

Value at Risk and Precommitment: Approaches to Market Risk Regulation

Arupratan Daritya and Simone Varotto

1. INTRODUCTION

Traditionally, regulation of banks has focused on the risk entailed in bank loans. Loans are typically nontraded assets. In recent years, another component of bank assets has become increasingly important: assets actively traded in the financial markets.¹ These assets form the “trading book” of a bank, in contrast to the “banking book,” which includes the nontraded assets such as loans. Though for most large banks the trading book is still relatively small compared with the banking book, its rising importance makes the market risk of banks an important regulatory concern.

In January 1996, the European Union (EU) adopted rules to regulate the market risk exposure of banks, setting risk-based capital requirements for the trading books of banks and securities houses. At this point, one must ask what the purpose of such regulatory capital is. We proceed under the hypothesis that the purpose of regulatory capital is to provide a buffer for contingencies involving large losses, in order to protect both depositors and the system as a whole by reducing the likelihood that the system will fail. In this paper, we look at two different

ways of calculating bank capital for market risk exposures and compare their performance in delivering an adequate cover for large losses.

The approach taken by the EU is to use a “hard-link” regime that sets a relation between exposure and capital requirement exogenously. The adopted requirements, known as the standardised approach, laid down rules for calculating the capital requirement for each separate risk category (that is, U.K. equities, U.S. equities, U.K. interest rate risk, and so on). These are added together to give the overall requirement. A weakness of this method is that it does not take into account the diversification benefits of holding different risks in the same portfolio, and thus yields an excessive capital requirement for a large diversified player. One way to correct for this problem is to use the value-at-risk (VaR) models that some banks have developed to measure overall portfolio risk. The Basle Supervisors’ Committee has now agreed to offer an alternative regime, with capital requirements based on such internal VaR models, and the EU is considering whether to follow suit.

While the measure of risk exposure employed by the two regimes is different, in both approaches the regulator lays down the parameters for the calculation of the capital requirement for a given exposure. Thus, both regimes embody a hard link.

Arupratan Daritya is a lecturer in the Department of Economics at Birkbeck College, and Simone Varotto is an analyst in the Regulatory Policy Division of the Bank of England.

Under VaR, the capital requirement for a particular portfolio is calculated using the internal risk management models of the banks.² For any portfolio, the aim is to estimate a level of potential loss over a particular time period that would only be exceeded with a given probability. Both the probability and the period are laid down by the regulator. Basle has set these at 1 percent and ten days, respectively. The capital requirement is based on this potential loss.³

But using VaR comes at a price. The regulator must try to ensure that the internal model used to calculate risk is accurate. Otherwise, banks might misrepresent their risk exposure. However, back-testing to check the accuracy of an internal VaR model is difficult in the sense that a large number of observations are needed before an accurate judgment can be made about the model.⁴ This motivated economists Kupiec and O'Brien (1997) of the Federal Reserve Board to put forward a new "precommitment" approach (PCA) that proposes the use of a "soft link." Such a link is not externally imposed, but arises endogenously. In the case of the proposed precommitment approach, the link between exposures held and the capital backing them is induced by the threat of penalties whenever trading losses exceed a level prespecified by the bank (known as the precommitment capital).

Specifically, under PCA, banks are asked to choose a level of capital to back their trading books for a given period of time (for example, one quarter). If the cumulative losses of the trading book exceed the chosen cover at any time during the period, the banks are penalised, possibly by fines. The chosen capital is thus a "precommitment" level, beyond which penalties are imposed. The task of the regulator is to choose an appropriate schedule of penalties to induce a desirable choice of cover for each level of risk. The banks then position themselves in terms of risk and capital choices for the trading book. The idea is attractive because it does not require the regulator to estimate the level of trading book risk of any particular bank or to approve the firm's model, and it promotes a more "hands-off" regulation.

2. AGENCY PROBLEMS AND FRAUD

This paper examines whether principal agent problems between the shareholders and the managers in banks would undermine the use of a capital regime relying on incentives for the shareholders.⁵ In particular, it looks at whether the management might choose to run positions that were excessive relative to the capital of the bank. This is not a question of illicit activity such as the hiding of positions, which no capital regime will deal with, but whether the managers, because of concerns about market share, their own bonuses, etc., might on occasions take excessive risk. For example, a very large position might be taken on the assumption that it could be treaded out of in minutes. Hard-link regimes avoid this issue because the positions taken at any time must be consistent with the amount of capital available to back them according to a formula laid down by the regulators. There is no scope for judgment by the managers. The scope for such judgment is an advantage in PCA. Depending on the effectiveness of the incentives, however, it could also be a weakness.

3. HARD LINKS AND SOFT LINKS: A POTENTIAL TRADE-OFF

PCA not only circumvents the problems of back-testing, but also gives the banks much greater freedom in choosing the portfolios they wish to carry. Since the trading desks of banks are likely to be more adept at estimating risks of various trades, it seems inefficient to impose hard links.

While these advantages of PCA have been discussed in the literature, another aspect of this soft-link approach seems to have received little attention. The flexibility of a soft-link approach such as PCA comes from the fact that it is not directly prescriptive, but creates incentives through the use of penalties. In more general terms, PCA tries to solve what is known as a "mechanism design" problem. It attempts to specify a mechanism (in this case, a penalty framework that the banks take into account in choosing portfolio risk and committed capital) that would make it incentive-compatible for the banks to choose the socially desirable risk profile. The success of such a programme depends on how well the regulator

anticipates the strategic opportunities that a mechanism might create.

In other words, while soft-link approaches are flexible and not subject to measurement problems, they create a host of strategic issues. To build a successful soft-link regulatory policy, one must recognise all possible conflicts of interest that might arise subsequently, and provide incentives to align them with the objectives of the regulator.

The first step toward building an optimal soft-link policy is to analyse the incentive effects of PCA in a detailed model of the conflicts of interest within the bank. An example of such a model can be found in Daripa and Varotto (1998a).

In Daripa and Varotto, we find that switching to PCA from a hard-link approach does entail a trade-off. On the one hand, the switch would allow firms greater scope to choose portfolios that were appropriate given their expertise and market liquidity. On the other hand, the switch could also increase the likelihood that large players have insufficient capital to cover market spikes. One issue is whether key features of the soft-link approach could be combined with certain features of a hard-link approach in order to circumvent certain incentive problems.

4. SEPARATION OF OWNERSHIP AND CONTROL IN LARGE BANKS: THE AGENCY PROBLEM

A large part of the corporate finance literature explores the corporate control problem. The problem is empirically well documented and theoretically well understood. The typical solution to agency problems is to use incentive contracts (see, for example, Gibbons and Murphy [1992], Jensen and Murphy [1990], Garen [1994], and the survey by Jensen and Warner [1988]). A corporate control problem arises whenever ownership is separate from the decision-making body. In many large corporations, ownership is diffuse and decisions are taken by managers.

As in most large corporations, an integral feature of large modern banks is the separation of owners from day-to-day decision making. The ownership is diffuse—

there are numerous small shareholders who have little impact on most decisions. For example, in the United Kingdom, shareholders rarely have more than 2 to 3 percent of the shares in any one bank. Even relatively large shareholders would in general have hardly any impact on day-to-day risk taking. It is the incentives of, say, the traders of the bank that determine what specific strategies they might adopt on a particular day. Thus, it is important to see to what extent the owners can control their actions.

However, in regulating banks, scarce attention has been paid so far to such internal control problems and their effect on the success of the regulatory mechanism. There is a good reason for this lack of attention. Regulation usually takes the form of an exogenous specification for capital for each level of estimated risk carried by the bank (combined with some form of inspection to ensure that the rules were adhered to). As Daripa and Varotto (1998a) show, regulation by such a hard link is not sensitive to agency problems.⁶ But this is no longer true when we consider a soft-link approach. In Kupiec and O'Brien (1997), the regulator interacts with banks intended as homogenous entities. Shareholders and managers are not considered as separate centres of interest. This leaves aside the important issue of the effects of the incentive structure within the bank. Indeed, under PCA, the generation of the right incentives is at the very heart of the problem. Thus agency-related control problems become central issues and must be addressed in order to gain a clear understanding of the regulatory incentives that would be generated.

As a control device, the owners write contracts with managers, and then the managers make the most of the trading decisions. Moreover, managers cannot usually be fined (that is, paid negative salaries) in the event of a loss.⁷ Thus, decisions about trading-book risk are taken by managers with limited liability, while the owners have to suffer the losses in the trading book and pay the penalty in the case of a breach under PCA.

This fact implies that to study the effectiveness of the incentive structure generated by PCA, it is no longer sufficient to consider the bank as a single entity

whose actions are influenced directly by the regulatory incentives. Without explicitly modeling the agency structure and the nature of optimal incentive contracts in the bank, the effect of regulatory policies on large banks is difficult to gauge.

In other words, to evaluate a soft-link regulatory scheme, the appropriate question to ask relates to the effect of the regime on the incentive structure within the bank. An analysis of this question would tell us which regulatory objectives are filtered through, and what aspects of the regulatory mechanism need further modification. In this paper, we aim to provide such an analysis.

5. SUMMARY OF THE RESULTS

In Daripa and Varotto (1998a), we investigate the above issues in a simple principal-agent framework. We obtain the following results.

5.1 AGENCY INCENTIVES UNDER A HARD-LINK APPROACH

First, we show that conflicts of interest within the bank⁸ have no implications for hard-link policies. The regulator sets a capital requirement for each level of estimated risk. At any point in time, the risk cannot exceed the level consistent with the given capital. It is easy to see that this is true irrespective of the incentive structure in the bank. Clearly, when regulators are relying on models specified by the firms to generate capital requirements there may be some scope for managers to produce results that downplay the losses. But the managers' scope is severely limited. The regulators lay down the amount of returns data that must be used (one year minimum), the parameters used in the model, and approve the model. The regulators also carry out back-testing.

So, while a hard-link regime such as VaR is subject to measurement problems—as highlighted in the literature—and is economically unattractive in some respects, the presence of a hard link does manage to sort out some potential strategic complications. A hard link works because it sets an exogenous requirement that cannot be breached.

However, the estimated risk under VaR uses fixed parameters and does not take into account extra information about, say, future market liquidity that might be available to the manager. The estimated risk also fails to reflect managerial expertise in choosing holding periods optimally, given the opportunity set. Thus, the VaR estimate may often be an overestimate. Of course, an overestimate provides even better cover for extreme losses; at the same time, however, it cuts off certain investment opportunities inefficiently.

5.2 AGENCY INCENTIVES UNDER PCA

While the structure of an agency would be a concern under any soft-link regime, the precise effects would differ across different soft-link policies. In this paper, we analyse the effects of agency on the outcomes generated by PCA.

Under PCA, the capital chosen does not constrain the manager's choice of riskiness. Even if the shareholders used an internal model to monitor risk, they would not want to cut off too many investment opportunities. In fact, they would like to rely on the judgments of the manager in order to reap the benefits of his expertise. Instead of putting a priori constraints on portfolios, they would want to link payment to "performance."

In the absence of a priori restrictions on the choice of risk, the outcome depends on the manager's preferences, because even with the use of a VaR model the manager could choose the holding period according to expected market liquidity or price volatility. We show that if managers care only about monetary compensation, the principal (that is, the bank owner/shareholders) could design contracts that would generate incentives for the manager to behave consistently with the principal's objectives, and in turn, the regulator could therefore achieve the right capital levels. But the manager might also be interested in nonmonetary rewards (for example, attaining star status by generating large positive returns) and might therefore undertake high-risk strategies (limited managerial liability implies that only the upside matters). In Daripa and Varotto (1998a), we show that in this case tighter controls

on the manager can be achieved only at the cost of the principal's own profit. This leads the principal to choose a level of control that is not too tight, resulting in a nontrivial probability of very risky investments and large losses in relation to the amount of capital pre-committed.

6. MODIFYING PCA: OPTIMAL REGULATION

Correcting for agency distortions is, in general, not straightforward. This is a problem of designing a mechanism to implement a certain objective given that various interacting agents have conflicting preferences.⁹ Such a general approach could be very fruitful in this context. While devising a suitable approach is one of our research areas, an analysis along this line is beyond the scope of the paper.

However, there is another possible route—since the interaction between the regulator and the banks takes place repeatedly over time, we need not focus simply on static regulation. The key problem here is that on the one hand, maintaining flexibility makes it necessary to allow the banks to choose their own riskiness. On the other hand, such flexibility might result in loss of control by the principal over the manager. A hard link is inflexible, but it allows full control.

A loss of control occurs when managers of different types have different preferences for portfolio risk. In view of this, we might attempt to retain the flexibility and yet harden the soft links under PCA in the following manner.

Consider the following scheme for any given bank:

- Regulate according to PCA to start with.
- In any future period t , if there has been no breach in period $t-1$, regulate according to PCA.
- If a breach occurred in period $t-1$, adopt a hard-link approach for T periods (if VaR is econometrically problematic, adopting the standardised approach would do just as well—as would any other hard-link regime that puts limits on managerial risk taking). At the end of T periods, switch back to PCA.

Such a scheme would help eliminate the agency distortion. The reason is that the manager must trade off risk today with risk tomorrow.¹⁰

Suppose the manager puts a large weight on portfolio risk. Suppose he takes a very high-risk strategy in period t and large losses occur. In a static context, limited liability implies that the manager would not care about the losses. But now there are other consequences. Since the manager puts a large weight on risk, unless he discounts the future heavily, he would care about the risk he can undertake in period $t+1$ and after. Higher risk in period t increases the chances of facing a hard-link regime for T periods that would put limits on managerial risk taking. Thus, there is now a trade-off. This helps reduce the agency distortion.

The policy is simple enough—a violating bank must go through a “probationary” phase during which its risks would be very inflexibly controlled. This approach maintains the flexibility of PCA, while hardening the links on punishment paths.

In future research, we hope to explore these issues further and shed light on optimal regulation.

ENDNOTES

The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of England. The content of the paper as well as the exposition have benefited enormously from regular interaction with Patricia Jackson and Ian Michael. We have also benefited from comments on an earlier version by William Perraudin and two referees for the Bank of England Working Paper series, as well as comments by our discussants Jean-Charles Rochet and Paul Kupiec at the Financial Regulation and Incentive Conference at the Bank of England. We are grateful to all of them.

1. For example, securities and foreign exchange or commodities positions that are held for short-term trading purposes.
2. The value at risk of a given portfolio can be calculated via parametric or nonparametric (historical-simulation) models. Parametric approaches are based on the assumption that the distribution of future returns belongs to a given parametric class. The historical-simulation approach produces a time series of profits and losses that would have occurred if the portfolio had been held over a specified estimation period.
3. The Basle rules specify an additional multiplier of three, which is applied to the results of the VaR model to convert it into a capital requirement.
4. See Kupiec (1995) and Jackson and Perraudin (1996).
5. This paper is a summary of the results derived by Daripa and Varotto (1998a). Readers interested in a more formal discussion should refer to that paper.
6. With this we do not mean that hard-link regulation prevents managers from undertaking fraudulent activities. An implicit assumption in our analysis is that managers act legally.
7. Even when fired, most managers are usually able to find other jobs.
8. Clearly, if they do not degenerate into fraudulent actions on the part of the manager.
9. For a lucid discussion of the central issues in the implementation literature, see the survey by Moore (1992).
10. Of course, such a scheme would work only if the expected duration of the manager's employment were not very short.

REFERENCES

- Besanko, D., and G. Kanatas.* 1996. "The Regulation of Bank Capital: Do Capital Standards Promote Bank Safety?" *JOURNAL OF FINANCIAL INTERMEDIATION* 5: 160-83.
- Bliss, R.* 1995. "Risk-Based Bank Capital: Issues and Solutions." Federal Reserve Bank of Atlanta *ECONOMIC REVIEW* 80, September-October: 32-40.
- Campbell, T., Y. Chan, and A. Marino.* 1992. "An Incentive Based Theory of Bank Regulation." *JOURNAL OF FINANCIAL INTERMEDIATION* 2: 255-76.
- Chan, Y., S. Greenbaum, and A. Thakor.* 1992. "Is Fairly Priced Deposit Insurance Possible?" *JOURNAL OF FINANCE* 47: 227-45.
- Daripa, A., P. Jackson, and S. Varotto.* 1997. "The Pre-Commitment Approach to Setting Capital Requirements." Bank of England *FINANCIAL STABILITY REVIEW*, autumn.
- Daripa, A., and S. Varotto.* 1998a. "Agency Incentives and the Regulation of Market Risk." Bank of England Working Paper, January.
- . 1998b. "A Note On: Agency Incentives and the Regulation of Market Risk." Bank of England *FINANCIAL STABILITY REVIEW*, spring.
- Dewatripont, M., and J. Tirole.* 1993. "The Prudential Regulation of Banks." Cambridge: MIT Press.
- Garen, J. E.* 1994. "Executive Compensation and Principal-Agent Theory." *JOURNAL OF POLITICAL ECONOMY* 102: 1175-99.
- Giammarino, R., T. Lewis, and D. Sappington.* 1993. "An Incentive Approach to Banking Regulation." *JOURNAL OF FINANCE* 48: 1523-42.
- Gibbons, R., and K. J. Murphy.* 1992. "Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence." *JOURNAL OF POLITICAL ECONOMY* 100: 468-505.
- Jackson, P.* 1995. "Risk Measurement and Capital Requirements for Banks." Bank of England *QUARTERLY BULLETIN*, May: 177-84.
- Jackson, P., D. Maude, and W. Perraudin.* 1996. "Bank Capital and Value-at-Risk." Birkbeck College Working Paper.
- Jensen, M. C., and K. J. Murphy.* 1990. "Performance Pay and Top-Management Incentives." *JOURNAL OF POLITICAL ECONOMY* 98: 225-64.
- Jensen, M. C., and J. B. Warner.* 1988. "The Distribution of Power among Corporate Managers, Shareholders, and Directors." *JOURNAL OF FINANCIAL ECONOMICS* 20: 3-24.
- Kupiec, P.* 1995. "Techniques for Verifying the Accuracy of Risk Measurement Models." *JOURNAL OF DERIVATIVES*, winter: 73-84.
- Kupiec, P., and J. O'Brien.* 1997. "The Pre-Commitment Approach: Using Incentives to Set Market Risk Capital Requirements." Federal Reserve Board Finance and Economics Discussion Series, no. 97-14, March.
- Marshall, D., and S. Venkatraman.* 1997. "Bank Capital Standards for Market Risk: A Welfare Analysis." Federal Reserve Bank of Chicago Working Paper, April.
- Moore, J.* 1992. "Implementation, Contracts and Renegotiation in Environments with Complete Information." In *ADVANCES IN ECONOMIC THEORY: SIXTH WORLD CONGRESS*. Vol. 1: 182-282. Cambridge: Cambridge University Press.
- Prescott, E.* 1997. "The Precommitment Approach in a Model of Regulatory Banking Capital." Federal Reserve Bank of Richmond *ECONOMIC QUARTERLY*.
- Rochet, J.* 1992. "Capital Requirements and the Behaviour of Commercial Banks." *EUROPEAN ECONOMIC REVIEW* 36: 1137-78.

The views expressed in this article are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System. The Federal Reserve Bank of New York provides no warranty, express or implied, as to the accuracy, timeliness, completeness, merchantability, or fitness for any particular purpose of any information contained in documents produced and provided by the Federal Reserve Bank of New York in any form or manner whatsoever.