur, thus helping systems competition to function better than it otherwise would do. However, the authors of Basel II certainly do not believe in a liberal approach where disclosure is all that is needed to avoid the asymmetric information among lenders and regulatory authorities which is the cause of the welfare loss resulting from systems competition.

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[15] See Basel Committee on Banking Supervision (2001) for the details of the latest proposal.

The review of Basel I complements a review already underway of EU legislation on bank capital requirements to shape a new EU capital adequacy framework. The revised EU bank capital legislation is supposed to replace the existing legislation on capital requirements which basically has been in place since 1988.[16] The aim of the revision is to ensure that European banks and investment firms are able to respond quickly to market changes and to guarantee both financial stability and the smooth functioning of the internal market in financial services. The EU proposal also focuses on minimum capital requirements, a supervisory review process, and an emphasis on market discipline.

The Basel Committee on Banking Supervision as well as the European Commission want to create a new global capital framework that guarantees greater stability of the international financial system by better reflecting the changes in financial markets in recent years. By co-operating closely and by co-ordinating the timing of the review processes, both institutions ensure that the harmonisation rules do not contradict but rather complement one another. Basically, the policy response coincides with the recommendations following from the theoretical analysis of this chapter. Rather than relying on unbridled systems competition, collective international action is taken to avoid the welfare losses from lemon banking which otherwise might occur.

It should not be overlooked, though, that both the Basel and the EU approaches suffer from a lack of enforcement possibilities for countries not directly involved. The original Basel agreement was a voluntary commitment by the G-10 countries, and Basel II is a voluntary agreement backed by 13 countries. The EU rules will be binding for all 15 EU countries, which will have to adjust their banking laws accordingly. Other countries, in particular Latin American and Asian countries, cannot be forced to obey the rules if they do not want to. In total only 19 out of 206 countries in the world have committed

[16] See Directive 2000/12/EC of the European Parliament and of the Council of 20 March 2000 relating to the taking up and pursuit of the business of credit institutions.

themselves.[17] How the other countries will react and whether this number is enough to make systems competition workable remains to be seen.

[17] The participating countries are the EU countries, Canada, USA, Japan and Switzerland.

References

Basel Committee on Banking Supervision (1988): *International Convergence of Capital Measurement and Capital Standards,* Bank for International Settlement, www.bis.org.

Basel Committee on Banking Supervision (2001): *The New Basel Capital Accord - Consultative Document*, Bank for International Settlement, www.bis.org.

Bester, H., and M. Hellwig (1987); "Moral Hazard and Equilibrium Credit Rationing: An Overview of the Issues," in: G. Bamberg and K. Spremann, eds., *Agency Theory, Information and Incentives*, Springer: Berlin and Heidelberg.

Blum, J., and M. Hellwig (1995): "The Macroeconomic Implications of Capital Adequacy Requirements for Banks," *European Economic Review* 39, 739-49.

Calomoris, C. W., and A. Powell (2000): "Can Emerging Markets Bank Regulators Establish Credible Discipline? The Case of Argentina, 1992-1999," *NBER Working Paper* No. 7715.

Corsetti, G., P. Pesenti and N. Roubini (1998): "What Caused the Asian Currency and Financial Crisis? Part II: The Policy Debate," *NBER Working Paper* No. 6834.

Dornbusch, R. (1998): The New International Architecture, Munich Lectures in Economics, CES, University of Munich, unpublished manuscript.

Dow, S. C. (1996); "Why the Banking System Should be Regulated," *Economic Journal* 106, 698-707.

Dekle, R., and K. Kletzer, "Domestic Bank Regulation and Financial Crisis: Theory and Empirical Evidence from East Asia," *NBER Working Paper* No. 8322.

Gollier, C., P.-F. Koehl and J.-C. Rochet (1997): "Risk Taking Behavior with Limited Liability and Risk Aversion," *Journal of Risk and Insurance* 64, 347-70.

Goodhart, C. A. E. (1991): "Are Central Banks Necessary?," in: F. Capic and G. E. Wood, eds, *Unregulated Banking: Chaos of Order?,* Macmillan: London, 1-21.

Kane, E. J. (2000), "Capital Movements, Bank Insolvency, and Silent Runs in the Asia Financial Crisis," *NBER Working Paper* No. 7514.

Kydland, F. E., and E. C. Prescott, (1977), "Rules Rather Than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy* 85, 473-91.

Minsky, H. (1991): "The Financial Instability Hypothesis: A Clarification," in: M. Feldstein, ed., *The Risk of Economic Crisis*, University of Chicago Press: Chicago, 158-70.

Miller, M. H. (1977): "Debt and Taxes," *Journal of Finance* 32, 261-75.

Modigliani, F. (1961): "Long Run Implications of Alternative Fiscal Policies and the Burden of the National Debt," *Economic Journal* 71, 730-55.

Modigliani, F. (1982): "Debt, Dividend Policy, Taxes, Inflation and Market Valuation," *Journal of Finance* 37, 255-73.

Rochet, J.C. (1992): "Capital Requirements and the Behaviour of Commercial Banks," *European Economic Review* 36, 1173-78.

Sinn, H.-W. (1980): *Ökonomische Entscheidungen bei Ungewißheit*, Mohr: Tübingen. Here cited according to the English translation: *Economic Decisions under Uncertainty*, North-Holland Publishing Company: Amsterdam, New York and Oxford 1983.

Sinn, H:-W. (1982): "Kinked Utility and the Demand for Human Wealth and Liability Insurance," *European Economic Review* 17, 149-62.

Sinn, H.-W. (1986): "Risiko als Produktionsfaktor," *Jahrbücher für Nationalökonomie und Statistik* 201, 557-71.

Sinn, H.-W. (1997), "The Selection Principle and Market Failure in Systems Competition," *Journal of Public Economics* 66, 247-74.

Stiglitz, J., and Weiss, A. (1981): "Credit Rationing in Markets with Incomplete Information," *American Economic Review* 71, 393-410.