

Capital Adequacy Requirements, Deposit Insurance and Bank Behaviour

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Abstract: As financial market regulations have been eliminated over the past decade, the fragility of the international financial system has been exposed. In turn, this has generated interest in the design of prudential regulations and safety net procedures for banks. In this paper the thesis is advanced that the two must be treated as interdependent and not substitutes. A capital adequacy requirement ensures that there is a buffer against a decline in the value of bank assets. However, it does not eliminate the possibility of runs. On the other hand, deposit insurance creates a moral hazard problem which can best be limited by setting appropriate capital requirements and risk weights.

I INTRODUCTION

The past decade has witnessed a considerable increase in the competitiveness of financial markets throughout the world. Official barriers to entry restricting the establishment of branches and subsidiaries by foreign institutions have been lifted gradually. Most OECD countries have either eliminated or are in the process of eliminating controls on the international flow of funds. As a result, new and better financial services have been introduced such that both borrowers and lenders would appear to be better off. However, in the wake of this new competitive environment has come increased regulation. For example, the minimum capital adequacy standards proposed by the Bank for International Settlements in 1987 not only attempt to harmonise regulations across the major industrial countries; they also establish a system of risk weights which require bank owners to put up more capital for loans which are perceived to be riskier. That is, loans to corporations and sovereign developing country borrowers require more capital than mortgages or loans to OECD

governments. The existence of such weights is bound to influence the structure of bank balance sheets. Similar capital adequacy requirements for security house and investment banking exist in a number of countries and these are currently under review by a number of authorities including IOSCO and the European Community. Two questions then arise. First, why should there have developed such an intense interest in regulating financial markets just at a time when long-standing restrictions are in the process of being dismantled? Second, what effect will changes in the regulatory environment have upon the operation of the banking system? As a result of addressing these questions, the following conclusion will be drawn: in order to achieve a safe and sound banking system (1) safety net procedures, such as subsidised deposit insurance and (2) minimum capital adequacy requirements must be viewed as complementary policy instruments. They cannot be viewed as alternative means of protecting bank depositors or as independent policies aimed at different objectives.

II ECONOMIC ARGUMENTS FOR MARKET INTERVENTION

The case for intervention in markets is usually based upon the existence of "market failures" which create an inefficient allocation of resources. Generally such failures arise from: (a) the existence of externalities, (b) fraudulent activities, and (c) the abuse of market power arising from natural or regulatory barriers to entry. In principle all are relevant to the operation of financial markets and largely arise from the way information about risks and returns is generated and transmitted.

The most important externality created by a bank involves the use of its liabilities as media of exchange. By providing this facility and by acting as a clearing house for payments, banks reduce transactions costs and hence enable the real sector to operate more efficiently than otherwise. Banks are able to provide these services because of the profits which they generate as financial intermediaries, in the process creating a second externality. By transforming liabilities into assets possessing entirely different risk, return, maturity and liquidity characteristics, they enable a more efficient allocation of investor funds than would occur if banks did not exist. If asset and funding risks are known to a reasonable degree of accuracy, banks and non-monetary financial intermediaries (e.g. insurance and pension funds) enable real sector borrowing transactions to be undertaken on better terms than would be possible if primary securities markets were the sole mechanism for enabling savers to deploy their funds. The costs to borrowers and the risks faced by lenders are both reduced. Consequently, a second externality is created through the process of intermediation.

A bank is able to perform these tasks by gathering information that reduces the uncertainty that is faced by the non-bank sector, a task which would be too costly for every individual or company to undertake. In an attempt to reduce uncertainty, many financial institutions will invest heavily in research. Since this is costly, they will seek either to keep the information to themselves or to sell it for a fee to selected customers. The resulting asymmetry in the way information is distributed is a prime cause of the unethical and fraudulent behaviour and the abuse of market power, the first two types of market failure noted previously. In other words, the comparative advance that banks and other financial institutions have in gathering and interpreting information about sources of funds and potential borrowers could be misused. The positive externalities generated from financial intermediation could be offset by the inefficiencies arising from an abuse of market power or fraudulent activity.

In addition, this asymmetry in the distribution of financial information may also give rise to the herd instinct in financial markets. Those institutions without large research staffs will be watching the behaviour of the larger banks, acting as market leaders, in order to follow their moves. Rumours are also a product of the uncertainty existing in the markets and may also generate some herd movement until the rumour is either confirmed or dismissed. In an unregulated world rumours about the quality of a bank's portfolio or about suspected fraudulent activities could generate a run on that bank. Contagion effects could develop, with customers of other banks unsure that their banks may be in a similar situation. The ability of the financial system to generate the positive externalities noted earlier is thereby threatened. Depositors would have the incentive to spread their risks across many banks, each of whom they would need to monitor. As a consequence transactions costs would increase.

Given the proven ability of financial institutions to innovate in the face of market opportunities, it does not seem unreasonable to assume that banks would begin to compete with each other in the provision of insured deposits, where the insurance is provided by a third party. Deposit rates would fall to the risk free rate of interest. Lending rates would also decline but by a smaller amount since borrowers would have to cover the cost of insurance.

From the point of view of the banking system as a whole, such insurance would eliminate the possibility of runs since depositors would no longer care about how the bank was managed or the quality of its portfolio. They would be safe. However, as Goodman and Santomero (1986) point out, if borrowers bear the full costs of insurance, the performance of the real sector will be less efficient. As a result of this externality, there exists a case for some form of subsidisation.

However, deposit insurance like any other type of insurance creates a moral hazard problem. Without the discipline of depositors threatening to withdraw

funds if a bank's portfolio position should deteriorate, the bank now has the incentive to increase its leverage or to restructure its portfolio towards more risky ventures. Consequently the probability that the insurance will be drawn upon actually increases. This is particularly the case where deposit insurance is either explicitly subsidised and the cost unrelated to the riskiness of the bank's portfolio. For this reason it is important that deposit insurance schemes should be complemented with limitations on the leverage which banks can attain, with a minimum statutory capital/asset ratio. Bank capital acts as a buffer stock which enables losses to be absorbed periodically by the owners of the institution without the value of liabilities to third parties being affected. For example, if the value of a bank's assets should fall below the value of its deposit liabilities, not only would the value of owner equity be zero, in the absence of any insurance, depositors would be required to make good some of the bank's losses. With insurance, this burden would be borne by the insurer. This problem could be avoided in the extreme by requiring all assets to be fully supported by capital. However, the bank's owners seek to make profits from the leverage which they obtain from deposit taking. In turn, depositors value the services provided by the bank. Hence, by setting a limit on leverage, the regulator is limiting the probability that depositors or the deposit insurance scheme will suffer losses.

This approach is most apparent in the recent scheme proposed by the Bank for International Settlements (BIS). The idea is that by ensuring that financial institutions maintain certain minimum levels of capital, the owners will bear the cost of non-performing activities and not the financial institution's customers. Consequently, the positive externalities created by these institutions will be protected. In addition, a further stated objective of these international organisations is to ensure that all financial institutions are operating on a level playing field. That is, institutions from one country should not have a competitive advantage over institutions from abroad where the regulatory environment may be more restrictive. An important aspect of these proposals is that the minimum capital requirements are not applied uniformly across all institutions. Institutions with high risk portfolios will have to put up more capital than institutions which are relatively risk averse. For example, this is achieved within the BIS scheme through the assignment of risk weights to different asset classes. By itself, however, this system is not sufficient to prevent runs on the banking system unless capital adequacy requirements were set very high. However, in these circumstances, they would act as a barrier to entry and hence reduce the efficiency of the banking system. Consequently it is important that deposit insurance schemes, whether explicit or implicit, be managed in such a way that they complement capital adequacy requirements. This leads to a generalisation of Morgan's optimal policy (1984, p. 141): given

the potential for market failure in the banking system, as discussed previously, the optimal policy for the regulators is one of designing capital adequacy requirements *and* safety net procedures in such a way that marginal social benefits just equal marginal social costs.

In the next section, we shall take a first step toward understanding the potential costs and benefits by examining the implications of deposit insurance and capital adequacy requirements within a simple model of the banking firm.

III A MODEL OF BANK BEHAVIOUR

Despite increasing interest in the operation of financial markets and the insightful survey papers by Baltensperger (1979) and Santomero (1984), relatively little work on the theory of the banking firm has been undertaken. In this section I shall take as my starting point a very simple model of a bank and utilise it to illustrate the relationship between deposit insurance, capital adequacy requirements and bank behaviour. The structure is similar in spirit to the buffer stock model used to compute optimal cash balances held by firms (e.g., Miller and Orr, 1966) and represents an extension of the framework contained in McKenzie and Thomas (1990).

While banks could extend loans simply on the basis of funds raised through a share issue, it is in the interest of owners to take advantage of the leverage involved in deposit-taking. By increasing loans for any given equity base, the bank is able to increase its profits and hence the rate of return obtained on that equity. However, there is a limit to which a bank can profitably extend its leverage. This will depend upon four factors:

- (a) the expected return and risk profile of the bank's portfolio;
- (b) the preferences of the bank's owners and managers *vis-à-vis* expected return and risk;
- (c) the perception of depositors as to the creditworthiness of the bank; and
- (d) the existence of some form of deposit insurance.

The variables of the model are as follows:

- K = bank capital (the equity of the owners)
- D = deposit liabilities
- A = the assets of the bank (equal to K + D)
- α = the asset capital ratio, i.e., A / K
- G = the cost to the bank of deposit insurance
- r = the risk free rate of interest
- r_D = bank deposit rate
- r_L = return on portfolio, with expected value $E(r_L)$ and variance $V(r_L)$
- π = bank profits, $Ar_L - Dr_D$.

Now let us consider three scenarios. In the first the bank operates in an unregulated environment. In the second, the bank is required to purchase the deposit insurance at its full cost. Finally, we consider the case where the insurance is fully subsidised.

Scenario 1. When the operations of a bank are not subject to any form of government intervention, the bank's behaviour will be constrained by the perceptions of its depositors. As a bank attempts to improve its return on equity by increasing its leverage, the potential value of assets subject to default also increases. Hence the probability that the value of such losses will exceed capital rises. In a world of perfect information, rational depositors will perceive that they could lose part or indeed all of their deposit funds. Consequently they will demand as compensation deposit rates which reflect the risks associated with the degree of the bank's leverage. In this model, I shall assume that the deposit rate is a linear function of the risk free rate of interest r and the bank's asset/capital ratio α :

$$r_D = r + b\alpha \quad r, b > 0 \quad (1)$$

The difference between r_D and risk free rate of interest may be thought of as representing the amount of money which the depositor would require in order to purchase insurance against the risk of bank default.

The objective function of the bank will be assumed to take the following form:

$$F = E(\pi) / K - 0.5 \phi V(\pi) / K^2. \quad (2)$$

The second term on the right hand side of (2) represents the aversion to bank failure on the part of the owners of the bank. (That is, ϕ may be thought of as a coefficient of risk aversion.) This involves a behavioural conjecture that the owner/managers do not wish to lose the power associated with running a bank or the prestige that they may enjoy in the community. Note that,

$$V(\pi) = A^2 V(r_L). \quad (3)$$

Thus by substituting (1) and (3) into (2), we obtain

$$F = \alpha E(r_L) + (1 - \alpha)(r + b\alpha) - 0.5\alpha^2 \phi V(r_L). \quad (4)$$

The optimal degree of leverage can then be obtained by maximising (4) with respect to α , viz:

$$\alpha = (E(r_L) + b - r) / (2b + \phi V(r_L)). \quad (5)$$

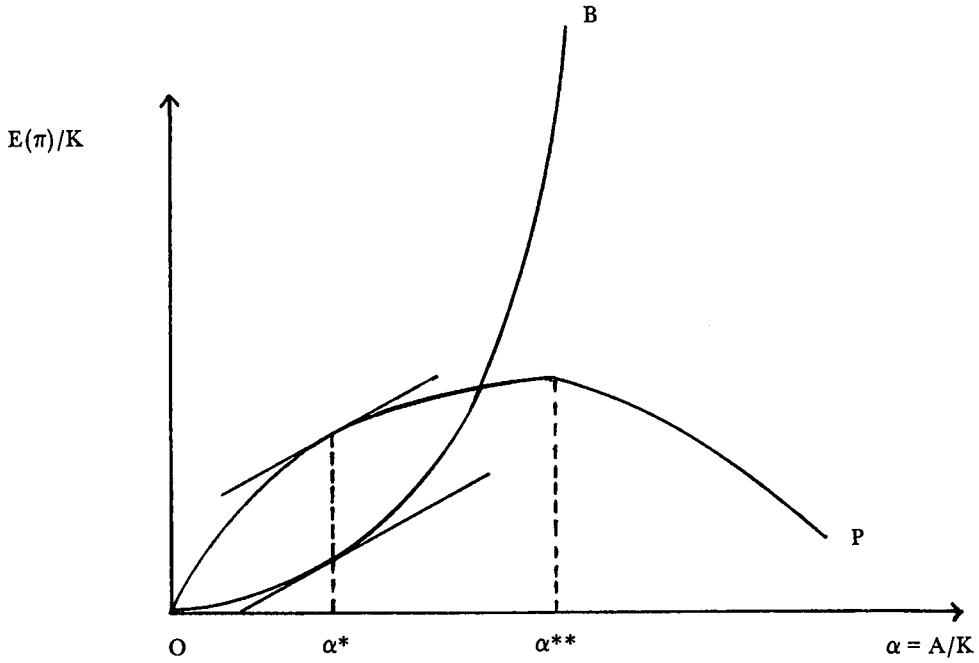


Figure 1a

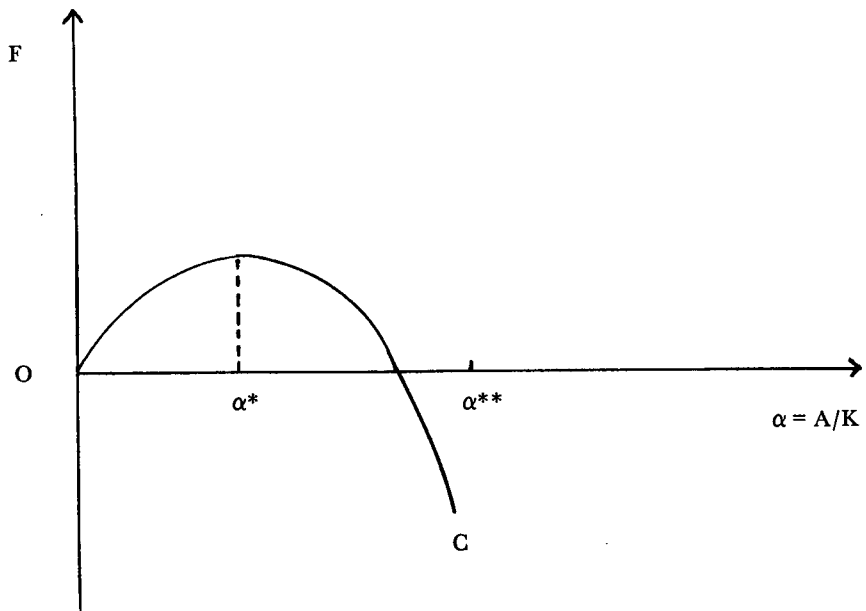


Figure 1b

Since $\alpha \geq 1$ and $A = D + K$, it must be the case that

$$E(r_L) - r > b + \phi V(r_L). \quad (6)$$

The implications of this scenario are depicted in Figures 1a and 1b. Let us think of the bankowner's objective of maximising the function F as really one of maximising expected profits taking into account the psychic costs of bankruptcy. The schedule OP represents the expected return on capital that can be obtained from increasing leverage. As loan income increases, so deposit rates will also increase to compensate for the increased risks being borne by the depositor. The degree of leverage that would maximise the expected rate of return is shown as α^{**} . The psychic costs or aversion to bankruptcy are represented by the OB schedule which increases at an increasing rate. The bank's objective function is therefore maximised where the marginal financial return is equal to the marginal costs, i.e., at α^* . The value of F is depicted in Figure 1b. As discussed in Section I, such a system as this would be subject to bank runs. Any rumour (founded or unfounded) could lead to a run and possibly create a contagion involving runs on banks which were perfectly secure.

Scenario 2. In this case I assume that there exists a regulatory authority which requires banks to insure all deposits. The bank is free to choose whatever degree of leverage is consistent with its objectives. However, the cost of the deposit insurance fully reflects the risks involved. I assume that this cost per £ of deposit equals $b\alpha$ and thus is exactly equal to the premium on the deposit rate that would have to be paid in the unregulated scenario discussed previously. For simplicity, this neglects transactions costs which are bound to be higher in the aggregate when many depositors arrange deposit insurance on an individual basis than for a single bank. Since depositors are fully insured the deposit rate is equal to the risk free interest rate. The result is that the structure of this scenario is exactly the same as the structure of the first.

Scenario 3. If the cost of deposit insurance is zero (i.e., $b = 0$) in Equation (5), then the optimal asset/capital ratio for the bank becomes:

$$\alpha = (E(r_L) - r) / \phi V(r_L). \quad (7)$$

This implies that the net revenue obtained from loan and deposit activities OP becomes a straight line as shown in Figure 2a. The objective function shifts upwards as in Figure 2b. Given the condition expressed by Equation (6), the solution to Equation (7), α^+ in Figure 2, will be greater than the asset/capital ratios occurring under scenarios 1 and 2. That is, the existence of fully subsidised deposit insurance encourages the bank to take on a riskier portfolio. The extent of the greater leverage depends, of course, on the bank's aversion to risk, as represented by the parameter ϕ .

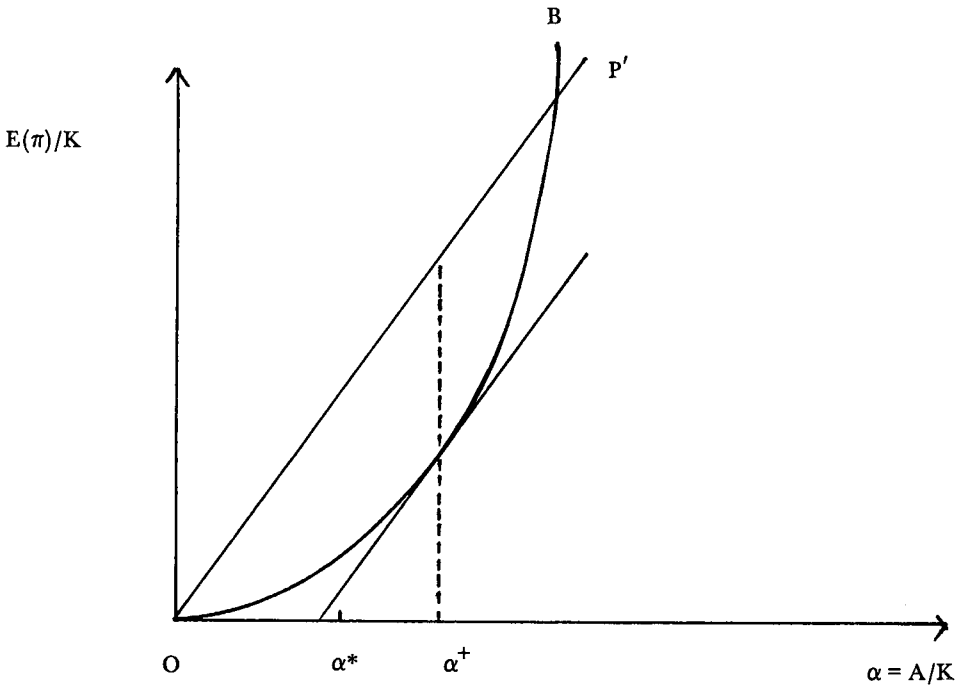


Figure 2a

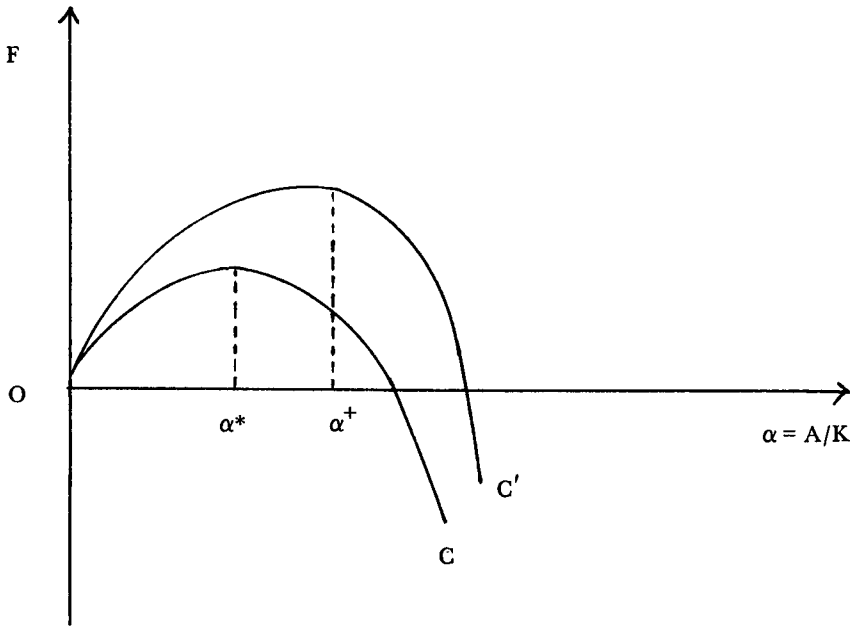


Figure 2b

If the bank is risk neutral, its sole objective will be to maximise its rate of return on capital. The OB schedule effectively becomes a straight line lying on the horizontal axis. There is no limit to the degree of leverage sought by the bank. From Equation (7), as ϕ tends towards zero, α tends towards infinity. In these circumstances, it becomes imperative for the regulatory authority to impose capital adequacy requirements upon the bank. This is particularly important if the insurance is implicit in the regulator's safety net procedures. In the absence of such requirements, the regulator would continually be called upon to bail out and restructure banks. If the insurance was provided explicitly by a government agency, such as the Federal Deposit Insurance Corporation in the US, then that agency would find that its resources would be very quickly depleted.

The only way to limit these calls upon the regulatory authority or insurer is to impose certain limitations upon the operation of banks. If all borrowers have the same characteristics, as in this model, then capital adequacy requirements will set a limit on the extent of bank failures that is acceptable. However, when the statutory maximum asset/capital ratio is less than the one which is optimal from the bank's point of view there develops the incentive to develop new financial instruments which would enable it to utilise its capital more efficiently. This possibility was clearly analysed for the first time by Minsky (1957) who noted that restrictive Federal Reserve regulations in operation at the time led to the development of the commercial paper and Federal Funds markets. The former represents an innovation on the liability side of the bank balance sheet whereas the latter was an innovation on the asset side. Subsequently, this tendency by financial institutions to seek ways to offset, partially or wholly, the effects of regulation has come to be known as Goodhart's Law (e.g., Goodhart, 1984, Chapter 5).

From the point of view of a bank, it becomes desirable to introduce an innovation if the marginal gains are greater than the marginal costs where the latter includes both the costs associated with developing the innovation as well as changes in the psychic costs associated with the risks involved. In principle, the innovation could shift the OP and OB schedules upwards or downwards. A complete taxonomy is beyond the scope of this paper. However, an examination of two cases will be sufficient to illustrate an important policy issue. Let us assume that deposit insurance is fully subsidised as in scenario 3 and that the innovation involves both an increase in expected return and in risk. In one case, shown in Figure 3a, the bank's objective function shifts in such a way that the optimal asset/capital ratio increases from α^+ to α'' . Given the statutory maximum ratio α^M , there will be no change in leverage. However, there will be a deterioration in the quality of the bank's portfolio and hence an increase in the probability of bankruptcy. In the second case,

shown in Figure 3b, the objective function has shifted such that the optimal asset capital ratio actually declines from α^+ to α''' . In theory it is possible that this could fall below the statutory requirement α^M . Nevertheless, there has still been an increase in the probability of failure.

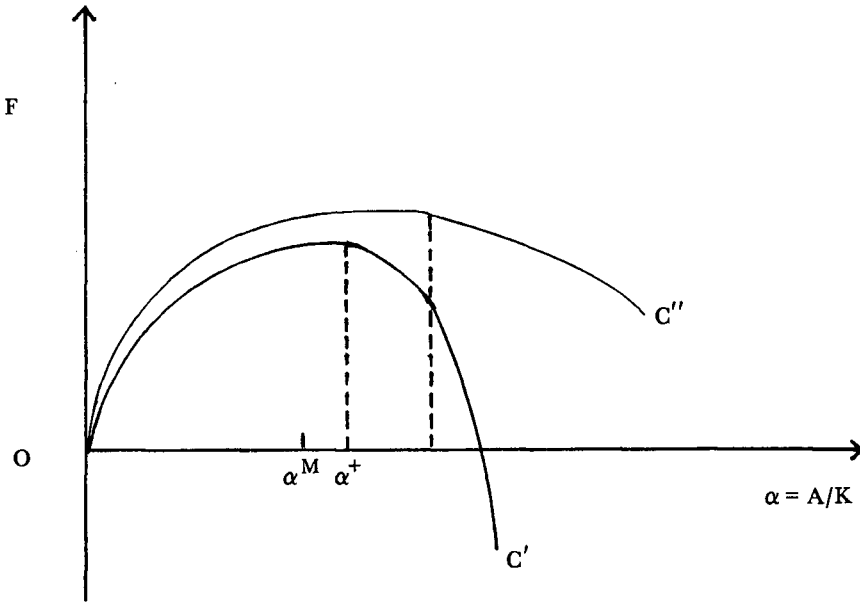


Figure 3a

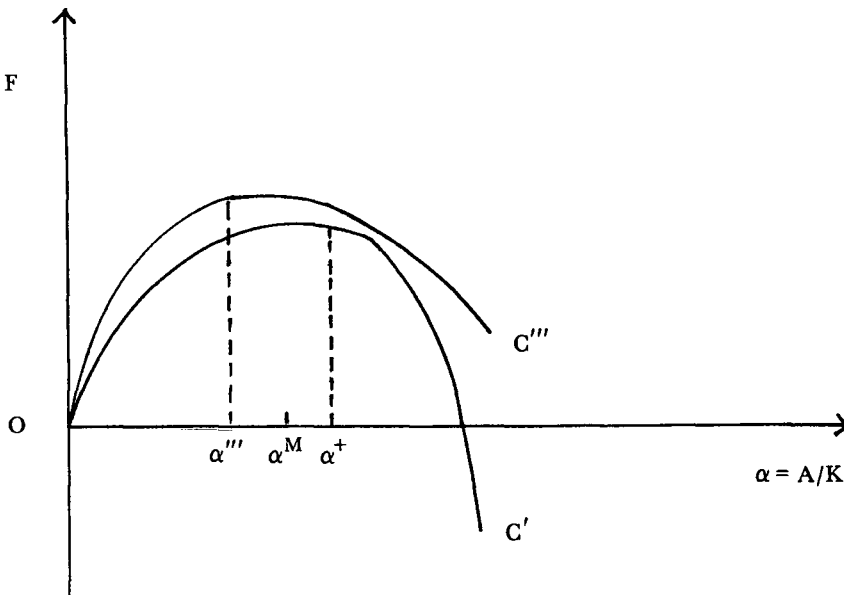


Figure 3b

The conclusion to be reached here is that capital/asset ratios are not necessarily a good indicator of the quality of a bank's portfolio. In a world of heterogeneous assets, a bank with a conservative stance would find itself forced to hold as much capital as a bank with a very aggressive attitude towards risk. As we have just determined in a world where financial institutions are innovative, the introduction of assets with increased expected returns and increased risk could be consistent with either an increase or a decrease in the optimal asset/capital ratio. In these circumstances a risk weighting scheme such as proposed by the Bank for International Settlements has a role to play. In practice the BIS weights are limited in that they only refer to credit risk, whereas a complete scheme would also need to take into account investment, interest rate and exchange rate risks.

IV CONCLUSIONS

On the basis of the above analysis it is clear that safety net procedures and capital adequacy requirements are inextricably linked. This result stands in contrast to positions adopted in much of the current literature. For example, in the study commissioned by the American Bankers' Association (Benston, *et al.* (1986), the focus is entirely on issues associated with deposit insurance and lender of last resort facilities. Only passing reference is made to the role of bank capital (pp. 176-177, 305). More recently, Pen Kent (1990) has argued correctly that capital requirements and safety net schemes cannot be viewed as substitutes (p. 2). However, he then goes on to argue that the purposes of the two are different, i.e., safety net procedures protect depositors whereas capital requirements protect the bank against failure. As we have seen, the two issues are intertwined.

As old regulations are tightened and new ones imposed, financial institutions have the incentive to introduce strategies which tend to offset the social objectives of the regulations. As the model presented in this paper has illustrated, subsidised deposit insurance induces banks to take on riskier portfolios than otherwise. Hence the need to introduce capital adequacy requirements to limit the incidence of bank failure. In turn, however, this may induce banks to restructure their portfolio towards riskier ventures. To limit this, a risk weighting scheme for assets is introduced.

Such schemes are costly for financial institutions to carry out and costly for the regulatory authority to monitor and enforce. However, as the well-worn expression goes, there is no such thing as a free lunch. A completely unregulated system would require everyone to become a financial analyst capable of evaluating and comparing bank balance sheets or indeed the evaluations of competing credit rating agencies. There would be the incentive for households and businesses to establish a diversified portfolio of bank accounts.

There would always be the possibility of a run based on rumour. In such a world transactions costs would be much higher than now and the financial system would be less efficient.

On the one hand, some important empirical issues must be resolved before one can make a judgement about whether the costs of regulation are worth bearing: e.g. (i) are the externalities arising from financial intermediation that important? (ii) are bank runs an important phenomena in practice? On the other hand, an unregulated system might, but not necessarily, function smoothly if more information was provided by banks as to the structure and quality of bank portfolios. This would require international harmonisation of accounting standards. Although this would also involve substantial costs for both banks and regulatory authorities, the need for full disclosure could have the effect of inducing greater risk aversion by the financial system. Banks would wish to compete in convincing depositors that they really are a safe haven. Further, it could also induce banks to offer two broad classes of liability: those that are insured and those uninsured. These are issues which must be placed upon the agenda of both economists and policy makers for further discussion.

REFERENCES

- BALTENSPERGER, ERNST, 1979. "Alternative Theories of the Banking Firm", *Journal of Monetary Economics*, 6, pp. 1-37.
- BANK FOR INTERNATIONAL SETTLEMENTS, 1987. *Proposals for International Convergence of Capital Measurement and Capital Standards*, Basle.
- BENSTON, G., R. EISENBEIS, P. HORVITZ, E. KANE, and G. KAUFMAN, 1986. *Perspectives on Safe and Sound Banking*, Cambridge, Mass: MIT Press.
- GOODHART, C., 1984. *Monetary Theory and Practice*, London: Macmillan.
- GOODMAN, L., and A. SANTOMERO, 1986. "Variable-Rate Deposit Insurance", *Journal of Banking and Finance*, pp. 203-218.
- KENT, P., 1990. "Capital Adequacy Requirements in the UK Financial Sector", paper presented at a joint seminar of the European Commission and the Centre for Economic Policy Research, London, 5 February.
- McKENZIE, G., and S. THOMAS, 1990. *International Financial Instability and the Debt Problem*, London: Macmillan.
- MILLER, M., and D. ORR, 1966. "A Model of the Demand for Money by Firms", *Quarterly Journal of Economics*, pp. 413-435.
- MINSKY, H., 1957. "Central Banking and Money Market Changes", *Quarterly Journal of Economics*, pp. 171-187.
- MORGAN, G., 1984. "On the Adequacy of Bank Capital Regulation", *Journal of Financial and Quantitative Analysis*, pp. 141-162.
- SANTOMERO, A., 1984. "Modelling the Banking Firm", *Journal of Money, Credit and Banking*, pp. 576-602.