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# FRBSF WEEKLY LETTER

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## Market Risk and Bank Capital: Part 2

In last week's *Weekly Letter* (94-01) I described the problem of market risk in banking and the efforts of the Basle Committee on Banking Supervision to deal with it. The Basle Committee proposes to set bank capital standards to cover losses due to fluctuating exchange rates, interest rates, and stock prices. In this sequel, I evaluate the proposals. I argue that there are good conceptual grounds for the approach taken by the Basle Committee, and that the proposal is an admirable balance of simplicity and precision. I also present evidence that the approach, desirable in principle, may work well in practice.

As explained in the earlier *Letter*, the Basle Committee's approach first consolidates a bank's market exposures into net positions for the bank as a whole. The results are composite portfolios—in different currencies, equities, or maturities in the case of traded debt—that summarize the market risks the bank faces. The bank's position in each of these currencies, equities, or maturities is either long (gaining from an increase in the market) or short (losing from an increase). In each case, the riskiness of a bank's market-sensitive portfolio is assumed to be proportional to the size of the portfolio. The proposals gauge size through a weighted sum of two measures of the aggregate portfolio position: the net aggregate position, or NAP, which is the difference in value between long and short positions, and gross aggregate position, or GAP, which is the sum of the long and short positions. In the earlier *Letter*, I christened the result WAP, for "weighted aggregate position."

### WAP versus a theoretical benchmark

It is easy to compute gross and net positions for any portfolio, and from those construct WAP. But does this make sense as an approach to measuring risk? That is, is the actual market risk of a bank's portfolio likely to be proportional to WAP? Finance theory provides a solid benchmark measure of risk against which the Basle Committee proposals can be judged. In finance, risk often is measured by the portfolio variance,

or by its square root, which is the portfolio standard deviation. (The standard deviation is related to the average size of unexpected shocks to a bank's capital.) These rigorous measures of risk depend partly on the size of the positions the bank takes; they also depend on the volatility of each exchange rate, stock price, or interest rate, and on the covariances or correlations among these market variables.

Under certain simplifying assumptions about the structure of bank positions, market volatilities, and correlations between different rates or prices, the Basle Committee's WAP-based approach is related to the portfolio standard deviation. Specifically, the portfolio variance is theoretically equal to a weighted sum of the squares of GAP and NAP. (For details, see Levonian 1994.) It follows that WAP, as a simple weighted sum of the same GAP and NAP, plausibly can be viewed as a linear approximation to the portfolio standard deviation; with correctly chosen weights, WAP could be a reasonable measure of the market risk of a bank's portfolio.

Why not just use the portfolio standard deviation itself, instead of something like WAP that is at best an approximation? Calculating a portfolio standard deviation is complicated, at least compared to typical banking regulations. In addition, it requires estimates of market volatilities and correlations, and these would be difficult to codify into capital standards. Such complications tend to increase the costs of implementing and enforcing the standards, and raise the cost to banks of complying. The precision of a risk measure such as the portfolio standard deviation would bring some benefits, but perhaps not enough to outweigh the added costs of complexity. International regulatory bodies consistently have preferred simpler approaches, and WAP represents a happy balance of precision and simplicity.

### Choosing the weights

Theoretical modeling shows that WAP can be a good proxy for the actual risk, if the weights are

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chosen properly. Theory also has implications for the best weightings of GAP and NAP. Each constructed bank portfolio consists of net positions in its various components: currencies, equity issues, or debt maturities. The model suggests that, ideally, NAP should be weighted more heavily the larger the number of distinct components, or the more highly correlated movements in the prices of the components tend to be, with GAP given correspondingly less weight under those conditions. Together, the number of components and the correlations determine the best *relative* weights on GAP and NAP; the *absolute* level of the weights depends on the overall market volatility of exchange rates, interest rates, or stock prices.

Many elements of the Basle Committee's proposals are roughly in line with the results of the theoretical model. For example, the equity risk proposal places higher absolute weights on NAP and GAP than does the foreign exchange risk proposal; this makes sense, since stocks are generally more volatile than currencies. For diversified equity portfolios, the weight on GAP is reduced to 50 percent; this fits with the theoretical observation that GAP *should* get relatively less weight in diversified portfolios.

The proposal covering the interest rate risk arising from traded debt securities has a more complicated structure, and although similar, it is not exactly the same as the other two segments. However, it too is broadly consistent with the implications of the theoretical model. Longs and shorts are netted in stages, within and then across maturity bands. At each stage some of the netting is disallowed, meaning that some portions of the opposing short and long positions are not permitted to offset. As described in Part 1, the effect of the disallowances is to set relative weights for NAP and GAP at each stage of the calculation, with a smaller disallowance factor implying heavier weight on NAP.

Ideally, NAP should get more weight if correlations are higher, and this is precisely what happens in the proposal: Disallowance factors (and therefore the weights on GAP) are low for debt securities with similar maturities, which are likely to be highly correlated. Within a single maturity band, the weights implied by the disallowance factors are 95 percent on NAP, 5 percent on GAP. Exposures in different maturity or repricing bands tend to be less correlated, and the disallowances shift the weights for netting

across adjacent bands to 85 and 15 or 80 and 20 percent. Disallowances are highest for exposures at opposite ends of the maturity spectrum: When netting long term against short term, the weight on NAP is only 25 percent, with 75 percent on GAP. Thus, the system of disallowances is a simple, logical way to incorporate the fact that not all interest rates change in the same way at the same time.

## How good?

The results of the formal, abstract model suggest that *in principal* WAP could work as the basis for market risk capital standards. But the Basle Committee has proposed specific variants of WAP, with specific weights, for each of the three types of market risk. Whether the Basle proposals are likely to work well in practice can be judged only by examining how well they track risk in actual bank portfolios.

To develop a feel for the empirical performance of at least one of the three proposals, I examined data that federal banking supervisors have collected on U.S. banks' foreign currency exposures. The data are consolidated foreign currency exposures for each bank at particular reporting dates. Bank portfolios from 1990, 1991, and 1992 were sampled. From these, it is straightforward to compute GAP, NAP, and WAP.

The standard deviation of changes in the value of these bank portfolios is needed as a benchmark for evaluating the performance of the Basle Committee's equally weighted WAP. This requires estimating variances of all of the relevant exchange rates, as well as their correlations. Exchange rate data for these calculations came from the period 1980–1992. The variances are combined with the bank currency portfolios to provide the benchmark measures of actual foreign exchange market risk.

Tests showed that the Basle Committee's foreign exchange proposal works well: equally weighted WAP picked up over 95 percent of the variation in foreign exchange risk as measured by the theoretically correct portfolio standard deviation. WAP was clearly proportional to portfolio risk, and the proportional relationship has been largely stable over time. Such good performance is remarkable from a simple construct like WAP.

Similar empirical analysis of the other two parts of the market risk proposals would be useful. Some testing has been done at central banks in

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various countries. The bulk of those analyses and their results are confidential; however, they generally support the methods and weightings incorporated in the proposals.

### **Conclusion**

The approach to market risks and bank capital standards taken by the Basle Committee rests on a solid conceptual foundation. A theoretical analysis shows that it might be expected to work well in principle; the specifics as formulated by the Basle Committee seem broadly in accordance with the theory. Empirical tests of one part of the plan, the proposal for foreign exchange risk, suggest that at least this aspect of the framework is likely to work well in practice. The Basle Committee's proposals not only are simple, and therefore practical, but seem reasonably precise in their assessment of the market risks banks face.

The Basle Committee has asked for comments on the draft proposals. Testing and refinement of the framework will continue, probably for some time. As discussed in this pair of *Weekly Letters*, the current version of the market risk capital standards looks promising, and should help correct some of the more obvious deficiencies of the original 1988 risk-based capital standards.

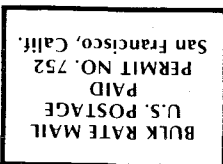
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### **Reference**

Levonian, Mark. 1994. "Bank Capital Standards for Foreign Exchange and Other Market Risks." Federal Reserve Bank of San Francisco *Economic Review* (forthcoming).

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