

# Policy Essay

## Risk-Based Bank Capital: Issues and Solutions

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**B**anks are subject to many forms of risk, of which credit and market risk are perhaps the most important. Credit risk involves the risk that a counterparty to a contractual obligation, be it a mortgage, loan, or swap agreement, will default on the promised payments. Market risk is the risk that the values of assets or the cash flows from assets will change in response to movements in broad market factors, such as interest or exchange rates. Traditionally, banking regulation has focused on credit risk, the quality of assets, and internal control systems. But financial markets have changed so that market risk has become increasingly important.

Risk is an integral part of bank business. In assessing the creditworthiness of a loan applicant the bank makes a judgment about the riskiness of the loan. In taking a position in the foreign exchange market the bank takes on a risk that it factors into the price quoted to its customer. Regulatory interest is not in controlling the risk a bank can take on per se but in limiting the chances that adverse outcomes will exceed the bank's capacity to bear losses—hence the regulatory focus on bank capital, which provides a buffer against the potential for losses inherent in the bank's conduct of its normal business. For exposures to market risks from trading desk operations, however, existing regulations for the determination of bank capital, based on the quality of assets held, are not appropriate.

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Derivatives—financial assets whose value and pay-offs are determined by the value of an underlying asset or index—are used to transfer risks from one party to another (at a cost, of course) and thus are a means of risk management, much like insurance. Derivatives such as forward foreign exchange contracts, interest rate swaps, commodity and financial futures, together with more exotic variants such as caps, swaptions, and structured notes, have grown explosively in the past twenty years, though some types of derivatives are as old as financial markets themselves. These instruments are now an integral part of international trade, finance, and corporate financial risk management. As the market has grown, certain large commercial banks have become lead players, competing directly with investment banks to create and sell derivative “products” in order to meet the risk-management needs of their customers. Increasingly, providing these products, either directly or through correspondent relations, will become important for smaller banks as well.

Derivatives also have a dark side. They have been the subject of widespread and sometimes lurid publicity. Some consider them unimaginably complicated, dangerously risky, even a threat to the financial system. Rightly or wrongly, derivatives have been associated with a number of well-publicized financial disasters in recent years.<sup>1</sup> The resulting furor has led to demands that Congress and regulatory agencies “do something!” Some might argue for an outright ban on derivatives trading by commercial banks. But such a ban would only drive the market (and its associated revenues) offshore or into nonbank institutions. It would therefore be futile and would simply hamstring U.S. commercial banks in the global financial marketplace. One can no more ban derivatives than the Luddites could ban power looms in the early nineteenth century.

While fear drives public calls for regulation, there are also sensible reasons for reevaluating the current approach to regulating banks’ trading activity. Bank involvement in derivatives trading represents a new and very different business from the traditional role of credit assessment and loan origination, and traditional methods of assessing bank capital are not appropriate to this new business line. For a trading desk’s portfolio, the primary sources of risk are market factors—interest rates, exchange rates, mortgage prepayment rates—not credit factors. This environment has led to the discussion of “risk-based capital” assessment.

Risk-based capital fits into a larger framework of the bank’s overall capital. The Federal Deposit Insurance Corporation Improvement Act contains provisions for increasingly stringent supervisory intervention as capi-

tal ratios fall. The concern is that trading desk activities may lead to rapid changes in bank capital because of the potential volatility of the trading portfolio’s value. An additional concern is that failure of large banks involved in derivatives origination and market making may have systemic implications. For these two reasons, regulators are subjecting trading risk to special scrutiny. Beginning in 1993, the Basle Committee on Banking Supervision (1993) outlined the need for requiring the assessment of capital to cover trading-portfolio risk and discussed means of doing so. The current regulatory discussion follows from that initiative.

The basic goal of risk-based capital assessment is to determine the optimal level of risk-based capital a bank should hold against possible losses in its trading portfolio. Determining what is optimal involves trading off the costs of implementation and holding excessive amounts of capital, on the one hand, against the need to ensure that sufficient capital is available to cover reasonably likely outcomes given the bank’s positions, on the other hand. Because portfolio positions are changing rapidly, it is desirable to have a means of assessing capital requirements that is responsive to these changes. Fixed-capital requirements are likely to be too high or too low. If too high, burdensome capital requirements place banks under a competitive disadvantage relative to offshore and nonbank competitors. Alternatively, if too low, capital requirements do not provide adequate protection from losses, thus placing the bank’s other activities at risk and ultimately passing the risk on to deposit insurers.

There are three major proposals for determining risk-based capital. These are (1) the standard or supervisory model approach, (2) the internal models approach, and (3) the precommitment approach. Both the standard and internal models proposals are concerned with regulating, to a greater or lesser degree, the models used internally by banks for risk assessment and management. These are referred to herein as the models-based approaches. The precommitment approach is not models-based regulation in that it does not attempt to regulate models. It emphasizes incentives and goals while leaving modeling issues entirely to banks.

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### **Models-Based Approaches to Risk-Based Capital**

It is worthwhile reflecting on the complex and dynamic nature of modern securities and security markets. Competing pricing and hedging models are

developed by so-called rocket scientists within investment banks and academics at universities. These models are based on financial-asset pricing theory, are necessarily cast in terms of sophisticated mathematics, and their implementation involves complex statistical issues. The relative merits of these models are hotly debated, and their development is ongoing. Not only are they dynamic and subject to disagreement among experts, but the securities these models are used to price and hedge are also rapidly evolving in response to changing market forces and the efforts of intermediaries to provide products to sell to customers.

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There is a continuing dynamic between the regulators, attempting to devise regulations that will meet social objectives, and the regulated, attempting to maximize their profits within and around regulatory constraints. This conflict in goals and incentives sometimes leads to a contest that regulators rarely win. Regulations must necessarily be general and written so that compliance is unambiguous. Regulations take time to write, inevitably involve compromises, and tend to evolve slowly. In contrast, firms can respond quickly to changing markets and can adjust their business practices to the regulations in ways that are difficult to anticipate and that may produce unintended social consequences. Responding to these innovations only leads to another round of regulations and innovations, with the regulations becoming increasingly complex, burdensome, and costly to monitor. Viewed in terms of incentives, some approaches may be counterproductive while others minimize the asymmetry between the goals of regulators and the regulated.

**The Standardized Model Approach.** The standardized model approach would have a single model, designed by regulators, applied to all banks. This ap-

proach is designed to keep the reporting burden from being excessive and to provide a framework that supervisory personnel can verify. By defining the model to be used for determining risk-based capital and by deciding many of the judgment questions that keep model builders occupied, the standardized model might, in principle, be free of the temptation to "game" the system to reduce capital set-asides. The underlying philosophy of this model is to divide securities into broad categories and then to assign weights to these categories. Unfortunately, in practice this approach is an invitation to gaming. For instance, one question raised in the proposed regulations was whether undiversified equity portfolios should be assessed an additional 8 percent risk-based capital set-aside. Clearly, "diversification" is not an either/or quality, and an 8 percent additional capital set-aside would be too much for some portfolios and too little for others. Attempts to use such rules of thumb to reduce complex and continuously varying properties into a few discrete categories are apt to lead to unsatisfactory results. Hugh Cohen (1994) assessed a related, and similar, regulatory proposal for measuring loan-portfolio interest rate risk. He showed that even for default-free bonds, the simplest of securities, portfolios that are "equivalent" under the proposed regulations will have widely varying risk characteristics. Adding complexity to a standardized model to attempt to solve these problems is an exercise in futility. Attempting to adapt the model to such circumstances will make it increasingly complex, unwieldy, and costly to implement and monitor.

The "one-size-fits-all" approach implicit in the standardized model approach does not reflect the diversity of portfolios and strategies that exist. Neither is it likely to keep up with changing circumstances. Portfolio positions change rapidly, requiring real-time monitoring. Contrast the rapidity of Baring's decline with the once-a-quarter reporting requirements for most banks. Financial innovation and customization of financial products means that a standardized model may be outdated before it is promulgated. While the model may address, inadequately, "vanilla" securities, it will not be able to handle either customized or newly created types. The regulatory agencies will be challenged to develop the highly technical models needed to be suitably firm-specific, rapidly evolving, and flexible.

**The Internal Models Approach.** As a result of criticisms of the standardized model approach, the internal models approach has been advanced as an alternative (see Board of Governors 1995a). The assumption underlying this approach is that banks are in a better position to devise models suitable to their risk-management

needs than are regulators. Risk-management models already exist within banks. The proposed internal models approach seeks to piggyback on a bank's existing risk-management model to determine levels of risk capital to be held.

At the heart of the internal models approach is the "value-at-risk" calculation, whereby the maximum loss that a portfolio is likely to experience in a given time interval is quantified to a certain level of probability. The output of such a model is a measure of value at risk, or VAR. For example, a 5 percent VAR of \$1 million means that a loss exceeding \$1 million is expected to occur one period out of twenty, at most. Of course, the bank expects to be making profits on average. Such calculations are performed routinely by banks with active trading portfolios to limit their exposures over short time intervals. Investment and commercial banks use daily VARs because that horizon fits into their risk-management systems, which monitor and adjust the bank's overall position risk on a daily basis. Under the internal models approach, regulators would then adjust the bank's daily VAR to reflect the longer period of regulatory interest, say, a quarter, by some fixed factor to arrive at the required capital level.

Unfortunately, over longer horizons, the nonlinear payoffs of options in many portfolios make it impossible to extrapolate risk exposures linearly on the basis of one-day VAR calculations. Consider a portfolio that has written in an out-of-the-money option on interest rates that are very unlikely to become in-the-money in a single day. This position contributes nothing to the one-day VAR. But the possibility of a large interest rate move over, say, a week may be such that the probability of the option going in-the-money becomes important. Thus, the potential losses from the option position over a week are not just a simple multiple of the potential losses over a single day; the potential losses are a nonlinear function of the time interval. Additionally, extrapolating from single-day potential losses to longer periods assumes a static portfolio position. In reality, a trading desk would be constantly adjusting its portfolio to reflect changing market conditions.

Because there is no economic model for determining how to extrapolate daily VARs, which banks' internal models produce, to the horizons of interest for capital assessment, the proposed regulations simply pick a multiplier number: 3.16.<sup>2</sup> This number would be the same for all banks regardless of their portfolio composition or internal model performance. In order to ensure the adequacy of most banks' capital this multiplier will likely be conservative (that is, high). Although for a few banks with risky portfolios the risk-

based capital will be too low, for most banks this approach imposes a risk-based capital requirement that is unduly burdensome given the actual risk of their portfolios. Since capital is expensive the requirement will impose unnecessarily high costs on banks and place them at a disadvantage relative to their competitors. It will then be natural for banks to reduce their effective capital costs by increasing their multiperiod risks relative to their daily VARs, for instance by increasing the use of securities with nonlinear payoffs, thus gaming the regulations and frustrating their intent.

The proposed internal-models regulations seek to constrain banks' internal models in various ways by defining acceptable inputs, limiting permissible relations, segregating various types of securities for separate treatment, and so forth. The proposed regulations address the nonlinearity issue by directing that the banks internal models incorporate the nonlinearities. Of course, the internal models currently do just that, but over a one-day horizon. A different model would be needed to adjust for nonlinearities over different horizons. Backsliding into modeling, of course, runs counter to the premise that "banks know best" when it comes to constructing models. Because banks are going to maintain for their own internal uses models that reflect their best judgments as to how to build models, regulatory restrictions may well lead to a second set of models maintained only for risk-based capital determination. This development invites banks to "adjust" these regulatorily constrained models to minimize their capital requirements. Thus, by micromanaging modeling, the internal models approach will suffer from the same "gaming" problem as the standardized model approach.

Unfortunately, the VAR approach is also inherently flawed. The primary flaw is that it creates adverse incentives for banks. Because the output of the bank's internal risk-management models, even if banks are left to their own best judgment, is to be used to impose costs (capital set-asides) on the bank, banks will, perfectly rationally, weigh the costs produced by their models against the benefits of having "better" risk-management systems. Management and model builders alike will be conscious of the dual objectives, and this ambiguity cannot help the pursuit of optimal internal risk-management systems. In an extreme case a bank may maintain separate internal models, one for capital assessment, another for risk management. This separation would destroy the premise of the internal models approach, which is that banks are best able to design models to measure their portfolio risk. Once a bank starts keeping separate books, so to speak, the persons building the model used for capital assessment will no



longer be trying to measure risk. They will be trying to reduce costly capital set-asides, at least to the extent that they can get away with adjusting their models to do so. Such extreme gaming is apt to be rare but is more likely in those banks that are of the greatest regulatory concern, thus making regulatory oversight all the more difficult.

Another challenge for regulators is verifying the accuracy of the bank's VAR model to ensure that the bank is not trying to game the regulations by adjusting its models. Verifying the accuracy of these models—particularly in measuring low-probability events—will be difficult and unreliable, as Paul Kupiec (1995) argues. The apparent solution to the inadequacies of the internal models approach is to mandate very conservative, and hence costly, capital requirements.

The second flaw in the internal models approach is inherent in the concept of VAR itself, namely, that it focuses solely on the probability of losses greater than a specified amount. It totally ignores how large those losses are expected to be when the bound is violated. Suppose that a bank had losses exceeding its 99 percent VAR 2 percent of the time but never by more than 1 percent of the bank's total capital. The VAR standard would say that the bank's model was inadequate, inviting regulatory intervention. Meanwhile, another bank that violates its 99 percent VAR only 0.5 percent of the time but on average by 20 percent of its capital would have an "adequate" model (and hence level of risk capital) by the VAR standard. The magnitude of the second bank's losses clearly indicates that this bank is riskier. The fixed VAR multiplier inherent in the internal models approach is unable to distinguish between these situations: it can address only the average-loss distribution. Banks are therefore invited to game the system by investing in projects that trade slightly higher expected returns for larger (though no more likely) potential losses. No single-figure measure of risk can capture an entire probability distribution or even the tail of a distribution. Thus, the attempt to leverage the risk-based capital set-aside off the VAR number will not capture the distribution of potential losses and will lead to inadequate or burdensome capital set-asides. VAR is useful, but it should not be used in isolation.

Because regulators and regulations are ill-adapted to regulating model building, it is worthwhile to consider whether they should and why they would want to. Returning to the basic purpose of regulation—to provide sufficient capital to ensure that, in most situations, the trading losses do not endanger the bank's solvency—it becomes obvious that model-based regulation is one step removed from the ultimate objective.

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## The Precommitment Approach to Risk-Based Capital

An alternative to models-based regulation with its inherent conflict between the social goals underlying regulation and the profit incentives of the regulated is to attempt to devise regulations in such a way as to align the firms' incentives with the regulators' goals.

Such an approach to achieving regulatory goals has been proposed by Kupiec and James O'Brien (1995b), two Federal Reserve Board economists. They argue that the models-based approach fails to satisfy two critical requirements: "(1) that an internal model can accurately measure the bank's risk exposure over a holding period of concern to regulators and (2) that the regulatory authority can verify that each bank's model is indeed providing such an accurate measure of the bank's exposure" (Kupiec and O'Brien 1995a, 43).<sup>3</sup>

Kupiec and O'Brien's alternative approach focuses on goals—namely, maintaining sufficient capital to cover trading losses—and leaves it to banks to determine the best models and inputs to achieve the goals. Banks would determine their optimal amount of capital indirectly by determining a maximum-loss precommitment over a reporting period. This precommitted maximum loss would then be used to determine the appropriate capital set-aside. Bankers' incentives to announce reasonable precommitments and thus set aside sufficient capital lies in the penalties that would be imposed should a bank's trading losses in a reporting period exceed the amount previously chosen by the bank as its maximum expected loss. Banks that have good risk-management systems or conservative portfolios could precommit to lower maximum loss levels and hold less capital because of their confidence that they will not breach their precommitted maximum trading losses. Conversely, banks with fewer resources in risk management, or less confidence, or simply more conservative (risk-averse) preferences would choose a higher precommitment level and consequently higher capital levels. Under the precommitment scheme, regulators would not intrude on banks' market-risk models and control procedures.

An additional benefit of the Kupiec and O'Brien approach is that costs are determined by the banks rather than imposed on them directly. If they feel that devoting more resources to their models is worthwhile in terms of reduced probability of penalties, they can invest those resources. If not, they need not. In any case, the agencies simply provide a set of incentives (schedule of penalties) to motivate their decisions. If the

penalties are properly designed, they reduce or eliminate the temptation to game the system to reduce capital set-asides. Neither of the two model-based approaches is able to do this.

Conceptually the Kupiec and O'Brien precommitment approach has much appeal. A number of details in the implementation are, however, quite important to make it work in practice. These include (1) the form the penalties should take, (2) the penalty schedule, (3) the reporting frequency, (4) the reporting and regulatory burden this approach will entail, (5) whether the precommitment approach should be used alone or in combination with another approach, and (6) the link between precommitment and capital.

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### What Form Should Penalties Take?

The key to the precommitment approach lies in the incentives that, for the approach to work, should focus the bank's efforts on risk assessment and loss reporting, not on gaming the capital set-aside. Penalties need to be large enough in proportion to precommitment violations to provide an effective deterrent to deliberately underestimating potential losses but not so large as to force banks to overcommit, thus maintaining unnecessarily high levels of capital or, worse yet, providing incentives to hide losses so as to avoid penalties. It is necessary that the bank be prevented from manipulating its precommitment level to minimize its capital set-aside, so incentives unrelated to the capital set-aside itself should be used to ensure that precommitments accurately reflect portfolio risk or at least do not underestimate potential losses.

**Why Capital-Based Penalties Will Not Work.** Careful analysis suggests that the use of increased future capital requirements as a penalty cannot achieve the desired focus. If violation of a precommitment level results only in an increase in the ratio of precommitment to capital set-aside in the future, there is no certain penalty today. The bank then responds to a precommitment violation either by reducing next period's reported precommitment or increasing the risk of its portfolio, in either case nullifying the penalty. It is worth remembering that precommitments are worst-case, so actual violations will (should) be rare and gaming therefore hard to detect.

If instead of adjusting the ratio of precommitment to capital set-aside the penalty takes the form of an increase in capital unrelated to the future precommitments, then the entire premise of the precommitment

approach is undermined. Banks will have no incentive whatsoever to report accurate risk measures.

**Why Fines Will Work.** What is needed is a penalty that is certain and that cannot be "unwound" by any action the bank takes. Fines meet these criteria. Once a precommitment level is breached, the bank would incur an immediate cost (the fine). There is then no incentive to game the system for the next reporting period. Any attempt to do so by underreporting future potential losses (to reduce capital requirements) would only increase the probability and magnitude of potential fines in the next period. Banks cannot profitably play a multiperiod game to reduce capital set-asides in proportion to their trading risk. Discipline through capital-based penalties cannot do this.

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### The Need for Nonlinear Penalties

A second characteristic that effective penalties must have is that they increase nonlinearly in the size of the precommitment violation. This requirement would provide disincentives to deferring today's losses in the hope that future outcomes will reverse them. The hiding of losses with the concomitant taking of increasingly risky positions in an attempt to "bail out the boat" characterized debacles such as Barings and Daiwa, and any risk-management system, including fixed-capital and models-based approaches, has the potential for such problems.

A linear penalty function means that banks face no downside in deferring today's losses until tomorrow rather than reporting them today. In the worst case the bank will have additional losses tomorrow and, if it gives up the game and reports all losses then, it will have penalties equal to the sum of the penalties it would have paid had it reported losses each day. This deal is a good one for banks—but not for society. It defers the penalty payment, for one thing. For another, deferral avoids for one period the fixed costs associated with loss reporting, such as increased regulatory attention, impacts on stock prices, and management compensation. The real problem, though, lies in the question, Why not continue the game indefinitely?

Increasing penalties nonlinearly breaks down this perverse incentive to defer losses. If a bank defers losses until tomorrow and then loses again it will have to pay a much larger penalty than the total it would have had to pay if it recognized the losses each period. Encouraging banks to report small losses early wipes the slate clean each period and has losses flowing through the financial

statements while they are still small in comparison with capital levels. A schedule of fines can easily be devised to provide an appropriate penalty schedule.<sup>4</sup>

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### **The Need for Frequent Reporting and Assessment**

To further reduce incentives for deferring, or hiding, losses it is necessary to have losses and fines assessed frequently. Kupiec and O'Brien's (1995b) original precommitment proposal suggested a regulatory period of three months. This period is still long enough that if a bank has excessive losses early in the quarter it may be tempted to undertake more risky positions in an attempt to reverse the results before it has to pay the piper. As the regulatory period is shortened, it becomes increasingly difficult for banks to pursue such a strategy. In addition, except for extreme cases, losses over shorter intervals may be expected to be smaller in proportion to available capital, the per-period costs of recognizing losses (and paying any fines) will be less, and therefore the temptation to defer (or hide) losses will be correspondingly reduced.

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### **Reporting Burden**

The inherent costs of frequent reporting need not be excessive. Each reporting period a bank would report two numbers: its gains/losses for the previous period and its precommitment for the next period. The gains/losses should be readily available from the bank's own profit-and-loss tracking programs. The raw inputs for the precommitment numbers should be available from its internal risk-management systems. The bank will have to decide how it will arrive at the actual precommitment numbers. The two reported numbers would then be fed into a computer program that would determine if a fine needed to be assessed and in addition would look for repeated precommitment violations. In the latter case supervisory personnel would be alerted to the potential problem. In the beginning it is envisioned that only about thirty banks would be subject to these regulations, most others having no significant trading activity. The precommitment approach compares favorably with the work hours required for implementing the standardized model or adapting the internal model and then having these checked in detail by examiners.

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### **Other Issues**

Some concerns have been raised that the penalties inherent in the precommitment approach will be destabilizing and may push a marginal bank into insolvency. Obviously this result is not the intention of the penalties. However, a bank that experiences losses that make it unable to pay its fines comfortably is a bank that is in trouble, whether or not the fines are enforced. In such cases waiving the fines and letting trading proceed only invites compounding the problem. Frequent reporting will reduce the chance that fines will be large relative to capital and provide incentives for the bank to alter its strategy before losses become large. Regulatory forbearance with respect to fine assessment should be avoided except in times of systemic stress (such as a market crash). Such episodes should be determined by the central regulatory authority. A request for bank-specific relief highlights the bank-specific nature of the problem. A policy of permitting bank-specific forbearance in times of normal market volatility undermines the incentive structure on which the precommitment approach is built.

The use of fines, particularly on a regular and automatic basis, seems strange to current regulatory practice. It need not be. The fines envisioned in this paper are not punishments, per se, for malfeasance, but rather are an incentive device and a device for imposing costs in proportion to regulatory risk. The schedule of fines imposes costs on those banks that maintain low levels of capital set-asides relative to their actual portfolio risks. These banks are the ones most at risk of becoming regulatory burdens, and it is perfectly fitting that they should pay a higher cost for this increased risk. Meanwhile banks that are less at risk will not pay the costs. Fines only make explicit and bank-specific the costs that the one-size-fits-all models-based approaches implicitly impose on all banks. The amounts assessed are, in effect, risk-based insurance premiums, wherein risk is revealed in the adequacy of the individual bank's precommitment levels relative to their realized losses.

A potential weakness of any system that seeks to address market risks is the need to mark to market assets that may not have readily observable market prices. Marking-to-market is done in the normal course of business for the bank's internal profit-and-loss tracking by means of models or traders' "sense of the market." The less liquid and more specialized a security is, the more uncertainty surrounds this valuation. Obviously the result is adverse incentives for traders and perhaps firms to shade their valuations to their own advantage.

Countering this incentive is the firm's interest in its own long-term survival, which makes it important to have the best possible picture of its positions. The valuation problem is inescapable. It applies equally to any approach to capital management. With volatile financial securities, recourse to accounting cost numbers is inappropriate, or worse. Examiners simply need to be cognizant of the problem, as they are of other potential problems such as inflated real estate appraisals, and check for clues that valuations are being manipulated.

In Kupiec and O'Brien's proposal and in the proposed regulations, the multiplier used to determine capital set-aside from precommitted maximum losses is fixed at unity. This stipulation is unduly restrictive. Adjustments to the ratio of precommitment to capital set-aside, used in combination with fines, should be one of the additional tools available to regulators to reward or penalize banks. While the precommitment system is being implemented, and both banks and regulators are gaining experience, a higher initial multiplier would provide an additional degree of safety. This precaution may be dispensed with as banks gain experience and banks with good risk-assessment experience are identified by their history of staying within their precommitted maximum loss levels. Setting the base multiplier to a higher number also provides the flexibility to reward banks with good (conservative) loss estimates by lowering their multiplier. An additional benefit of a variable multiplier is that it provides examiners and other regulators with a degree of flexibility in implementing the regulation without reducing the certainty of the penalties, which is essential for them to be credible.

That said, adjustments to the ratio of precommitment to capital set-aside and other regulatory sanctions should be used only as an addition to a fixed, certain schedule of fines. Without fines, gaming of the other sanction procedures will become feasible.

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## Summary and Conclusions

Neither the standardized model nor the internal model approach permits the design of a system of rewards and penalties that would align the incentives of bank management with those of regulatory authorities. All these approaches can do is attempt to shortstop the effects of the adverse incentives they create, which requires more costly and burdensome supervision. The

precommitment approach, however, if carefully implemented, can achieve the desired incentive compatibility.

It is reasonable and proper for bank regulatory agencies to specify goals and penalties. Regulators should avoid the temptation to micromanage banks' models, though, and should focus instead on the outputs. Both the standardized and internal models approaches to risk-based capital have serious disadvantages. In particular, both lead to gaming. In the standardized model the opportunity to game the system flows from the inflexible and static nature of regulations that, because they are not adaptable, are standardized across a variety of differing portfolios and market conditions. In the internal model the temptation to game flows from the adverse incentives the approach imposes on banks. In both cases adjustments to the problems are likely to make the models expensive to the regulated and burdensome to the regulators. If an internal models approach is to be adopted, model implementation should be left to the banks, and regulators should concern themselves with how well the models work. Thus, regulations regarding how actual losses are to be compared with a model's VAR predictions are reasonable, as are actions to be taken and penalties to be imposed when the model's forecasts prove inadequate.

The precommitment approach represents a radical departure from the detailed, check-list, look-over-the-shoulder approach to regulation. It recognizes that focusing on results is more important and, in this case, more feasible than double-checking the work of the regulated.

This approach does not mean, of course, that there is no need for supervision beyond the reporting and tracking of precommitments and results. But, in the absence of evidence of gross problems—for example, a trader hiding losses or a pricing model deferring losses while recognizing gains—the focus should be on the precommitment levels and loss experience. When precommitments are frequently violated, a more intrusive regulatory intervention is warranted, including raising the capital set-aside multiplier or ultimately prohibiting the bank from trading.

In a world in which financial modeling is becoming increasingly complex and esoteric and supervisory resources are increasingly stretched, the precommitment approach can enable regulators to identify and focus their efforts on problem banks while providing incentives for the majority of banks to stay out of trouble without constant, detailed oversight.



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## Notes

1. It may be well to remember that none of the recent highly publicized debacles has arisen from errors in pricing models. Barings and Daiwa resulted from internal control problems, and bank regulators should pay strict attention to these. Orange County's disaster grew out of the trader's certainty that he knew what interest rates would do (and such hubris can hardly be regulated) together with lax supervision. Metallgesellschaft had to do with hedging, not valuation, and is still being vigorously debated by academics on both sides. One case involving valuation, that of Bankers Trust, has less to do with whether Bankers Trust's models were right than with whether Bankers Trust fully informed its customers. The moral here is that customers should treat marketmakers like car salesmen and verify valuations with a neutral third party or build their own models. This is not to say that models are never a prob-

lem. In the early 1990s, collateralized mortgage obligation (CMO) valuation models were found to be painfully inadequate when a sudden drop in interest rates caused unanticipated rates of prepayment with corresponding losses to holders of some CMOs (and, of course, corresponding gains to others).

2. The daily VAR, or average of the last sixty days' daily VARs, whichever is greater, is first multiplied by 3.16 (the square root of 10) to convert to a ten-day VAR. This number is then multiplied by a minimum factor of three to arrive at the required capital set-aside.
3. Their alternative, introduced in Kupiec and O'Brien (1995b), is open for public comment in the *Federal Register* (Board of Governors 1995b).
4. Kupiec and O'Brien (1995b) have proposed one such nonlinear penalty schedule.

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## References

- Basle Committee on Banking Supervision. "Proposal to Issue a Supplement to the Basle Capital Accord to Cover Market Risks." April 30, 1993.
- Board of Governors of the Federal Reserve System. "Risk-Based Capital Standards: Market Risk" (Docket No. R-0884). *Federal Register* 60 (July 25, 1995a): 38082-142.
- \_\_\_\_\_. "Capital Requirements for Market Risk" (Docket No. R-0886). *Federal Register* 60 (July 25, 1995b): 38142-44.
- Cohen, Hugh. "Data Aggregation and the Problem of Measuring a Bank's Interest Rate Exposure." Federal Reserve Bank of Atlanta Working Paper 94-6, August 1994.

- Kupiec, Paul. "Techniques for Verifying the Accuracy of Risk Measurement Models." *Journal of Derivatives* 3 (Winter 1995): 73-84.
- Kupiec, Paul, and James O'Brien. "Internal Affairs." *Risk* 8 (May 1995a): 43-47.
- \_\_\_\_\_. "A Pre-commitment Approach to Capital Requirements for Market Risk." Federal Reserve Board of Governors Working Paper 95-36, July 1995b.