

A Primer on the Risks of International Lending and How To Evaluate Them

*By Janice M. Westerfield**

Among recent changes on the U.S. banking scene, surely one of the most dramatic has been the surge in international lending. Loans to foreign governments, firms, and individuals have grown both in volume and in earnings, and some aggressive international bankers have found that their foreign earnings actually exceed their domestic ones.

The steep upward trend in international involvement, which is tied in with overall trade expansion and new opportunities for profit, has brought different kinds of risks as well as substantial returns. The lender who makes loans in foreign countries has all the risks that he would have at home. But, beyond these, he has to consider risks which derive from the unique political, social, and economic conditions of the country in which the loan is placed.

These risks obviously are important to

*Janice M. Westerfield, who received her Ph.D. from the University of Pennsylvania in 1974, writes frequently on international finance and trade.

bankers because banking is a profitmaking industry and risk affects profit. Now that international lending has become such a high-volume business, the possibility that foreign loan losses might have an adverse impact on the American banking industry as a whole has become a matter of concern to government and to the public.

Even the most careful risk management won't obviate all the hazards of lending in foreign countries. But bankers are working hard to identify, evaluate, and reduce the risks that go with foreign lending. And those who succeed in reducing their risks, through geographical diversification of their loans, or by other means, stand a good chance of receiving returns that repay their efforts abroad.

U. S. BANKS GO INTERNATIONAL

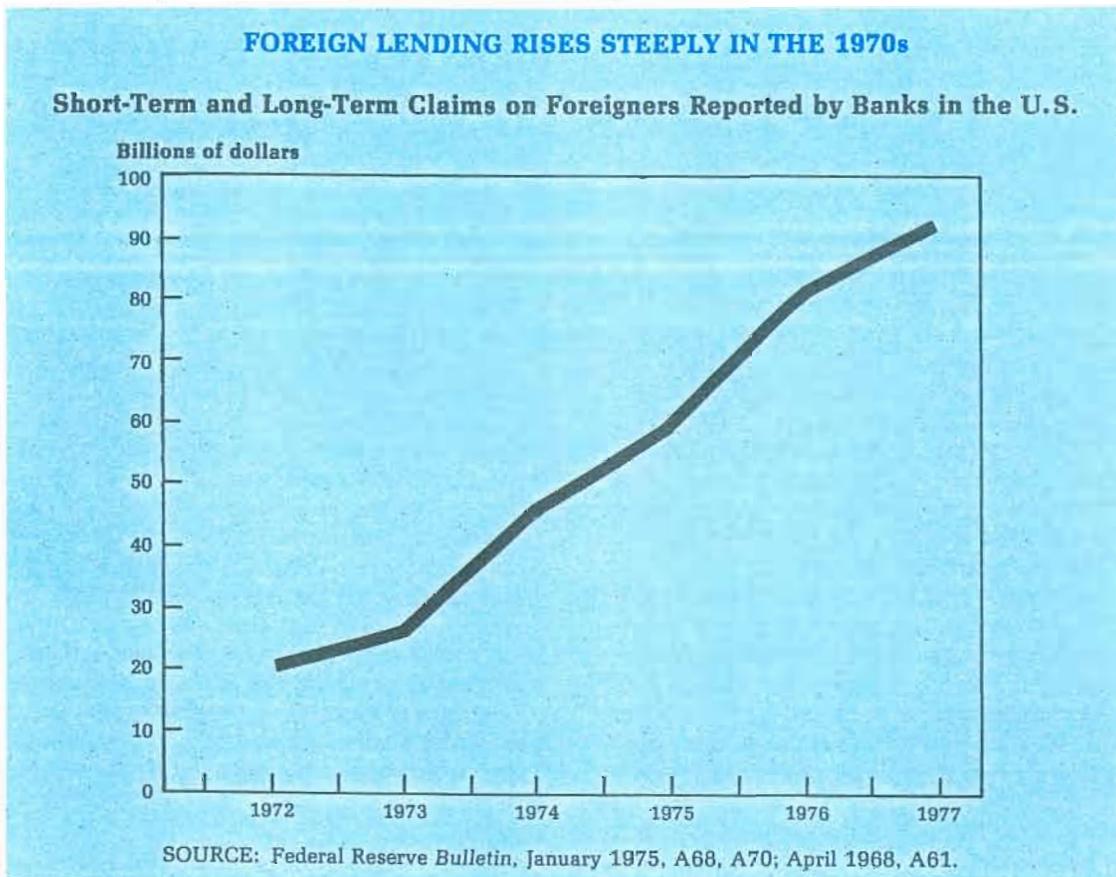
Since the beginning of the decade, U.S. banks have moved decisively into international finance, increasing their foreign claims and their earnings from foreign assets.

Growth . . . The statistics tell most of the international lending story.

Foreign claims of banks in the U.S. have grown from about \$21 billion in 1972 to over \$92 billion in 1977—a compound annual growth rate of 30 percent. And foreign branches of U.S. banks now have about double that volume of claims on foreigners. Earnings of foreign assets also are up sharply, especially in relation to domestic earnings. A Salomon Brothers study of thirteen large bank holding companies found that, from 1970 to 1976, their foreign earnings rose by

about \$700 million while earnings at home grew by less than \$40 million.¹ Thus 95 percent of the increase in their total earnings came from international operations. By 1976, foreign earnings accounted for more than half of total earnings for six of these bank holding companies. For the whole group, foreign earnings averaged 43 percent of total earnings (see FOREIGN LENDING RISES...).

¹Thomas Hanley, Salomon Brothers, 1976, U. S. *Multinational Banking: Current and Prospective Strategies*.



. . . **And Its Causes.** The growth of international banking operations is related to a number of developments, especially the overall expansion of U.S. trade with other

countries. Also important have been the spread of multinational corporations, the effect of government regulation on domestic profit opportunities, and the impetus for

financing trade deficits that changes in petroleum prices have generated in some foreign countries.

U.S. trade has increased. American merchandise exports rose from \$50 billion in 1972 to \$115 billion in 1976, and imports showed similar growth. Much of this growth in dollar value—part of it real, part of it caused by inflation—was financed by U.S. banks, through letters of credit and banker's acceptances and through other instruments. To take a simple illustration: An exporter may ship goods in July and desire payment immediately, but the importer probably won't have the funds to pay until he receives the goods in October. Under circumstances such as these, both parties may agree to have a bank forward payment to the exporter and lend money to the importer through creation of a banker's acceptance during the time the goods are in transit. Once the importer receives and processes his shipment, he reimburses the bank for the amount of the acceptance (including applicable interest). Trade financing of this sort has become commonplace for U.S. banks.

Many firms that first incorporated in the United States now operate through subsidiaries in other countries and have a significant percentage of their assets and employment positioned abroad. As these firms have expanded into foreign countries, they have brought their bankers with them. In Europe alone, for example, U.S. multinationals, with substantial financing by U.S. banks, have upped their direct foreign investment to over \$56 billion.

This investment has paid off. Over the period 1966-75, sales by American affiliates in Europe rose by about 9 percent per year in real terms. And although reduced earnings prodded U.S. businesses to cut their foreign subsidiaries somewhat in 1976 and 1977, there remains a significant amount of multinational activity in Europe, and in other parts of the world, for U.S. banks to finance.

Interest in foreign banking operations probably has been encouraged by the regula-

tory environment at home. It's certain that domestic banking regulations helped to shape the responses of U.S. banks to changes in trading patterns. In the 1960s, the Federal government imposed controls on outflows of U.S. financial capital. These controls encouraged American corporations to finance their foreign investments with foreign funds. But in order to accommodate their corporate customers, U.S. banks set up foreign branches that tapped foreign capital sources. For this reason and others, branches of U.S. banks became more firmly established abroad. And this result was abetted by Regulation Q, which, by limiting the interest rates paid on domestic deposits, further induced U.S. banks to set up foreign branches to supplement their traditional sources of funds. The number of overseas branches increased from 180 in 1965 to 732 in 1975.

Thus regulation, along with the internationalization of U.S. corporate activities, helped spur the growth of overseas branches. And despite some regulatory changes, there remain considerable incentives for setting up overseas offices to service multinational corporate customers.

Finally, *balance-of-payments deficits* in other countries have played an important role in the growth of U.S. bank claims on foreigners. Especially since the quadrupling of oil prices in 1973, many third-world countries have been unable to generate enough export earnings to pay their oil import bills without outside help. Among these countries, the poorest have had little access to credit markets; but others have found help in the form of medium-term loans from U.S. commercial banks. Substantial credits have been extended directly to foreign governments or their dependencies rather than to businesses or individuals.

Thus American banks have been responsive to large-scale developments in world trade as well as to regulation at home and payments shortfalls in other countries. And they are striving to consolidate the gains they have made so far as well as to explore new

foreign profit opportunities. But their foreign operations have brought new kinds of risks—risks which deserve close scrutiny.

IDENTIFYING FOREIGN LOAN RISKS

The primary principles for foreign lending are the same as for domestic—define and assess risk exposure and then reduce the risk that borrowers will default. But when a prudent banker makes a loan abroad, whether the borrower is an individual, a firm, or a government, he'll be thinking about not only these principles but also country risk.

Basic Risks. The chances that a loan will be repaid in full are affected by many characteristics of the borrower. The less sound the borrower is financially, the greater the risk that part of the interest or principal of the loan will not be repaid. Thus an understanding of the financial condition of the borrower is important for domestic and foreign loans alike.

Besides the amount of repayment, the time of repayment also affects risk. Just as his domestic counterpart, the international lender must consider what he needs to preserve the overall liquidity of his portfolio. Liquidity—the ability to meet day-to-day obligations—may be impaired by having too much money tied up in long-term investments. Loans maturing in, say, five years cannot be used to pay liabilities due in six months. Thus the lender has to know not only how much of a return he can expect on his loan but also when he can expect to get it. And there are circumstances which could make a lender less confident of his expectations when he deals with foreign borrowers than when he deals with domestic ones.

Country Risk. There are certain risks that can attach to a loan just because it is placed in a foreign country. One kind of country risk is *sovereign risk*, which derives from the unique mix of political, social, and economic institutions that characterizes a sovereign state. Another kind is *currency risk*—the risk

that a loss will be caused by currency restrictions or trade barriers.

Default occurs whenever a borrower fails to repay either the principal or the interest on a loan. Sometimes a borrower may want to reschedule debt—to stretch out payments because they can't be met out of current resources. When a loan is rescheduled, the borrower usually must pay an interest penalty to compensate the lender for the higher risk of eventual loss. But the lender still may lose out on part of his return; and even if he doesn't, his liquidity may be reduced by having his money tied up longer than expected. A foreign government that can offer assurances against default and rescheduling of loans to private borrowers and autonomous government agencies will make such loans more attractive to international lenders.

Sovereign risk is closely tied to political developments, particularly the attitudes of the government authorities towards foreign loans or investments. Some countries attempt to smooth the way for foreign funds, whether those funds are flowing to public or private borrowers. But others make it very difficult to establish and maintain profitable lending operations. Minor obstacles can appear in the form of wage-price controls, profit controls, tax and legal restrictions, and so on. These forms of government interference generally raise the costs of doing business and sometimes reduce the chances that the lender will be fully reimbursed. Further, they may be signs that the borrower should face up to the possibility of nationalization of an investment, expropriation of assets, or prohibition of foreign loan repayment—any of which could change the risk picture.² Although the chance of expropriation may be small, the loss associated with it is so complete that it cannot be ignored. Sometimes partial compensation is offered, but even

²There are few recorded cases of large-scale nationalization by a foreign government. Chile and Cuba appear to be two examples.

this may be delayed for long periods while host governments negotiate with foreign investors or lenders.

Currency risk, which can occur by itself or in combination with sovereign risk, has to do with currency value changes and exchange controls. Some loans are denominated in foreign currency rather than in dollars, and if the currency in which the loan is made loses value against the dollar during the course of the loan, the repayment will be worth fewer dollars when the loan comes due (though the asset loss may be offset by liabilities in the same currency). Because not all foreign currency markets are well developed, international loans sometimes cannot be hedged to reduce this kind of currency risk. Credits that are denominated in dollars, as most are, also may be subject to currency risk. Exchange controls, which are relatively common in developing countries, may limit the cross-border movement of funds or restrict a currency's convertibility into dollars for repayment. Or exchange rate changes may affect the borrower's capacity to generate sufficient earnings to pay off dollar loans.

All in all, the lender who wants the returns that go with foreign operations must be prepared to make an extra effort to identify his risks. But that's only the beginning. Once it's known what *can* happen, the lender has to evaluate the likelihood that it *will* happen. And that takes information.

RISK EVALUATION

Lenders have different ways to evaluate risk. In some cases they use in-depth studies of foreign countries. In others they use statistics that indicate a borrower's financial condition or checklists that pull together economic, social, and political data.

In-depth studies usually are based on both statistics and other information about a country's economic and financial management. Depending upon the extent of a bank's international operations, its evaluations may be quite comprehensive. Besides background information on basic economic trends in the

foreign economy, these evaluations often contain careful analyses of inflation, fiscal policies, trade and capital flows, debt accumulation, political stability, and other variables.³ Since some circumstances that affect country risk cannot be captured in statistics, it is inevitable that practical judgment and experience also come into play. And lenders who maintain branches or representative offices abroad may rely on their staffs not only to generate business but also to help them keep up with local developments that aren't reflected in a timely way by indicators and checklists. So the overall in-depth evaluation of a country is likely to come from many sources.

When bankers find it too costly or time consuming to get in-depth analyses, they may turn to on-site reports, checklists, and statistical indicators—separately or in combination—for assessing the debt-servicing capabilities of prospective borrowers. These aids may not be long on theory, but they do provide ways to get a grip on the information that a loan officer has to grapple with.

Some of the statistical indicators are designed to measure foreign exchange earnings entering a country against outgoing expenditures for debt servicing. The debt-service ratio was the first such indicator to be used extensively. This ratio states a country's interest and amortization payments as a percentage of its export earnings from goods and services. Other indicators, such as the current account deficit, net interest payments, and growth rate of real GNP, have been developed to supplement the debt-ser-

³The way country risk is assessed will depend somewhat upon the purpose for which the assessment is to be used. Bankers are interested primarily in avoiding debt-servicing difficulties and in making profitable loans. International institutions such as the International Monetary Fund want country studies as background information for annual consultations or for approving drawings from one of the Fund's facilities. The World Bank does its country evaluation studies for the purpose of deciding how much to loan and what kind of technical assistance to provide to its various members.

vice ratio. And sometimes, because any of these individual indicators used alone may be misleading, several of them will be combined to construct composite indicators for more reliable identification of problem borrowers (see STATISTICAL INDICATORS).

Somewhat similar are the checklists of economic, social, and political variables that some bankers use along with their statistical indicators. These checklists are designed to yield supplementary information about a country's economic and financial management. The checklists are not standard from bank to bank, but they usually include variables about GNP, money supply growth, foreign trade, debt accumulation, and so on. The checklist items generally are not ratios, as the statistical indicators are, but they can

be assigned numerical ratings and aggregated into a total score for each country.

Neither the checklists nor the statistical indicators are reliable predictors of debt-servicing difficulties. Often they signal false alarms. Most of the indicators and checklists describe conditions as they were a year or two ago. Even when current, they describe the situation only as it now is; they do not tell how the picture will change in the future. And predicting debt-servicing difficulties is essentially peeking into the future. Nevertheless, these indicators may serve as warning signals that a prospective foreign borrower ought to be examined more closely.

Thus the lender has to decide how much information he needs to negotiate a loan with a prospective borrower, and then he has to go

STATISTICAL INDICATORS

Several indicators are used by international lenders to gauge country risk. These indicators, and the techniques of using them, do not have a high degree of reliability as predictors of debt-servicing difficulties. But they still may provide useful information to lenders.

The *debt-service ratio*, which probably is the most commonly used statistical indicator, measures foreign exchange earnings channeled into debt servicing against total exchange earnings from (current account) exports.

The ratio of the current account deficit to export earnings from goods and services—the *current deficit-export ratio*—measures temporary balance-of-payments difficulties and may fluctuate considerably from year to year. When combined with the *cumulative deficit-export ratio* over, say, a three-year period, the current deficit-export ratio can give a longer term picture of the amount and rate of growth of a country's debt burden.

The *interest-reserve ratio* measures net interest payments on external debt against international reserves in the most recent period. The interest payments reflect the debt interest burden for all debt accumulated. (Amortization data, which is not comprehensive in any case, is excluded.) This ratio measures the short-run ability of a country to meet its interest payments—out of international reserves, if necessary. The focus is on reserves as a last source of funds to service debt.

A variant of this ratio which also uses net interest payments is the *interest-export ratio*. This measures the debt interest burden against average annual export receipts and is a proxy for the debt-export ratio.

Indicators such as these focus on a country's ability to repay its external debt out of current account export earnings. But a reduction in these earnings needn't lead to debt-servicing difficulties or attempts to cut back imports, since grant aid, capital inflows, and international reserves may be used along with export earnings to service debt. Thus a country may have more flexibility than is suggested by external debt indicators.

Other indicators, which chart both internal and external economic conditions, are used for overall ranking purposes as well as for in-depth country studies. Some measures suggested by the literature include economic growth rates of gross domestic product and money supply as well as export earnings stability and level of economic development.

out and get it. If the information simply is not available, or if it indicates too high a risk for the expected rate of return, the loan applicant may be turned down. But even if the decision is made to go ahead with the loan, the prudent banker will want to reduce the risk of loss.

METHODS OF REDUCING RISK

Bankers have several ways to cut risk. They can seek third-party support in the form of loan guarantees or management assistance for borrowers; they can share risk exposure with several lenders; or, most important, they can diversify their loans among several borrowers or areas. And the regulatory authorities may be able to assist international lenders in holding down their country risk exposure.

Third-Party Help. One way for a banker to reduce the risk on a loan is to get a third party to agree to pay back both principal and interest if the borrower defaults. Foreign governments and central banks sometimes act in this capacity. But the guarantee is good only so long as the backer is solvent and adheres to the contract. And if the same government or central bank guarantees several loans, there's a chance that its ability to supply the required funds might be strained if more than one of these loans were to require funds at the same time.

An alternative to the foreign government guarantee is the external guarantee by a parent company or outside institution. The Overseas Private Investment Corporation, for example, offers programs to insure bank loans against the risks of war, expropriation, and inconvertibility, as well as to finance loans directly. Also, the U. S. Export-Import Bank (Eximbank) guarantees medium-term loans made by commercial banks against both political and credit risk. And the Foreign Credit Insurance Association, acting as agent for member insurance companies and the Eximbank, offers insurance against these risks.

Another form of third-party help that many bankers find reassuring is the presence of institutions such as the International Monetary Fund. The IMF does not assist the lender directly. It does not, for example, provide commercial bankers with its country reports. But it can put the lender's mind more at ease by fostering conditions in a borrower country that increase the likelihood of loan repayment.

In the course of determining whether a country that has balance-of-payments difficulties is eligible to draw from its funding facilities, for instance, the IMF examines the prospective borrower's current condition and economic policies. And it negotiates measures that the borrower must take to qualify for eligibility. A country's adherence to these measures, which the IMF monitors, can increase the probability that the borrower will be able to repay without difficulty. Thus the international banker benefits indirectly but importantly from having the IMF on site.

Risk Pooling. When third-party assistance isn't available, bankers still can cut the risk for any one institution by making a participation loan. Under this kind of arrangement, several banks combine their funds to reduce exposure directly for individual banks. This type of effort may include a sharing of expertise among the participants, but generally each bank wants and is expected to make its own assessment. Since participation loans sometimes are large and involve big-name banks, the country that gets them probably will feel that its access to credit markets will be served best by prompt repayment.

While third-party presence may reduce default risk and pooling may lessen the exposure of individual banks, there is another strategy that deserves consideration. Instead of focusing on each loan prospect in isolation as it comes along, the banker can examine each one for its effect on risk to the total loan portfolio.

Diversification. The portfolio approach to

managing assets is important to bankers because they want to maintain a steady stream of returns over time. The typical lender does not want to put all his eggs in one basket, where they all can be broken simultaneously. And, in any case, he is prevented from doing so by legal restrictions. Instead, he diversifies the portfolio by investing in a variety of loans, so that, in case one borrower defaults, the earnings from other investments will minimize the effect of the loan loss on the bank's total earnings.

But whether diversification reduces risk for a given portfolio depends on how the returns on individual loans are correlated with one another—to what extent they are affected in similar ways by common conditions or events. Diversification will be a source of potential risk reduction if returns on individual loans are not perfectly correlated.⁴ Thus of two loans with the same rate of return and riskiness, the one that is less perfectly correlated with the rest of the portfolio will be the more attractive; and it may even happen that a loan with a relatively low rate of return will be a useful addition to a portfolio because it's imperfectly correlated with the rest of the portfolio's contents (see Appendix).

Portfolio diversification can be pursued in several ways, of which geographical dispersion may be the most obvious. When loans to a foreign recipient are under consideration, it's usually the country-specific aspects of the loan that are first considered. That is, everything else being held constant—the maturity, loan guarantee, characteristics of the firm and industry, and so on—it's the sovereign state that makes the difference.

⁴Citicorp states this point in its 1976 annual report (p. 25) as follows: "Overseas earnings, which contributed over 70 percent of the total earnings in 1976, are derived from doing business in more than 100 countries. Citicorp's worldwide policy of broad diversification of both assets and liabilities helps maintain earnings stability and reduces the risk of excessive concentration in any one particular country, currency, or industry."

This element in the choice among countries is what is identified most commonly as country risk.

But the choice among countries may ignore another source of country exposure, and that is loan concentration. A bank develops expertise in certain countries and cultivates sources yielding first-hand information, which is essential to sound decisionmaking. Furthermore, detailed knowledge of the borrower is required in order to form opinions about probabilities of repayment. The argument can be made that expertise built up in a country over a long period is hard to beat. But if several loans have already been generated in, say, Country A, an additional loan in Country A may actually be more risky than a first loan in, say, Country B. Why? Because risks of excessive concentration may not be fully offset by first-hand information.

The risks of undue concentration stem from the possibility that a common factor may have an adverse effect on all the loans in a given country. This is because the economic and political management of a country influences all its economic units. If some adverse development should occur, many units within the country would be similarly affected. Take the case of a country that depends on two or three export products for its foreign exchange earnings. Although foreign exchange may also be obtained from other sources such as capital inflows or reserves, many countries derive foreign currency supplies primarily from export earnings. When the export market for a country's products deteriorates and foreign exchange earnings fall short, the government, its agencies, and many businesses all may have insufficient earnings to repay debts on schedule.⁵

Besides the effects of sovereignty and concentration on country exposure, interac-

⁵A few countries rely mainly on earnings from just one export to repay their debts. A fall in the price of this export can produce debt-servicing difficulties and consequent debt rescheduling.

tion effects between foreign and domestic loans are important for diversification. Thus a bank's portfolio ought to be considered in its entirety and not analyzed in separate foreign and domestic sections. Risk to the overall portfolio probably can be reduced when some foreign loans are added to a predominantly domestic portfolio. The reason is that the business cycles of most other countries differ in timing and magnitude from those of the U.S., and so foreign borrowers and domestic borrowers are unlikely to suffer from overall economic declines at the same time. Thus diversification can be construed broadly over country, currency, industry, maturity, and so on.

Reducing portfolio risk for the same expected return (or else increasing the return for the same risk level) is the benefit the banker hopes to get through diversification. It follows that international lenders have a lot to gain by diversifying their loan portfolios. Spreading out their loans to achieve a relatively constant return is the best hedge against crippling loan losses. Even though there may be great advantages to specializing in one country and becoming thoroughly acquainted with conditions there, bankers ought to be willing to sacrifice some information advan-

tage for the security of diversification.

How Regulators Can Help. The agencies that regulate American banking have watched international developments more and more closely as the volume of lending has grown. They recognize that geographical expansion has brought a new kind of risk, and they are interested in assuring the soundness of U.S. banking efforts abroad.

The regulator's position is a delicate one. Mere acceptance of international lending guidelines that banks set for themselves may not provide an effective level of monitoring. But imposition of uniform limits on the volume of a bank's foreign loans, for example, could operate to restrict foreign profit opportunities severely, with consequent harmful effects on the overall health of the American banking system (see SUPERVISION AND COUNTRY RISK).

The answer appears to lie in helping banks improve their information on foreign borrowers and avoid unusually large concentrations of credit in a single country. At present, the agencies with the heaviest involvement in international lending—the Federal Reserve System, the Comptroller of the Currency, and the Federal Deposit Insurance Corpora-

SUPERVISION AND COUNTRY RISK

The growth of U. S. bank claims on foreigners and the increase of other capital flows are major developments requiring assessment by the U. S. monetary authorities. Because information about happenings in the rest of the world often is incomplete, this task is a difficult one. The first step may be to gather information about the magnitude and geographical distribution of foreign exposure. The Federal Reserve, the Office of the Comptroller of the Currency, and the Federal Deposit Insurance Corporation are doing just that in a semiannual country exposure report of more than 400 banks, their overseas branches, and subsidiaries. The detailed information on borrowers and maturities is designed to assist these agencies in judging the risks that banks face in their international lending.

Several policy proposals are being discussed now, such as guidelines that would guard against excessive loan concentration in one country in relation to a bank's total capital. Others involve closer monitoring of bank internal procedures. Further, last January the Comptroller of the Currency issued a ruling on loan concentration designed to clarify the interpretation of banking law which limits national bank loans to individual borrowers to 10 percent of total bank capital. This ruling attempts to define the conditions under which governments, their instrumentalities, and their agencies can be considered separate borrowers.

tion—are moving deliberately forward with such an approach. They are developing a data collection system that will help banks track their foreign exposure by recording the volume and maturity of loans in a given country, whether the loans have external guarantees, and whether they are denominated in local or nonlocal currency (usually dollars). This approach provides an analysis of loan concentration by country with respect to a bank's overall financial capital. With this information in front of them, bank managers and examiners are in a position to evaluate lending procedures and portfolio risk.⁶

SUMMING UP

Lending to foreigners involves country risk exposure and requires an assessment of risks of government policies and risks of currency or trade restrictions. Commercial bankers perceive that the profitability of their foreign operations and thus a substantial portion of their earnings vary directly with how well they evaluate foreign risks. Gov-

ernment authorities, as well, stress the importance of a careful analysis of country risk to ensure sound banking practices.

Because of the problems associated with incomplete information, bankers, regulators, and other concerned parties have developed a mix of qualitative and quantitative methods to evaluate risks associated with foreign claims. Yet, in the past, these measures have tended to focus on a single country and its political, economic, and social fabric. While these indicators are useful, they generally ignore how a single event might adversely affect a whole country. Nor do they recognize how countries depend on one another in the trading, financial, political, and other spheres.

Since these common relations are reflected in returns on loans, appreciable gains may be made from examining how an individual claim fits into the overall portfolio. Diversification of loans is essential if risk to the total portfolio is to be kept at an acceptable level. And imperfect correlation of returns is the key to successful diversification. As international operations continue to grow, bankers can be expected increasingly to explore the benefits that diversification could bring to the world of foreign lending.

⁶See "A New Supervisory Approach to Foreign Lending," *Quarterly Review*, Federal Reserve Bank of New York, Spring 1978, pp. 1-6.

APPENDIX

DIVERSIFICATION CAN REDUCE RISK

Suppose that a U. S. bank has decided to allocate \$1 million of its funds to foreign loans in Country A or Country B. The bank feels it has developed some expertise in Country A, and it already has made several loans to public or private borrowers there. It has no loans outstanding in Country B. The maturities of the loans will be the same in whichever country they're placed.

The bank's international experts know the rate of return over the maturity of each loan and the probability of default. Using these basic data, they can calculate both the expected return and the variance of return. (Variance of return measures risk and is a function of the probability of obtaining a return that differs from the expected return.)

The loan to Country A would have a yield to maturity of 10 percent and a default risk of 2 percent.

The calculation for the loan's expected return then is:

$$E(R_A) = 0.98(0.10) + 0.02(0) = 0.098.$$

The calculation for its variance is:

$$\text{var}(R_A) = 0.98[0.10 - E(R_A)]^2 + 0.02 [0 - E(R_A)]^2 = 0.00033.$$

Note that a 2-percent default risk means that the bank has a 2-percent chance of receiving no payment on its loan and a 98-percent chance of receiving the full 10-percent yield.

The loan to Country B would have a yield to maturity of 10.2 percent and a default risk of 4 percent. Calculations will show that the loan to Country B would have the same expected return as Country A's—0.098—but a higher variance—0.00040. Thus the whole picture would be as follows:

	Yield to Maturity	Default Risk	Expected Return	Variance of Return
Country A	10.0%	2%	0.098	0.00033
Country B	10.2%	4%	0.098	0.00040

Assume, however, that the bank wants to diversify by splitting the \$1 million 50-50 between the two countries instead of lending the full amount to the country with the lower variance—Country A. Further, assume that the returns on the loans to Country A and Country B move together somewhat and have a correlation coefficient $c = 0.4$. Finally, assume that the portfolio has an expected return that is equal to the expected return on the loan to Country A while the variance is less than it would be if the full amount were loaned to Country A:

$$\begin{aligned} \text{var}(R_P) &= X_A^2 \text{var}(R_A) + X_B^2 \text{var}(R_B) + 2c_{AB} X_A X_B \sigma_A \sigma_B \\ &= 0.00026. \end{aligned}$$

The loan to Country B has the same expected return as, and a higher variance than, the loan to Country A. But when Country B is added to the portfolio, the variance of the portfolio as a whole is less than the variance of either individual loan. Thus the variance of return on the individual loans has been offset by the less than perfect correlation among the returns. Diversification has reduced portfolio risk for the same expected return.

If the bank desires to find out what percentage allocation to Country A would *minimize* the variance of the portfolio return, this percentage (X_A^*) can be computed as well.† The minimum-variance portfolio turns out to have 58 percent loaned to Country A and 42 percent loaned to Country B. Again, diversification reduces portfolio risk for the same expected return, although the variance— $\text{var}(R_P^*) = 0.00025$ —is only marginally less than that of the 50-50 portfolio.

$$\begin{aligned} \dagger X_A^* &= [\text{var}(R_B) - c_{BA} \sigma_B \sigma_A] / [\text{var}(R_A) + \text{var}(R_B) - 2c_{BA} \sigma_B \sigma_A] \\ &= 0.58. \end{aligned}$$

$$X_B^* = 1 - X_A^* = 0.42.$$

FEDERAL RESERVE BANKS AND BOARD OF GOVERNORS

Publications Services
Division of Administrative Services
Board of Governors of the
Federal Reserve System
Washington, D.C. 20551

Federal Reserve Bank of Atlanta
Federal Reserve Station
Atlanta, Georgia 30303

Federal Reserve Bank of Boston
600 Atlantic Avenue
Boston, Massachusetts 02106

Federal Reserve Bank of Chicago
Box 834
Chicago, Illinois 60690

Federal Reserve Bank of Cleveland
P.O. Box 6387
Cleveland, Ohio 44101

Federal Reserve Bank of Dallas
Station K
Dallas, Texas 75222

Federal Reserve Bank of Kansas City
Federal Reserve Station
Kansas City, Missouri 64198

Federal Reserve Bank of Minneapolis
Minneapolis, Minnesota 55480

Federal Reserve Bank of New York
Federal Reserve P.O. Station
New York, New York 10045

Federal Reserve Bank of Philadelphia
100 North Sixth Street
Philadelphia, Pennsylvania 19106

Federal Reserve Bank of Richmond
P.O. Box 27622
Richmond, Virginia 23261

Federal Reserve Bank of St. Louis
P.O. Box 442
St. Louis, Missouri 63166

Federal Reserve Bank of San Francisco
San Francisco, California 94120
