Measuring Loss on Defaulted Bank Loans: A 24-Year Study

by Elliot Asarnow and David Edwards

Sometimes, bankers wishing to perform research on historical losses of bank loans are stymied by a dearth of data. However, in this article, the authors present the results of an analysis of losses on bank loan defaults based on 24 years of data compiled by their institution. Numerous tables illustrating the average loss in event of default, the components of loss, and the differences between various size loans are presented.

In trying to understand the investment characteristics of any credit risk-sensitive instrument, one of the most important measures is *expected loss*, that is, the average default loss anticipated over a defined time horizon. With respect to loans to medium- and large-size corporations, banks have traditionally been pure buy-and-hold investors in what are generally floating rate instruments. Given this approach, the main concern is gauging the potential reductions in contractual cash flows paid directly by the

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borrower (issuer) to the holder of the loan agreement (the bank/investor). In other words, the concern is exclusively about potential defaults. As such, expected loss is clearly a critical measure.

Investors who actively rebalance their portfolios using secondary markets are concerned about price risk as well as default risk: If they sell an investment before maturity, they may sell at some price other than par. For floating rate, credit risk-sensitive instruments, price risk is primarily a function of changes in issuer credit quality and general changes in the market level of credit spreads. Even in this context, expected loss remains a critical measure.

Expected loss can be expressed as follows:

Expected Loss = Probability of Default x Loss in the Event of Default (LIED)

The probability of default represents the expectation that investment performance will become impaired over a defined time frame, such as one year. In public bond market studies, default is generally defined as a missed principal or interest payment, a bankruptcy filing, or a troubled debt restructuring. Technical covenant violations do not qualify as defaults.

LIED is an estimate of the full economic (present-value) cost if there is a default.

Bond Default Studies

A significant amount of published research has been devoted to studying bond default rates, while less research has been devoted to measuring LIED for bonds. Even less research has been published on default rates or LIED for corporate loans. Fortunately, bond default studies can be used as benchmarks in assessing the likelihood of medium and large corporate borrowers defaulting, which constitutes a major advantage of breaking down expected loss into its two component parts. However, applying bond LIED rates to loans is a dubious practice. It is reasonable to expect that bank loans and bonds could have different LIED rates, since loans have many features not found in bonds.

Furthermore, just as LIED rates vary among different classes of bonds, such as senior secured, senior unsecured, and subordinated, LIED rates vary among different classes of loans. For example, a borrower may have two bank loans, one unsecured and one secured by its customer receivables. A default by this borrower would most likely lead to a different loss experience on the two loans, but the before-the-fact likelihood of default is identical.

For lenders, understanding the potential economic impact of a loan default is at least as important as the need for corporate bond investors to know the potential recovery rate on defaulted bonds. A lender's estimation of the cost of a default affects its pricing decisions, economic capital allocation, loan loss forecasts, and valuation of the existing loan portfolio. Therefore, it stands to reason that developing good LIED statistics for loans meets an important practical need.

In this article, we present the data, methodology, and empirical results of a study of LIED performed on a historical population of Citibank's U.S. defaulted borrowers. We also discuss some of the practical conclusions regarding the interpretation and use of the results.

Our study covers two groups of loans. One loan group is composed of general commercial and industrial (C&I) corporate loans. The other group is composed of structured loans. The structured loan group has the following characteristics:

- The loans are very closely monitored—the bank directly controls the company's cash receipts and disbursements.
- The loans are highly structured and contain many restrictive covenants.
- The loans are highly collateralized, and lending is done on a formula basis, for example, having a predetermined advance rate against customer receivables as collateral.

Data and Methodology for Estimating LIED

Default Definition

To study LIED, a definition of default must first be established. At Citibank, we have chosen to define defaulted C&I loans as any loans ever classified as doubtful or nonaccrual, according to the standard classifications used for bank regulatory reporting. We selected this default definition given the fact that bankruptcy status was not explicitly recorded in the database.

Citibank has compiled a rich, historical database that tracks problem loan classifications, write-offs, principal repayments, recoveries, interest payments, and other elements from 1970 to the present. To use this information to facilitate the comparison between corporate loan and bond LIED, it is necessary to associate an appropriate classification status (as recorded in the internal database) to the default definition generally used in public market studies. In practice, for C&I loans at Citibank, the classifications we selected for our study have been defined and applied consistently over time and closely correspond to the public market definition of default.

Other institutions may necessarily employ a different definition of default to fit their specific environment. However, it should be noted that a default definition must be chosen carefully, since historical loss estimates are determined by the definition selected. The definition also must be selected carefully to facilitate comparison with public market default and LIED studies.

Data

Over the 24-year period from 1970 to 1993, the total number of defaults (as defined by Citibank) consisted of 831 C&I loans and 89 structured loans. Because of the relative thinness and recent development of the secondary loan market, it is, at best, tenuous to use postdefault loan market prices as a primary LIED measurement technique. Instead, our study measures

LIED in terms of shortfalls in contractual cash flows.

Defaulted loans were not included in the study if they had not yet been resolved. We define resolution as when the most recently observed outstanding balance has been reduced to zero through repayments or write-offs. This definition is necessary to avoid misstating losses by including loans that have not yet been through the full workout process.

In the study, the average loan outstanding at the time of default is $6.3 million for C&I loans and $8.5 million for structured loans. However, default amounts are widely distributed, ranging from less than $1 million to greater than $190 million. For each default we have the following information:

- Month and year of default.
- Outstanding dollar amount at the time of default.
- Transaction history of each principal write-off, subsequent additions to default amount, principal repayments, interest collected, and recovery after default.
- Miscellaneous expenses and income, including legal expenses and proceeds from the sale of assets taken into the bank's possession.

Construction of LIED

The basic formula for calculating the economic cost of a default for an individual loan is expressed as a percentage of initial default amount, as shown in the sidebar on the next page.

The discount rate that should be used to compute the present value of losses as of the date of default is the contractual lending rate. This is appropriate because, on an ex post basis, it eliminates potential distortions owing to the specific timing of the accounting recognition of write-offs. For example, consider a $2-million defaulted loan in which $1-million portions are held by two banks. We know that the ultimate economic cost will be the same for both banks, with possible minor variations stemming from costs for internal staff and external professional assistance. For the sake of simplicity, assume that the loan is fully resolved after one year with a full principal loss of $1 million and the loss of one year's interest payments on the entire loan amount. Given a contractual lending rate of 10%, this represents an additional $100,000 loss.

Suppose one of the two banks correctly forecasts the full loss, immediately recognizes a $1-million principal write-off at the time of the default, and has no further accounting entries. The other bank, however, initially believes that a principal write-off may not be necessary but recognizes the $1-million write-off when the final resolution is confirmed. In doing so, the second bank recognizes an additional loss at the end of the first year postdefault because of the foregone interest of $100,000. The appropriate discount rate is the contractual lending rate at which foregone interest is recognized. This rate, 10% in our example, equates the second bank's loss of $1.1 million at the end of the first year with the first bank's loss of $1 million as of the default date.

LIED Formula

The basic formula for calculating the economic cost of a default (LIED) for an individual (ith) defaulted loan, expressed as a percentage of the initial default amount.

$$LIED_i = 100 \times [\{W_i + ID_i - IC_i - R_i - MSC_i\}/IDA_i]$$
$$W_i = \{PV(w_1) + \ldots + PV(w_j)\}$$
$$IC_i = \{PV(ic_1) + \ldots + PV(ic_k)\}$$
$$R_i = \{PV(r_1) + \ldots + PV(r_m)\}$$
$$MSC_i = \{PV(msc_1) + \ldots + PV(msc_o)\}$$

Definitions:

$LIED_i$ = loss in the event of default for the i^{th} default.

PV(.) = present value calculated to the date of default.

W = dollar amount of each write-off taken subsequent to default.

ID_i = interest drag—the total dollar amount of foregone interest on the outstanding default balance based on a monthly present value calculation for the i^{th} default.

IC = dollar amount of each cash interest payment.

R = dollar amount of each unanticipated principal recovery.

MSC = dollar amount of other income (or expense) events.

IDA_i = initial default dollar amount for the i^{th} default.

J = number of separate write-offs taken for an individual loan.

K = number of separate cash interest payments received for an individual loan.

m = number of separate unanticipated principal recoveries for an individual loan.

o = number of separate other income or (expense) events.

(continued)

LIED Formula (cont.)

Thus, the calculation for LIED is defined as the simple average of $LIED_i$ across all defaults, as shown below:

$$\text{LIED} = \left(\sum_{i=1}^{q} LIED_i\right) / q$$

Where q is the total number of defaulted loans.

In practice, since loan-specific contractual lending rates were not often available for the study, a more generic set of interest rates was used, namely, the yearly average interest rate on domestic C&I loans as reported in Citibank's annual financial statements. For each year, this rate is determined by comparing total interest income from domestic C&I loans with average balances.

Results

C&I loans and structured loans are analyzed separately. Most of the detailed results presented in this article focus on C&I loans, except where the differences are interesting to highlight.

The LIED for the C&I loans in this study is 34.79%; the LIED for structured loans is 12.75%. The difference between C&I and structured loans is not surprising in the sense that the structured loan defaults resulted in much lower economic loss than the C&I defaults.

The C&I LIED rate of 34.79% is not out of line with comparable studies done for corporate bonds. A Moody's report on corporate bond defaults from 1947 to 1992 shows an estimated recovery price for senior secured bonds of $66.79 per $100 face amount and $47.31 for senior unsecured bonds.[1] These recovery prices can be translated into LIEDs of 33.2% for senior secured bonds and 52.7% for senior unsecured bonds.

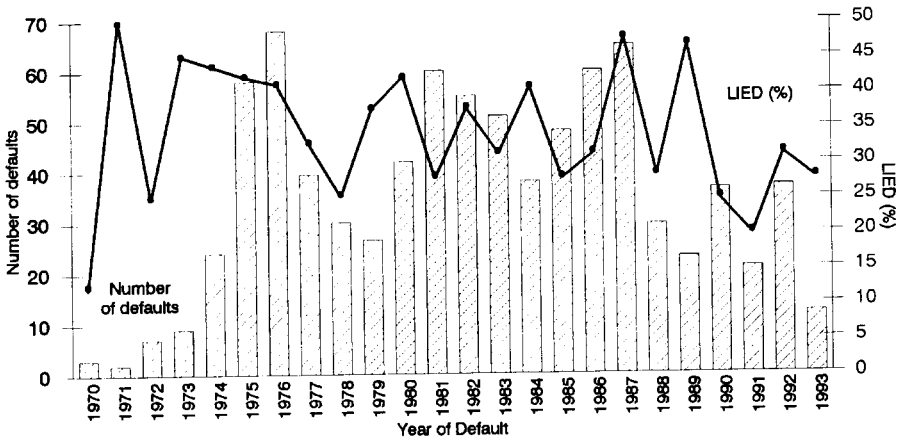
The Citibank C&I defaults are a mixture of secured and unsecured senior loans. For this historical population, it is not possible to identify which loans were secured at the time of origination. However, it would be misleading to expect the difference between the historical loan LIED of 34.79% and the unsecured bond LIED of 52.7% to be explained primarily by the original security associated with the loans.

[1] Jerome S. Fons, Lea Carty, and Denis Girault, "Corporate Bond Defaults and Default Rates," *Moody's Investors Service*, January 1993.

Table 1. Average LIED for C&I Loans by Year of Default

Year of Default	Number of Loans	Average LIED %
1970	3	10.60
1971	2	48.00
1972	7	23.89
1973	9	44.52
1974	23	42.82
1975	57	41.47
1976	69	41.00
1977	39	32.39
1978	30	24.31
1979	26	37.17
1980	42	42.09
1981	58	28.27
1982	54	37.02
1983	51	30.12
1984	36	40.17
1985	47	26.82
1986	60	31.19
1987	64	47.61
1988	28	27.79
1989	22	46.37
1990	36	24.21
1991	21	19.50
1992	36	31.30
1993	11	27.63
Total	**831**	**34.79**

Figure 1.
Average LIED for C& I Defaults by Year of Default

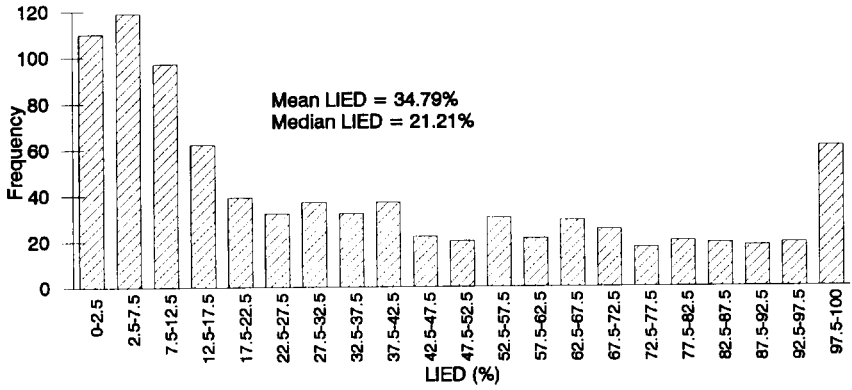


Loans generally have covenants that provide significant protection to the lender, including material adverse change clauses, financial ratio tests, and cross default provisions. In addition, problem loans are typically more actively managed than problem bonds. In the course of this active management, as companies experience credit quality problems, it is common for loan agreements to be restructured. Often, this restructuring takes the form of covenant relief for borrowers in exchange for an improved security package for banks. In other words, loans that were originated on an unsecured basis often are secured when and if a default occurs. Considering these factors, it is reasonable to expect that the LIED for initially unsecured loans would be lower than that for unsecured bonds.

The long time period covered in this study, while allowing the collection of a large default sample, also makes it possible to evaluate the historical stability of LIED, in addition to studying the long-term average LIED. Table 1 and Figure 1 show the simple average LIED (not the dollar-weighted average) for C&I loans grouped by year of default, along with the number of defaults each year. While there has been some volatility, the trend has been relatively stable or flat. In addition, the few years that represent the largest deviations from the overall trend (such as 1971, 1973, and 1989) are generally the years involving fewer defaults. This result is important because it reinforces the validity of relying on the 24-year historical average LIED rather than focusing only on recent years (and far fewer default observations).

Another interesting aspect of C&I LIED is its distribution. Many defaults result in little or no write-off

Figure 2.
LIED Distribution for C&I Defaults



and little economic loss, while other defaults result in large losses. This variation leads to a skewed distribution for LIED, as depicted in Figure 2. This result carries the usual statistical implications regarding the fact that LIED is not normally distributed and is important to know, for example, when modeling credit loss volatility.

An interesting practical effect of the skewness of LIED is that the skewness may explain why subjective or intuitive attempts by bankers to perform a bottom-up estimate of future losses in a portfolio often fail. The average loss incidence, about 35% in this study, rarely occurs, and median LIED is 21%. In fact, LIED within 5% of the average occurred in only 3.6%, or 30 out of 831, cases. Lacking solid data, bankers may tend to recall the very bad outcomes and assign a very high measure to LIED or recall very favorable outcomes and assign a very low measure to LIED. In both cases, the

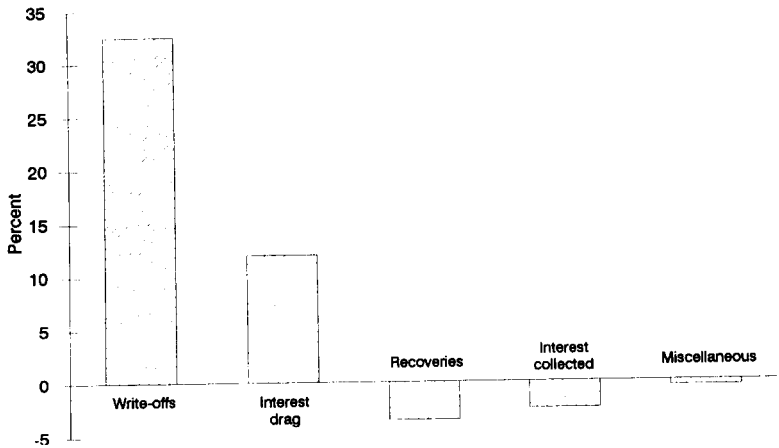
Table 2. LIED by Write-Off Category

Category	Average LIED	Number of Defaults
Total population	34.79%	831
Defaults with zero write-offs	6.83%	362
Defaults with greater-than- zero write offs	56.38%	469

Table 3. Components of LIED for C&I and Structured Loan Defaults

Components	C&I	Structured
Write-offs (%)	30.88	8.97
Interest drag (%)	10.73	7.41
Recoveries (%)	4.02	2.16
Interest collected (%)	2.53	1.36
Miscellaneous (%)	0.27	0.11
LIED (%)	34.79	12.75

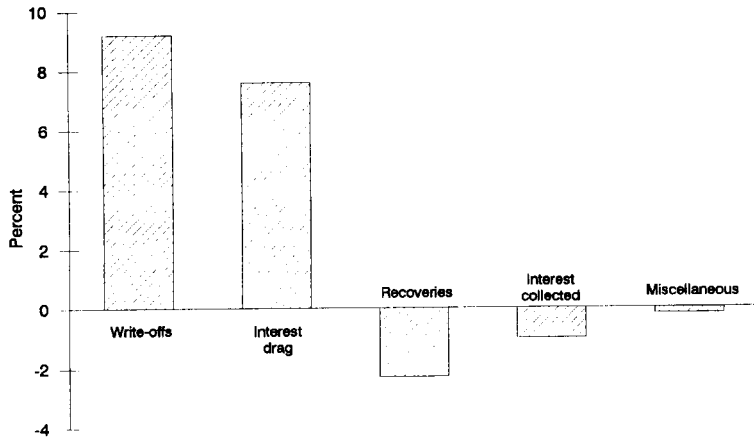
Figure 3.
LIED Elements for C&I Defaults



result will lead to a biased estimate of LIED for the overall portfolio.

Table 2 shows the LIED when there are write-offs and when there are not. It also illustrates why a banker might be misled by the counterintuitive relationship between write-offs and LIED. Notice that about 43% (362 out of 831) of all C&I defaults have no write-offs. Nevertheless, the average LIED is a material 6.83%—even when there is no write-off. This result would tend to

Figure 4.
LIED Elements for Structured Defaults



bias a subjective estimate of LIED because of both the high occurrence of taking no write-offs and the natural tendency to assume that zero write-offs equal zero losses. On the contrary, the other components of LIED, such as the opportunity cost of funds and expenses, play a significant role in expected loss.

To gain a better understanding of how economic losses are incurred, we broke LIED into its component parts for both C&I and structured loan defaults. The results are shown in Table 3 (and illustrated in Figures 3 and 4). Each component is expressed as a percentage of the initial default amount and averaged for all defaults after evaluating the component's present value as of the time of default.

As expected, for C&I defaults, write-offs are the dominant component. Interest drag is the second largest contributor to LIED and, clearly, too large to ignore. C&I recoveries are a relatively small percentage of the default amount but are about 13% of gross write-offs.

For structured loans, the write-off component is a much smaller contributor to LIED than for C&I loans, and this is not surprising. However, the interest drag component is almost as large as write-offs for structured loans. Also, recoveries are about 24% of gross write-offs.

A final aspect of LIED that seems of interest to analyze is the size of the default. For simplicity, in Table 4, we present C&I defaults divided into three groups: less than $1 million, $1 to 10 million, and more than $10 million. While there appears to be some relationship between default size and LIED, the difference is not statistically significant. However, for C&I loans, some of the individual components of LIED vary significantly by

Table 4. LIED and its Components for C&I Loans by Size of Default

	Small defaults <$1million	Medium defaults $1-10 million	Large defaults >=$10 million
Number of Loans	436	261	134
Components			
LIED	35.93%	35.82%	29.09%
Write-offs	32.12	30.91	26.79
Interest drag	8.51	12.94	13.68
Recoveries	3.24	5.18	4.32
Interest collected	1.44	2.91	5.37
Miscellaneous	0.02	-0.06	1.69
Average workout life (years)	1.10	1.89	2.19

the size of the default. This result is shown in Table 4 along with the average life of a loan in workout—defined as the length of time between the default event and when the loan is resolved.

From Table 4 it can also be seen that interest drag is a much larger component of large defaults than of small defaults because large defaults, on average, spend almost one year longer in workout than smaller loans. Presumably, more time and energy is spent on the large defaults resulting in lower write-offs and larger recoveries.

One of the most important reasons for examining the components of LIED relates to the need for banks to maintain loan loss reserves sufficient to protect them against forecasted write-offs (as opposed to "all-in" LIED). The kind of disaggregation shown in Table 4 lends itself to model development to support this requirement. In fact, after the event of default, even further disaggregation based on the specific timing of write-offs, repayments, and so forth, is required for this purpose, since the main concern is with write-offs or the total cost of credit that may occur over the next 12 months, as opposed to a present-value, full-workout-cycle perspective. Timing of principal and interest payments on defaulted loans is also important for modeling the cash flows of loan pools for securitization purposes. This detailed information underlies the more aggregated results presented in this study.

Conclusion

This study presents a calculation of LIED for C&I and structured loans and a description of the underlying methodology employed. Both the analyses and the results should be of interest to banks and other investors in bank loans. Given that LIED is an important component of expected loss, investors must have a reliable estimate to correctly price loans. Unfortunately, the availability of this type of information is very limited. Therefore, the results presented here may provide a useful benchmark for those banks and other investors lacking adequate in-house data to produce their own LIED study. We have delineated the components of LIED (write-offs, interest drag, cash interest collected, recoveries, and other miscellaneous expense or income events) to illustrate the relative importance each component plays. Again, this information may be useful to those who can generate internal measures for some of, but not all, these components.

Citibank's total corporate loan portfolio is large and diverse. This study included a broad cross section of major corporate and upper middle market loans. Given the number and variety of defaulted loans, this study may lend itself to greater general applicability than studies based on smaller portfolios.

The importance of a large database is demonstrated in the study by the ability to divide defaults into three size categories and examine the LIED components for each. For banks with diverse loan portfolios and a concentration of loans to middle market firms, these results should be particularly relevant.

This study provided some analysis of a 24-year time series of LIED that indicates relative stability over time. This finding is important because the very nature of the LIED calculation requires extensive use of historical data. There are two explanations for why LIED may be more stable over time than might intuitively be expected:

1. Citibank's internal default definition has been consistently applied during the study period.
2. LIED measures what occurs after default, thus leaving out an estimation of the probability of default. (The probability of default is a more volatile and cyclical component of expected loss.)

Finally, this study provides a useful comparison of loss severity between loans and bonds, since in this instance, the default definitions for each are similar. Our general conclusion is that LIED for typical C&I loans is significantly less than that for unsecured bonds. Based on our knowledge of Citibank's default portfolio, the difference between corporate loan and bond defaults is explained by a combination of original loan security, covenants, and the active management of problem loans. ■