

Bank Lending to Non-OPEC LDCs: Are Risks Diversifiable?

Since the 1973-74 quadrupling of oil prices, the largest United States and foreign commercial banks have substantially increased their involvement in international lending, including lending to non-OPEC less developed countries. This lending is an important link in the recycling process whereby surpluses from oil-exporting countries, in the form of deposits, are channeled to less developed countries (LDCs), in the form of loans, to finance their deficits.

The recycling process was an inevitable outgrowth of the first oil shock. A small group of oil-exporting nations—Organization of Petroleum Exporting Countries (OPEC)—accumulated a huge current account surplus in 1974-77, while both non-OPEC developing countries and industrialized countries ran a deficit in those years. Industrialized countries were able to finance their deficits in varying degrees through direct capital inflows from the OPEC countries. By contrast, the non-OPEC LDCs did not attract direct OPEC investments but, instead, sought to finance a substantial part of their deficits by borrowing funds from the international banks that were taking OPEC deposits.

As these large flows of funds occurred, many analysts began to express concern about the risks that banks face as a result of their participation in the recycling process. These concerns escalated after the second round of large oil price increases in 1979-80. During these years the average price of a barrel of oil more than doubled from \$14 to \$32.50 per barrel. The OPEC surplus, having declined from \$64 billion in 1974 to \$5 billion in 1978, swelled to \$120 billion in 1980, with nearly one half of these flows invested in commercial banks of the industrialized countries. Mean-

while, the deficits of the non-OPEC LDCs, having declined from \$38 billion in 1975 to \$21 billion in 1977, increased sharply to \$65 billion in 1980.

While there is nothing particularly new about recycling—banks have always played the role of intermediation between savers and ultimate investors—recycling does have several special characteristics. First, while governments have always deposited funds in commercial banks, the magnitude of the OPEC deposits together with the small number of countries and commercial banks involved is unique. More importantly, never prior to the 1974 oil shock had non-OPEC LDC governments used financial intermediaries for balance-of-payments financing on such a large scale. The latter aspect of recycling has exposed the largest United States and foreign commercial banks to country risk. Country risk can be thought of as the group of risks arising from the economic, political, legal, and social conditions in a foreign country that may have adverse consequences for loans extended to borrowers in that country. Thus, as discussed further in Box 1, the risks faced by financial intermediaries in the recycling process are somewhat different from those confronted in domestic and international financial intermediation.

Concern about country risk was greatly exacerbated by the financial intermediaries' increased exposure to non-OPEC LDCs in the wake of the oil price shocks. The exposure of United States banks to non-OPEC developing countries increased from \$23.8 billion at the end of 1974 to \$47.7 billion at the end of 1977. By December 1980 the figure had further swelled to more than \$73 billion. Foreign banks have increased their exposure even more rapidly, from \$20.0 billion at

year-end 1974 to \$122 billion by December 1980.

This has created the need for improved techniques for banks and their supervisors to monitor country risk. Banks have developed extensive internal procedures to evaluate country risk. The political, economic, and social conditions within each country are reviewed, generally twice each year, more often if close monitoring is necessary. Top management sets maximum exposure limits by country and by area, based on both lending opportunities and country risk considerations. Thus, bank management attempts to control risk by avoiding an excessive concentration of lending to a particular country. If a single borrower seeks a large credit, this can be accommodated via the syndication mechanism in which several banks collaborate to finance the loan.

The three Federal bank supervisory authorities—the Comptroller of the Currency, the Federal Deposit Insurance Corporation, and the Federal Reserve System—implemented a new approach to foreign lending at the end of 1978. The basis of this supervisory approach is to emphasize diversification across countries and types of borrowers to avoid excessive concentration of risk. The regulators attempt to highlight concentrations of lending that are large relative to bank capital or to country conditions for discussion with bank management. The regulators also examine the banks' procedures for monitoring and controlling country risk.¹

Both bankers and regulators emphasize that a careful evaluation of country conditions is appropriate before making a decision on a particular loan. This evaluation process allows the bank to appraise the return on the credit in relation to its risk. In addition, both bankers and regulators emphasize diversification. The logic is that, while credits to a particular country may not be paid off on schedule under all circumstances if the events triggering default differ across countries, the overall risk on the bank's loan portfolio may be very small.

Is this emphasis which bankers and regulators place in diversification warranted? Some analysts are concerned that the benefits to banks of loan diversification among non-OPEC LDCs may be very limited, as these countries face a more or less common set of problems. They are particularly concerned about the heavy dependence on imported oil which the non-OPEC LDCs must purchase at the world price. Others contend, however, that country specific factors are far more important. The LDCs are a heterogeneous

group of countries. Not only are they at different stages of economic development, but they have very diverse political systems, economic policies, and trade structures. Thus, there are indeed many opportunities for loan diversification.

The purpose of this article is to examine empirically the importance of the common risks in LDC loans in contrast to country specific factors. If these country factors are important relative to the common factors, there are substantial opportunities for reducing risk by diversifying lending to many different LDCs. Alternatively, if the common factors are large, compared with country specific factors, the opportunities for reducing risk by lending to many different LDCs will be limited. The intuition behind these concepts can best be explained by reference to portfolio theory.

The concept of diversifiable risk

When selecting its asset portfolio, a bank is concerned with many factors: the expected return on its loans and some estimate of the uncertainty associated with this prediction, the front-end and other fee income associated with its credits, the value of other business relationships which are generated by extending various credits, political considerations, the maturity mix of its assets *vis-à-vis* its liabilities, etc. By abstracting, however, we can consider a bank to be primarily interested in two features. The first is the expected rate of return on the portfolio. This is an average of all possible returns on the portfolio. The second feature is a measure of uncertainty which indicates the extent to which the actual return on the portfolio is likely to diverge from the expected value. The divergence of the actual return on the portfolio from its expected value is measured by the variance of the portfolio.² The bank will choose its asset portfolio in such a way as to maximize the expected rate of return for a given level or variance or to minimize variance for any given rate of return.³

¹ For a description of the supervisory approach to international lending, see the Federal Reserve Board press release issued on November 8, 1978, outlining the uniform examination procedures for evaluating and commenting on country risk factors involved in international lending by United States banks.

² For a clear and rigorous treatment of portfolio theory, see William F. Sharpe, *Portfolio Theory and Capital Markets* (New York: McGraw Hill, 1970).

³ Describing a portfolio solely in terms of two parameters, the expected return and the variance, is technically correct only in two situations: if the rate of return on assets can be described by a particular class of distributions or if the bank has quadratic utility. The acceptable distributions are those which can be completely described in terms of the expected return and the variance which are the first two moments of the distributions. Examples of this class of distributions include the normal and lognormal distribution. In the case of quadratic utility, only the first two moments of the distribution are relevant to the bank. Since the rate of return on loans is a skewed distribution which cannot be described in terms of two parameters, as a loan will never yield more than the promised rate of return, we are implicitly assuming that banks have quadratic utility or a close approximation thereof.

Box 1: Bank Risks

In the normal course of domestic and international financial intermediation, bank management must evaluate a well-known set of risks, namely, interest rate risk, credit risk, liquidity risk, foreign exchange risk, and regulatory risk. But, when banks take an active role in the recycling process, they encounter two additional risks: fund availability risk and country risk. Each of these risks will be explored in turn.*

Interest rate, credit, and liquidity risks are inherent features of financial intermediation. Banks generally hold liabilities of a shorter duration than the rollover period on their assets. Consequently, as interest rates change, banks incur *interest rate risk*. When interest rates rise, banks are forced to fund their lower yielding assets at the new higher rates, cutting into the banks' profit margins. Conversely, when interest rates fall, banks are able to fund their assets at the new lower rates, increasing their profit margin. In periods of volatile interest rates, interest rate risk can be substantial and funding decisions will have a large impact on the profitability of financial intermediaries. Banks can protect themselves against interest rate risk by attempting to match the interest rate structure of their assets and liabilities by tying the return on the former to a rate close to the market rate. Examples of this include banks' pricing their assets as a percentage over the prime lending rate or pricing as a percentage over the London interbank offer rate (LIBOR). To the extent perfect maturity matching is impossible, banks can and do hedge some of the remaining risk in the interest rate futures market.

Credit risk stems from the possibility that an entity may be unable to repay its debts. Banks attempt to minimize this risk by diversifying their loan portfolios and by syndicating a large credit to a single borrower among several banks. Syndication, which allows a group of banks to extend a large credit to a borrower at the same interest rate for the same maturity, is common in both domestic and international financial intermediation. In the former, syndications are rarely publicized, whereas in the latter they commonly are.

Liquidity risk is the risk that the bank, while still solvent, may be unable to make payments as they come due. Although some of these commitments are fixed in

advance, others may be hard to judge, such as when a corporate customer chooses to draw down a deposit or draw against a line of credit. Thus, the bank wants to position itself so that it can meet its unexpected as well as its anticipated obligations. This is achieved by holding liquid assets which can be resold easily in well-developed secondary markets. In addition, banks meet cash needs by borrowing in money markets such as Federal funds or overnight Eurodollars. Each bank must be careful to remain within what is perceived as its share of the market, since an excessive demand for funds could be interpreted as an indication of internal problems. This may cause a reluctance on the part of other banks to lend to a particular bank which, even if unwarranted, may cause a liquidity squeeze.

When a bank moves from purely domestic international financial intermediation, it encounters one additional risk, foreign exchange risk, and substantially increases its regulatory risk. *Foreign exchange risk* is the result of a bank holding a net open position in a foreign currency. This may result from either foreign exchange speculation or a currency mismatching of assets and liabilities. In both cases, as the value of the foreign currency in which the bank has a net open position fluctuates, the bank can experience foreign exchange gains and losses. Foreign exchange risk is a bigger problem for foreign banks than for United States banks, since the dollar is often the vehicle currency in international transactions. Both United States banks and foreign banks often limit their potential losses from foreign exchange risk by allowing each office to have only limited net exposure. This maximum can be set either on a currency-by-currency basis or as a limit on all foreign currencies. In addition, limits are often set on the global operations of the bank. Thus, the head office may offset what seems to be an excessive overall position (even though all branches may be within their limits) to keep its total exposure within desired limits.

Regulatory risk is the risk that reserve requirements, capital/asset ratios, special taxes, or other regulations may be imposed on banking operations in a particular location. Banks generally protect themselves against these by a clause in loan agreements which allows them to pass through the added costs that would result from the imposition of special taxes or regulations. Thus, the banks are able to preserve their profit margins to a great extent should this risk arise.

The role of commercial banks in the recycling process has posed two significant risks above and beyond those confronted in ordinary domestic and interna-

* A slightly different categorization of bank risks can be found in W.E. Moskowitz, "Global Asset and Liability Management at Commercial Banks", this *Quarterly Review* (Spring 1979), pages 42-48. That categorization focuses on the risks in domestic and international financial intermediation and does not examine the unique risks financial intermediaries face in the recycling process.

Box 1: Bank Risks (continued)

tional financial intermediation: fund availability risk and country risk. *Fund availability risk* arises because, while governments have always deposited funds in commercial banks, never has such a small group of surplus governments deposited so many funds in relatively few commercial banks over a prolonged period of time. In normal financial intermediation, if a large customer relies upon a bank for its full range of banking services and the customer withdraws all funds, the one bank can borrow more heavily. In the Euro-market, if a major depositor were to withdraw all funds, all banks could not simultaneously borrow more heavily. We would expect fund availability problems to be short run in nature as the depositor would have to move his funds to other investments. This will change relative rates of return until the market re-establishes an equilibrium situation. Banks protect themselves against fund availability risk by offering depositors who already have sizable deposits in the bank a lower return in an attempt to discourage such deposits. Banks may also protect themselves by including a fund availability clause in loan agreements, which allows a financial institution to recall a credit

should funding become impossible. But of course such a clause is only useful if the borrower can repay easily.

Country risk can be defined as the uncertainties arising from political or economic developments within a country which may influence the ability and willingness of borrowers within that country to meet their obligations. Country risk is usually broken down into two components. Sovereign risk is the possibility of political or military measures which may prevent payments of external obligations. Transfer risk relates to the inability of borrowers within a country to obtain foreign exchange in order to make payments in the currency agreed upon. Country risk occurs in international financial intermediation but is greatly aggravated by the recycling process, as never prior to the 1974 oil price increases had non-OPEC LDC governments used financial intermediaries for balance-of-payments financing on such a large scale. Banks have attempted to moderate country risk in the same manner as credit risk, by diversifying their loan portfolios and by syndicating a large credit to a single borrower among several banks. They are also paying closer scrutiny to economic and political developments abroad.

Box 2: Concepts of Expected Return and Variance

The concepts of expected return and variance can best be illustrated by reference to a simple example. Consider a one-year \$1 loan to country X priced at the London interbank offer rate (LIBOR) plus 3 percentage points. The loan has the following three payoff probabilities:

Probability	Payoff
94%	\$1 + r + 0.03, where r is the LIBOR
4%	\$1
2%	0

The highly simplified example is far more realistic than a simple paid-off-not-paid-off scenario in that it allows for a spectrum of possibilities: receiving principal plus interest, receiving only principal, and receiving nothing.

The expected return on the loan can be calculated by weighting the return on each payoff by the probability of occurrence. We take r to be 14 percent:

$$\begin{aligned}\text{Expected rate of return} &= 0.94(0.17) + 0.04(0) \\ &\quad + 0.02(-1) \\ &= 0.1598 - 0.02 = 13.98\%\end{aligned}$$

The variance is the squared deviation of each outcome from the mean, weighted by the probability of occurrence. This is computed as follows:

$$\begin{aligned}\text{Variance} &= 0.94 (0.17 - 0.1398)^2 + 0.04(0 - 0.1398)^2 \\ &\quad + 0.02 (-1 - 0.1398)^2 \\ &= 0.009 + 0.008 + 0.0260 = 0.0277 = 2.77\%\end{aligned}$$

Thus, this loan has an expected return of 13.98 percent and a variance of 2.77 percent. Changing the probabilities of the various outcomes will change both the expected rate of return and the variance.

Each asset has an expected return and variance. Box 2 illustrates how this can be calculated for a sample loan. The expected return on a portfolio is determined by the expected return of each of the underlying assets weighted by their share in the portfolio. By contrast, the variance of a portfolio depends, not only upon the variance of the individual assets, but also on the extent to which the rates of return on assets in the portfolio move together. The general proposition of portfolio theory is that, if different assets can be held in the same portfolio, the bank can achieve a lower variance for the same rate of return. This is desirable because the lower variance reduces the bank's uncertainty in its investment decisions.

The benefits from mixing assets can best be illustrated by means of a simple example. Consider two assets, each with an expected return of 15 percent and a variance of 5 percent. If a bank held a portfolio comprised solely of asset 1 or asset 2, the expected return on the portfolio would be 15 percent and the variance would be 5 percent. If the bank mixes assets, the variance of the portfolio will usually be less than 5 percent. The amount of reduction of variance depends on the extent to which the rates of return on the two assets move together. The comovements of two assets can be measured by a statistic called the correlation coefficient, a figure which is scaled to fall between 1 and -1. If one assumes the two assets have a slightly positive correlation, say, a correlation coefficient of 0.3 and the portfolio is comprised of equal amounts of assets 1 and 2, the mixed portfolio will still have the same 15 percent expected return as the underlying assets. However, the variance of the mixed portfolio now will be only 2.875 percent rather than 5 percent.⁴ If the returns on the two assets do not move together at all, that is, the correlation is equal to zero, the variance of a mixed portfolio will be 2.5 percent. If their rates of return move exactly inversely to one another, that is, the correlation between the assets is -1, a mixed portfolio comprised of equal amounts of assets

1 and 2 will have an expected return of 15 percent and zero variance. The intuition for this last result is, if asset 1 has a "good" outcome, perfect negative correlation requires this to be offset by asset 2's "bad" outcome and vice versa.

The only case in which diversification will not reduce risk at all is if the two assets move together perfectly, that is, they have a correlation of 1. This will occur if the two assets respond identically to various occurrences and, hence, become interchangeable for investment purposes. In this case, a portfolio comprised of equal amounts of assets 1 and 2 will have the same expected return and variance as each of the underlying assets: 15 percent and 5 percent, respectively.

To reiterate, a portfolio's expected return is the weighted average of the expected return on the component assets. The weights are given by the proportion of the portfolio in each asset. A portfolio's variance is dependent on the correlation between the assets as well as on the variance of each of the components.

This means that computing the variance of a portfolio with a relatively small number of assets, say 15, is tedious: it requires 120 terms—105 correlation terms and 15 variance terms. In general, computing the variance of a portfolio requires one variance for each asset and $N(N-1)/2$ correlation coefficients where N is the number of assets.

The process of computing the variance of a portfolio can be simplified by assuming that the actual rate of return on an asset may be separated into two components: one component which is asset specific and independent of all other returns (the nonsystematic portion) and another component which is common to all assets (the systematic portion).⁵ Consequently, the variance of an individual asset can be separated into its nonsystematic and systematic components.⁶ The

⁴ A portfolio's expected return and variance are given as follows:

$$E_p = \sum_i P_i E_i, \text{ where } i = 1 \dots N$$

$$\sigma_p^2 = \sum_i \sum_j P_i P_j \rho_{i,j} \sigma_i \sigma_j, \text{ where } i, j = 1 \dots N$$

and E_p = expected return on the portfolio; P_i = proportion of portfolio in asset i ; E_i = expected return on asset i ; σ_p^2 = variance of the portfolio; $\rho_{i,j}$ = correlation between assets i and j ; σ_i = standard deviation of asset i ; N = number of assets in the portfolio.

In the two-asset case, the variance can be simplified as follows:

$$\sigma_p^2 = P_1^2 \sigma_1^2 + P_2^2 \sigma_2^2 + 2 P_1 P_2 \rho_{1,2} \sigma_1 \sigma_2$$

For the portfolio discussed in the text, $P_1 = P_2 = 0.5$, $\sigma_1^2 = \sigma_2^2 = 0.05$, and $\rho_{1,2} = 0.3$. Thus, the variance of the portfolio can be easily computed.

$$\sigma_p^2 = (0.25)(0.05) + (0.25)(0.05) + (0.25)(0.3)(0.05) = 0.02875$$

⁵ Technically, it is assumed the rate of return on an asset is linearly related to both the market rate of return and an asset specific factor. The market return will be reflected in the rate of return on an index comprised of all relevant assets. The hypothesized relationship may be written as follows:

$$R_i = a_i + b_i I + C_i$$

where R_i = actual return on asset i ;

a_i = constant; b_i = constant; I = actual return of index; and C_i = uncertain variable related to asset specific factors.

⁶ If the expected value of C_i is zero and the correlation between the index and C_i is zero, it can be shown that the variance of asset i can be decomposed into two components:

$$\sigma_i^2 = (b_i \sigma_I)^2 + \sigma_{C_i}^2$$

where σ_i^2 = variance of asset i ; σ_I^2 = variance of the index; and

$$\sigma_{C_i}^2 = \text{variance of } C_i$$

The first term— $(b_i \sigma_I)^2$ —is the systematic variance of the asset.

The second term— $\sigma_{C_i}^2$ —is the nonsystematic variance of the asset.

systematic component consists of background factors which affect all assets. Different assets will have different absolute and relative amounts of systematic and nonsystematic variance.

The variance of a portfolio now takes on a particularly simple form: it has one systematic component and N nonsystematic components. The systematic component measures the sensitivity of the portfolio's rate of return to a factor common to some broader group of assets. This common factor is determined by forming an index comprised of all relevant assets. The nonsystematic components are the nonsystematic variance of each of the assets in the portfolio weighted by the square of their portfolio share.⁷

We can now explain why the nonsystematic variance for a portfolio can be diversified away. We have noted that the nonsystematic variance for a portfolio is given by the sum of the nonsystematic variances each weighted by the square of the share in the portfolio. Thus, if there are N assets in a portfolio and an equal proportion (1/N) of the total is held in each asset, nonsystematic variance is given by 1/N times the average value of the nonsystematic variance of the assets. Thus, if N = 10, the nonsystematic variance of the portfolio would be only 1/10 of the average value of the nonsystematic variance of the component assets. Hence, by holding ten securities, 90 percent of the systematic variance has been diversified. As N gets very large, nonsystematic variance disappears entirely.

Systematic variance by definition cannot be reduced through diversification. The systematic variance of the average asset is the same as the systematic variance of a portfolio comprised of all assets. Thus, systematic variance will not be reduced regardless of the number of assets in a portfolio.

Take a bank with a portfolio of assets consisting of non-OPEC LDC loans. Each credit will be associated with a certain amount of nonsystematic or country specific variance and a certain amount of systematic variance. The relative amounts of each of these types of variation measures will differ from loan to loan. Applying portfolio theory as outlined above, if one holds a very large portfolio consisting of small holdings of each of a large number of countries, the amount of

variation in the portfolio due to country specific factors will be small. Thus, of concern to the banker is the systematic variation of the country credits.

Portfolio theory hence provides a methodology whereby rate-of-return figures can be used to measure the amount of systematic and nonsystematic risk. Unfortunately, however, meaningful rate-of-return figures on non-OPEC LDC credits are not available over a sizable period of time because large-scale medium- and long-term lending to non-OPEC LDCs is a relatively recent phenomenon. Long-term lending to non-OPEC LDCs began to grow rapidly, albeit from a small base, in the late 1960s. This growth accelerated in the 1971-73 period, as banks began aggressively to seek new lending outlets by offering narrow spreads on syndicated credits and attractive terms on other types of loans. As we have seen earlier, the volume of lending mushroomed after the quadrupling of oil prices in 1973-74.

Measures of risk

Since rate-of-return figures are not available, we cannot explicitly estimate diversifiable and nondiversifiable risks in a portfolio of LDC credits. However, if we are able to develop proxies which are related to rates of return inasmuch as they capture country risk considerations, we can implement the methodology outlined above using the proxies. A proxy is a substitute for a variable which is unobservable or unavailable. Proxies for country risk may be found in indicators of problems that may hinder a country's ability to repay its debts: balance-of-payments difficulties caused by real or monetary disturbances, liquidity difficulties, and political difficulties. Each of these difficulties could be expected in some instances to translate into a difference between the actual and promised rate of return. Each of these difficulties will be considered in turn.

Country risk analysts spend a great deal of effort assessing the factors affecting a country's balance of payments, as foreign exchange earnings and competing needs for them are extremely important in forecasting debt-servicing difficulties. First, consider the real factors affecting the balance of payments. On the import side, an important consideration is a country's ability to lower imports in times of balance-of-payments difficulties. For example, the more important such items as food and fuel are in total imports, the less scope a country has to cut back. On the export side, the growth and diversity of exports are extremely important. An economy that depends primarily on the export of one commodity such as copper, the price of which can fluctuate widely, can easily encounter difficulties. On the other hand, if the economy exports a number of different raw materials and manu-

⁷ The variance of a portfolio is given as follows:

$$\sigma_p^2 = b_p^2 \sigma_1^2 + P_1^2 \sigma_{01}^2 + P_2^2 \sigma_{02}^2 + \dots + P_N^2 \sigma_{0N}^2$$

where P_i = proportion of portfolio in asset i;

σ_p^2 = variance of the portfolio; $b_p = \sum_i P_i b_i$, where $i = 1 \dots N$;

N = number of assets in the portfolio.

The first term on the right-hand side of the equation is the systematic component. The other N terms represent the nonsystematic components.

factured goods, the balance-of-payments difficulties stemming from a price change for any one commodity would be lessened. In addition to the diversity of exports, a country risk analyst must also consider a country's export markets. For example, the more widely dispersed export flows are across trading partners the less severe the effects would be if one trading partner were to suffer a recession or impose import barriers. In addition, the country's ability to develop its export markets is an indication of its economic management and hence its prospects for rapid development. Other important factors in analyzing a balance-of-payments position include the country's ability to attract foreign exchange through capital inflows, such as foreign direct or portfolio investment, as well as its ability to contain capital outflows.

Monetary disturbances can also have very adverse effects on the balance of payments of an economy. Few LDC governments permit exchange rates to float freely. Rapid money supply growth will tend to increase domestic inflationary pressures. When an overvalued exchange rate is maintained, foreign goods look relatively cheaper and imports are encouraged. This can result in large losses of foreign exchange reserves, causing a foreign exchange shortage. The maintenance of an overvalued exchange rate, even if it is not exacerbated by a rapidly growing money supply, can lead to a loss of reserves or to increased external borrowing.

A great deal of emphasis is placed on international liquidity in assessing country risk. Bankers tend to feel more comfortable with developing economies that have a relatively large international asset position. A sizable cushion of reserves allows a country to ride out transitory difficulties in the balance of payments and to adjust more smoothly to structural changes in the economy. Nonetheless, a large net asset position is not always desirable. It could be an indication that the government does not have a commitment to sustained real growth or lacks the planning and know-how to convert financial resources into expanded production.

Political risk is important for several reasons. It is closely aligned to economic prospects, as political instability may render governments unwilling or unable to pursue appropriate economic policies. Moreover, when forcible political change occurs, either internally or by invasion, the new government may again be unwilling to repay the debt-servicing costs incurred by the previous government. However, political factors are difficult to incorporate into a quantitative analysis, and thus are not considered further in this article.

Bearing in mind these major causes of debt service difficulties and data availability considerations, four

proxies were chosen for country risk:⁸

- (1) growth of exports,
- (2) growth of the money supply,
- (3) growth of international reserves,
- (4) growth of imports/reserves.

The growth-of-exports proxy measures, in a very crude sense, balance-of-payments risk due to real disturbances. The growth of the money supply serves as a proxy for balance-of-payments difficulties due to monetary risk. The final two measures serve as proxies for liquidity risk.

This choice of proxies is reinforced by recent efforts in country risk analysis that have concentrated on the development and use of discriminant analysis and logit models to determine which economic variables are the most important in terms of predicting debt rescheduling.⁹ These models have two major problems. First, they are based on relatively few past cases. Second, they use a "reschedule—did not reschedule" dichotomy whereas, in reality, there is a spectrum of possibilities for the bank, ranging from being paid off in full to receiving nothing. Not all debt reschedulings result in lower rates of return to commercial banks, as temporary problems can be overcome by allowing the country to stretch out its payments. In addition, rescheduling arrangements often involve more favorable spreads on loans from the lender's viewpoint. However, only in countries in which rescheduling or outright default occurs can the rate of return be lower than the promised rate of return. Borrowers prefer rescheduling to outright defaults as the latter will severely restrict their future access to international capital markets. Even with these problems in

⁸ These proxies were chosen solely for the purposes of the analytic study. They do not necessarily correspond to the country-risk screening indicators used by the Federal Reserve Bank of New York or the Federal Reserve System.

⁹ Discriminant analysis and logit are statistical procedures that allow a researcher to isolate ratios which best explain the binary valued dependent variables of rescheduling and nonrescheduling. Pioneers in the use of these models include: Charles R. Frank, Jr., and William R. Cline, "Measurement of Debt Servicing Capacity: An Application of Discriminant Analysis", *Journal of International Economics*, Vol. 1, No. 3 (1971), pages 327-44; G. Feder and R. Just, "A Study of Debt Servicing Capacity Applying Logit Analysis", *Journal of Development Economics*, Vol. 4, No. 1 (1977), pages 25-38; Alice L. Mayo and Anthony G. Barrett, "An Early Warning Model for Assessing Developing Country Risk", *Proceedings of a Symposium of Developing Countries' Debt*, ed. Stephen H. Goodman (Export-Import Bank of the United States, August 1977); Nicholas Sargen, "Use of Economic Indicators and Country Risk Appraisal", *Economic Review* (Federal Reserve Bank of San Francisco, Fall 1977); and Krishan Saini and Philip Bates, "Statistical Techniques for Determining Debt Servicing Capacity for Developing Countries: Analytical Review of the Literature and Further Empirical Results" (Federal Reserve Bank of New York, Research Paper No. 7818, September 1978).

the discriminant analysis and logit methodology, it is interesting to note that the proxies chosen are statistically significant in these models. This provides us with additional confidence in our choice of proxies.

Empirical results

Diversifiable and nondiversifiable risk was estimated for the major non-OPEC LDC borrowers. Each proxy was divided into its systematic and nonsystematic components using portfolio theory. The empirical methodology is described in Box 3. The empirical results for the first two proxies—growth of exports and growth of the money supply—are summarized in Table 1. The empirical results for the latter two proxies—

growth of international reserves and growth of imports divided by reserves are shown in Table 2. The results can be easily interpreted. Glancing at the growth of the money supply measure for Brazil (Table 1), one notes the standard deviation of the Brazilian money supply is 12.49 percent per quarter. The systematic standard deviation is 1.50 percent per quarter, while the nonsystematic standard deviation is 12.39 percent. The variance, which is equal to the total standard deviation squared, is 153.51 percent per quarter. The percentage of systematic variance is the systematic variance divided by the total variance. The systematic variance is 1 percent and the nonsystematic variance is 99 percent.

Box 3: Data and Methodology

This article utilizes data for non-OPEC LDC borrowers with more than \$1.6 billion in exposure to United States banks as of June 1979 to measure diversifiable and nondiversifiable risk. The exposed amount was calculated from the country lending exposure survey conducted by the three bank regulatory agencies on June 30, 1979. This survey includes both the claims and contingencies of United States banks and their overseas branches. Where the residence of the borrower differed from the residence of the guarantor, the latter was used to calculate country exposure. The sixteen countries with sufficient borrowings were Brazil, Mexico, Korea, Taiwan, the Philippines, Spain, Argentina, Hong Kong, Greece, Colombia, Chile, Yugoslavia, Ecuador, Thailand, Panama, and Peru. These largest non-OPEC LDC borrowers account for over 75 percent of total United States bank lending to non-OPEC LDCs. Unfortunately, due to data availability considerations, only twelve to fifteen of the countries could be used for most of the proxies as data on Taiwan, Hong Kong, Colombia, and Panama were sometimes unobtainable.

For each proxy, a quarterly time series of observations was compiled for each of the largest borrowers.* An index for each proxy was then constructed from the country indexes, with each country weighted by its borrowing share. A regression was then performed for each country as given by equation (1).

$$(1) X_i = a_i + b_i \bar{X} + e_i$$

where \bar{X} = index for a given country risk measure,

X_i = country risk measure X for country i ,

a_i and b_i are constants.

For export growth, international reserve growth, and

growth of imports/reserves, the regression was executed for the 1960-79 period. Data on money supply growth for some of the included countries were available only for the 1969-79 period. Systematic or nondiversifiable variance for country i for a given risk measure is equal to the b_i constant obtained from the regression, squared, times the variance of the index as given by equation (2).

$$(2) \text{Systematic variance} = (b_i \sigma_x)^2$$

The nonsystematic or diversifiable variance is the standard error of the regression, squared, times $(N-2)/(N)$ as given by equation (3).

$$(3) \text{Nonsystematic variance} = (\text{standard error of regression})^2 (N-2)/(N)$$

The systematic and nonsystematic standard deviation is the square root of the appropriate variance.

This approach could be flawed if the first oil shock caused structural changes which increased systematic risk. To test for the occurrence of structural shift at the end of 1973, a regression given by equation (4) was performed.

$$(4) X_i = a_i + b_i \bar{X} + g_i D + h_i D\bar{X} + e_i$$

where $D = 0$ prior to 1974-I;

$= 1$ from 1974-I to end of period; and

a_i , b_i , g_i , and h_i are constants.

The t -statistic on the h_i coefficient can be interpreted as a test for significance. It was found that the h_i coefficient was insignificant almost 80 percent of the time. In five out of twelve cases when the h_i coefficient was significant, it indicated a decrease rather than an increase in systematic risk for the later period. Thus, it appears that there was no structural shift in the proxies used in the post-1973 period.

* All data were obtained from the International Monetary Fund's *International Financial Statistics*.

Table 1

Empirical Results for Export and Money Supply Proxies*

In percent per quarter

Country†	Growth of exports, 1960-79					Growth of money supply, 1969-79				
	SSD	Non-SSD	TSD	Sys V	Non-SV	SSD	Non-SSD	TSD	Sys V	Non-SV
Brazil	10.14	16.43	19.31	28	72	1.50	12.39	12.49	1	99
Mexico	8.33	13.90	16.21	26	74	19.80	35.02	40.23	24	76
Korea	14.12	17.81	22.73	39	61	3.29	21.28	21.53	2	98
Philippines	5.24	13.56	14.54	13	87	6.27	46.71	47.13	2	98
Spain	12.68	21.47	24.93	26	74	5.65	19.03	19.85	8	92
Argentina	4.08	19.65	20.08	4	96	176.28	119.26	212.83	69	31
Hong Kong	4.72	8.92	10.09	22	78	—	—	—	—	—
Greece	34.79	45.25	57.08	37	63	3.48	24.70	24.94	2	98
Colombia	4.20	15.29	15.86	7	93	—	—	—	—	—
Chile	5.94	18.32	19.26	10	90	3.94	25.38	25.68	2	98
Yugoslavia	10.61	9.67	14.36	55	45	2.91	20.00	20.21	2	98
Ecuador	4.88	18.31	18.95	7	93	.60	36.77	36.78	0	100
Thailand	-1.69	16.42	16.50	1	99	5.69	49.18	49.50	1	99
Panama	5.04	18.60	19.27	7	93	—	—	—	—	—
Peru	5.50	16.00	16.92	11	89	-3.84	26.65	26.93	2	98

* The column headings are as follows:

SSD = Systematic standard deviation.

Non-SSD = Nonsystematic standard deviation.

TSD = Total standard deviation.

Sys V = Percentage of systematic variance.

Non-SV = Percentage of nonsystematic variance.

† Data on Taiwan not available from the International Monetary Fund, *International Financial Statistics*.

Table 2

Empirical Results for Liquidity Proxies*

In percent per quarter

Country	Growth of international reserves, 1960-79					Growth of imports/reserves, 1960-79				
	SSD	Non-SSD	TSD	Sys V	Non-SV	SSD	Non-SSD	TSD	Sys V	Non-SV
Brazil	17.86	12.42	21.76	67	33	15.53	13.29	20.44	58	42
Mexico	3.33	8.58	9.20	13	87	9.82	10.94	14.70	45	55
Korea	2.84	13.41	13.71	4	96	13.13	18.43	22.62	34	66
Philippines	2.89	14.33	14.62	4	96	4.48	13.21	13.95	10	90
Spain	3.89	13.71	14.25	7	93	4.13	16.82	17.32	6	94
Argentina	10.17	33.83	36.36	8	92	8.40	30.19	31.34	7	93
Greece	2.14	9.56	9.80	5	95	11.89	17.57	21.22	31	69
Colombia	7.85	20.14	21.62	13	87	9.71	25.46	27.25	13	87
Chile	6.54	33.84	34.46	4	96	8.94	36.70	37.78	6	94
Yugoslavia	3.29	23.28	23.51	2	98	10.58	20.13	22.74	22	88
Ecuador	8.66	16.43	18.57	22	78	8.02	21.90	23.32	12	88
Thailand	-.24	5.11	5.12	0	100	-.66	7.43	7.46	1	99
Panama	2.79	17.30	17.52	3	97	8.12	17.75	19.52	17	83
Peru	2.59	19.41	19.58	2	98	4.34	18.72	19.22	5	95

* See Table 1 footnotes.

For most countries, the bulk of the variance is non-systematic or diversifiable as opposed to systematic, although there is always a bit of both. Systematic variance dominated only in exceptional cases where one country had extremely rapid growth of a particular proxy, and the growth was highly correlated with the index. This was the case with Argentinean money supply growth and Brazilian international reserve growth. Even so, only six countries (Brazil, Mexico, Korea, Argentina, Greece, and Yugoslavia) had more than 33 percent systematic variance on one or more of the four risk measures. Only two of the countries (Brazil and Korea) had more than 33 percent systematic variance on two or more risk measures.

The four risk proxies each attempt to capture a different aspect of the economy. As such, the independent use of the four proxies may tell different stories for some of the countries. Systematic variance for a country can be high as measured by one proxy and low as measured by another. For example, Brazil has 28 percent systematic variance as measured by export growth, 1 percent systematic variance as measured by money supply growth, 67 percent systematic variance as measured by international reserve growth, and 58 percent systematic variance as measured by imports/reserves growth.

Even so, the stories were not very different for most of the countries. Widely disparate results, where systematic variance is more than 50 percent in one proxy and less than 10 percent in another proxy for the same country, occurs in only three cases (Brazil, Argentina, and Yugoslavia). Moderately disparate results, where systematic variance for the highest proxy is between 25 and 50 percent and systematic variance for the lowest proxy is under 10 percent, occurs in four cases (Mexico, Korea, Spain, and Greece). Five of the countries had less than 15 percent systematic variance in all indexes (the Philippines, Colombia, Chile, Thailand, and Peru).

One method of estimating systematic variances for a given country when disparate results were obtained from the four proxies is to calculate a weighted average. For example, if the proxies were weighted equally, systematic variance would be 38 percent for Brazil, 22 percent for Argentina, and 20 percent for Yugoslavia. The usefulness of these results depends on either the appropriateness of the weights chosen or the sensitivity of the results to the weights.

Extensions

Two empirical extensions to the above analysis were considered. First, the sample period was split at the end of 1973 to test for a structural change in the relationship between systematic and nonsystematic risk.

If there were a dramatic increase in systematic risk as a result of the first oil shock, it would render the original empirical work based on long-term series less useful. The empirical methodology is discussed in Box 3. It was found that in nearly 80 percent of the cases there was no significant difference between systematic risk in the period prior to end-1973 and the 1974 and after period. In nearly half the cases when there was a significant difference, it represented a decrease rather than an increase in systematic risk.

The second extension was to consider the extent of diversification that could be achieved when lending is concentrated in a particular area. The results discussed thus far assume that the bank is holding a portfolio of country credits, similar to the average portfolio of country credits held by all United States banks. While the major money-center banks do hold well-balanced portfolios, many regional banks do not. They concentrate their lending to countries in a particular area (for example, Latin America) because they have other business relationships with these countries, such as financing importers who concentrate on Latin American goods. Thus, those banks may have a built-in informational advantage over their competitors in dealing with particular countries. They can exploit this by specializing their limited international lending staff in making loans to the countries in an area. Consequently, they can often arrange for a larger role in syndicated credits and hence a larger front-end fee than would be warranted by their resources. The trade-off in this type of specialization is that they hold a less geographically diversified portfolio.

How much additional risk is assumed by this specialization? Recomputing the earlier results based on a portfolio of eight Latin American borrowers (Brazil, Mexico, Argentina, Colombia, Chile, Ecuador, Panama, and Peru) indicated a slight, but not substantial, loss in diversification opportunities as a consequence of a geographical specialization. When the sample was pared further to the six South American borrowers, the conclusion remained that the loss in diversification opportunities was not substantial. Thus, very sizable gains from diversification can be achieved by holding relatively few country loans.

Qualifications

The major strength of the approach used in this article is that it quantifies diversifiable and nondiversifiable risk in the absence of reliable rate-of-return measures. There are, however, four major qualifications to this approach. First, this methodology assumes that there is no measurement error in the proxies that will bias the results. If such error exists and is random, the measures used will overstate diversifiable risk and

understate nondiversifiable risk. While attempts were made to choose proxies which utilized the best available data, some measurement error was inevitable.

Second, even if these ratios capture in some crude sense economic ability to pay, they will not capture political ability or willingness to pay. If political risks are highly correlated across countries, the results presented in this article may overestimate diversifiable risk. To a limited extent, however, political risk may be captured in the economic variables. For example, political inability to pay may be captured in extremely sluggish export growth. Moreover, there is little evidence so far that political events that have interfered with debt service have been correlated across countries.

Third, even though the results may indicate the risk of a group of countries defaulting at the same time is low, the adverse effects from the default of a single large borrower can be severe. For example, the nine largest United States banks as of December 1980 had an exposure to Brazil equal to 43 percent of capital, an exposure to Mexico equal to 38 percent of capital, and an exposure to Korea equal to 19 percent of capital. For individual banks, the exposures to given countries were still higher.

Finally, it should be noted that this study estimates only diversifiable risk within a select group of non-OPEC countries. Bank management, however, is concerned with the total risk and the total rate of return on the bank's portfolio. Loans to non-OPEC LDCs comprise approximately 10 percent of the assets of the nine largest banks. To the extent that the bank's rate of return on LDC loans is not highly correlated with the rate of return on other assets in the bank's portfolio, opportunities for diversification are larger than those indicated. Thus, estimates of diversifiable risk presented in this article should be regarded as a lower bound. There is some evidence to suggest that the rates of return on the loans to non-OPEC LDCs are

not highly correlated with the rates of return on the loans to developed economies.¹⁰

Conclusions

The results presented in this article indicate that country specific risks appear to loom large relative to the common problems faced by non-OPEC LDCs. This has two important implications.

- First, it appears that the efforts of the Federal regulatory authorities to emphasize loan diversification are well placed. Since banks can significantly diversify risks even by holding credits to relatively few countries, the regulators' emphasis should indeed be placed on encouraging diversification and attempting to identify concentrations of lending that are large relative to bank capital.
- Second, it appears that the nightmares of bankers, regulators, and journalists of massive LDC defaults paralyzing the United States banking system are not warranted on economic grounds. Non-OPEC LDCs are not a homogeneous group, as this study has demonstrated. Country specific risks, which are relatively independent across borrowers are far more important to the economic health of the countries than common factors. Indeed, it is misleading to speak of the aggregate exposure of the banking system to non-OPEC LDCs as it implies a much greater uniformity across countries than appears to be the case.

¹⁰ A recent study by Robert B. Leftwich used real growth rates as a proxy for rates of return and examined the relationship between real growth rates of industrial countries and those of non-OPEC developing countries. It was concluded that there was little correlation between the two. See "Fears about the Level of LDC Debt Called Exaggerated", *Money Manager* (January 7, 1980), page 6.

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