Loan Equivalents for Revolving Credits and Advised Lines

by Michel Araten and Michael Jacobs Jr.

This article draws on almost six years of data ending December 2000 involving 1,021 observations of 408 facilities for 399 defaulted borrowers at Chase. The study and resulting article evaluates the bank's exposure at default, regardless of the borrower's motivation for draw-downs. Bankers can benefit from this analysis of risk associated with unused commitments, incorporating the results of this study into their pricing decisions and capital allocations.

When a bank makes a credit commitment, it provides a borrower both with immediate cash and the future availability of cash. Forms of commitments vary, as do restrictions on their continuing availability. Credit risk measures, such as expected loss and volatility of loss, are expressed as percentages of the amount drawn at the time of default. At any point in time, it's likely that the current amount drawn will remain outstanding in the future.

The exposure, or the additional amount drawn arising from the unused commitment, is of concern. In this article, *loan equivalent exposure* (LEQ) is defined as the portion of a credit line's undrawn commitment that is likely to be drawn down by the borrower in the event of default. While it is important to recognize that an option has been provided to the borrower to draw down on bank lines that would presumably be less expensive than the borrower's current funding source, even when the borrower has not defaulted, it is not the intention of this article to price this option. Instead, this article reviews the bank's exposure at default, regardless of the borrower's motivation for draw-downs.

Reliable estimates of LEQs are important in aggregating and analyzing a bank's effective credit exposure across different types of facilities as well as in assessing risk capital requirements. Although internal historical bank data should be used to estimate LEQs, methodological hurdles must be overcome to obtain estimates of these factors. Such hurdles include paucity of defaults from high credit quality borrowers, data integrity issues, and lack

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of additional demographic variables that would aid in interpreting the data.

A significant overstatement of risk and capital requirements can come from using a conservative assumption that the LEQ is on the order of 75% (BIS II) or even greater. Although there is no agreement in the industry concerning which factors, a priori, should contribute to a higher LEQ, there are a number of commonsense assumptions. It is generally understood that if a borrower's credit deteriorates, it may be shut out of existing funding sources and will seek replacement or additional cash to fund its operations. At the same time, if covenants permit, a bank will protect itself by seeking to cut off unused commitments. In effect, the LEQ measures the outcome of the race between the bank and the borrower with regard to the draw-down of unused commitments in adverse circumstances.

One view is that since investment-grade borrowers enjoy fewer restrictive covenants, they should have high LEQs. It has also been argued that high LEQ factors should be used for non-investment grade borrowers; because there is a greater probability of default or financial distress, the borrower is more likely to draw down a greater proportion of the unused credit over a given horizon. As a mitigant to this view, covenants are generally more restrictive for non-investment grade borrowers.

In return for credits being successfully renegotiated after covenants are violated, borrowers may be required to sell assets. This could well result in a reduction of both usage and commitments. In other instances, a lender may actually find it prudent to increase and, at the same time, restructure its commitment to enhance the borrower's viability. Here, the unused credit would be increased but with severe accompanying restrictions that prevent the borrower from drawing down these funds without the bank's permission. The LEQ measure, then, could be low in the event of default if there weren't an increase in commitment.

The tenor of the commitment is an important dimension of evaluating LEQs. The longer the time to maturity, the more time available for adverse credit migration—as well as greater opportunity and need for a borrower to draw down unused lines. Other factors that could affect differentiating estimates for LEQs include the nature of the obligor's business, access to commercial paper markets, whether there are borrowing-based limits restricting full commitment, the size of the commitment, and the current usage percent.

A Citibank study[1] covering 1987-1991 examined 50 facilities that were generally rated BB/B or worse and extrapolated these results to better graded facilities. The estimated LEQs, though expressed as a percentage of the normally unused commitments, decreased with decreasing credit quality.

The study upon which this article is based directly determines the LEQs on defaulted facilities. The study included 1,021 observations on 408 facilities for 399 defaulted borrowers at Chase over a five-and-three-quarter-year period ending in December 2000. Key results, based on historical draw-downs relative to unused amounts after properly filtering the universe of defaults and deciding upon an appropriate measurement procedure, are as follows:

- LEQs for Revolving Credits (RCs) averaged 43% across all ratings and time-to-default measures.
- LEQs show a highly significant increase relative to time-to-default across all ratings categories. One-year RC LEQs average 32%, while five-year LEQs are 72%. This may be due to a rating migration effect and a greater opportunity to draw down and implies that LEQs should be tenor adjusted in credit models.
- LEQs generally decrease as credit quality worsens, although unlike the time-to-default relationship, this is not as robust. An explanation may lie in tighter covenants and cutbacks in commitments for poorer ratings. In general, LEQs for BBBs and better average 62%, 48% for grades between BBB- and B+ and 27% for B and worse.
- The high volatility of estimated LEQs is seen in both the barbell-shaped distribution of LEQs, with observations clustered at 0% and 100%, and the relatively high standard deviation of 41.4%, with little variation across most grade and time-to-default categories. This implies that LEQ

volatility should be incorporated into credit risk capital models.

- Estimated LEQs do not seem to be differentiated by lending organization (middle-market versus large-corporate), RC commitment type, size of commitment, domestic-versus-foreign borrowers (though data is less robust for foreign borrowers), or by industry.
- There are some LEQ differences based on percentage utilization. Since utilization rates track to risk grades (worse grades tend to have higher utilization), this does not provide significant explanatory power.
- As expected, LEQs for advised lines for periods up to one year are lower than LEQs for RCs, and average 17%.

Analysis of Revolving Credits

This section examines the relationship between the estimated LEQs and various facility and obligor characteristics. Characteristics of interest are risk ratings, time to default, usage levels, commitment levels, facility types, borrower industry, borrower domicile, and lender organization (see Data & Methods, below).

The data set of 834 facility-years and 309 facilities implies that, on average, there are two to three years of LEQ measurements prior to default per facility. With 321 obligors, there were very few cases of multiple facilities to a given obligor. The average LEQ in the sample is 43.4%, with a relatively high standard deviation of 41.4%. The distribution is bimodal, with 39% of the sample in the 0-10% range and 26% of the sample in the 90-100% range. This is partly a consequence of the truncation procedure. Since there were more observations (28%) that were truncated to 0% versus truncated to 100% (14%), excluding all truncated observations would have the effect of increasing the average LEQ to 50.7%. Given the conservative practice of truncating negative LEQs to 0, it was deemed best to utilize all the data.

Analysis by Risk Grade and Time-to-Default

Table 1 shows the average and count of estimated LEQs by time-to-default (rounded up in time to the nearest year) and risk grade (10-point facility scale).

We can see the relative paucity of data at the better risk grades (BBB and better) and longer times-to-default (four to six years). The strongest pattern that emerges is the increase in average LEQ with longer times-to-default, monotonically from 32.9% to 71.8% going from one year to

Data &

This study estimated the LEQs on a set of defaulted unused facilities from the bank's historical experience. Results have been broken out separately for revolving credits and advised lines. Facilities that were considered to have defaulted were identified along with their amounts outstanding at the time of default. Risk ratings, used, and unused amounts were determined for all available periods prior to the default date. The differences in outstandings and outstandings at periods prior to default have been calculated by dividing these differences by unused amounts at periods prior to default. Averages of these quantities across facilities, for different facility characteristics, are the estimates of LEQ.

While exposure history of all defaulted facilities is included in the data set, it was culled down to those facilities identified as revolving credits or advised lines. The data included obligor names, facility identifier, date of observation, date of default, total commitment, drawn and undrawn amounts[2], 10-point obligor risk grade, 10-point facility risk grade, facility description, SIC code and description, and lending organization.

Following is a description of the various procedures for choosing the sampling population, identifying observations, and cleaning the data. These procedures were conducted on a loan-by-loan basis and were critical in ensuring that the data quality is very high. The results and discussion above is divided into separate sections dealing with revolving credits and advised lines.

Determination of the Sampling Population

Only facility types that could be categorized as revolving credits (long term, short term and convertibles) or advised lines were considered. For a facility to be included in the data sample, it had to have at least one data point of unused commitment prior to default. Multiple revolving credit facilities to a single obligor were judgmentally combined to ensure that separate calculations with different draw-down patterns would not confound the results. In general, if the facility types were the same and grades coincided at observation dates, they were combined so as to eliminate redundancy of data. To accomplish this, facility amounts were changed and new facility identifications were noted. To be conservative, for the purposes of determining time-to-default, these facilities were chained together as if they were a single facility.

Procedure for Identifying Observations

An LEQ measurement consists of an observation of the difference in usage, from a specific quarterly file date to the default date, relative to the unused portion of commitment. This required a positive unused at the file date. Observations were made at quarterly intervals prior to default at file dates for which either there was a change of grade or, if the grade

default to five years to default and greater, respectively. This pattern also holds across risk grade categories for which we have a reasonable amount of data, grades BBB+ to B-, although not in a strictly monotonically increasing pattern.

Table 1
Average LEQ by Facility Risk Grade and Time-to-Default for Revolving Credits
(number of observations in parentheses)

	Time-to-Default (in years)					
Facility Risk Grade	1	2	3	4	5-6	Total
1 (AAA/AA-)		12.1% (1)				12.1% (1)
2 (A+/A-)	78.7% (3)	75.5% (6)	84.0% (1)			77.2% (10)
3 (BBB+/BBB)	93.9% (1)	47.2% (7)	41.7% (5)	100% (2)		55.5% (15)
4 (BBB+/BBB)	54.8% (18)	52.1% (20)	41.5% (9)	37.5% (3)	100.0% (2)	52.2% (52)
5 (BB)	32.0% (81)	44.9% (84)	62.1% (45)	76.0% (17)	68.3% (4)	46.4% (231)
6 (BB-/B+)	39.6% (129)	49.8% (100)	62.1% (37)	62.6% (25)	100.0% (4)	50.1% (295)
7 (B/B-)	26.5% (86)	39.7% (22)	37.3% (5)	97.8% (2)		30.7% (115)
8 (CCC)	24.5% (100)	26.7% (14)	9.4% (1)			24.6% (115)
Total	32.9% (418)	46.6% (254)	62.1% (103)	68.7% (59)	71.8% (59)	43.4% (834)

The relationship between LEQ and credit quality is seen to be an inverse one, as the rightmost margin of Table 1 shows a decrease in average LEQ from investment grades to speculative grades. However, the pattern is not monotonic and is less pronounced across time-to-default categories. The decline in LEQ with increasing risk grade is most evident in the shorter time-to-default categories, years one and two.

Various forms of regression and different candidate variables were explored. It was found that a relatively simple form provided good explanatory power with all the coefficients highly significant[3]. A regression equation for LEQ in percent based on time-to-default

Methods

remained the same for several quarters, at each 1 year anniversary prior to default. This was judged as the best way to avoid over-weighting multiple observations having the same grade. However, if a facility grade migrated over time, LEQs were calculated for each new grade.

An important issue involved the definition of default. The default event was taken to represent the first time that a facility achieved a grade of 9 (substandard). Although in some instances a facility may not actually have defaulted, the substandard designation denoted restructuring of some sort if not actual default. It was deemed to be the point at which borrowers were unable to draw down any further amounts. The number of facilities which never defaulted (became non-performing) represented less than 10% of the facilities and their exclusion would have had minimal effects. In a number of instances, truncated measurements were required.

- A significant number of RC facilities (28%) actually had repayments of outstandings prior to default, indicating that even as credits deteriorated, the bank was able to effectuate repayments. Rather than calculate a negative LEQ, to be conservative, these were truncated to 0.
- A significant number of RC facilities (14%) actually had increases in outstandings at time of default that exceeded the unused commitments at some prior period. By definition, the bank made a fresh decision to increase its commitment at a later period, but not at the current period. The calculated LEQs for these periods were capped at 100%.

Data Cleansing

Various adjustments were made to the sampling population. These fall under the category of data errors or misleading information. In a number of instances, particularly for very poor grades, a very small amount relative to the total commitment was observed, but was not drawn down. It was clear that these unused amounts were left on the books of the bank and there wasn't any way possible for the borrower to draw them down. Including these 0% LEQs would have skewed the results and therefore they were eliminated as legitimate observations. The final sample consists of 1,021 observations, 399 obligors and 408 facilities.

In some circumstances the final amounts shown at the time of default were judged as not representative of the bank's true exposure. This occurred when there were either charge-offs or seizures of collateral that coincided with or occurred just prior to the default date. This would have shown up as a reduction in both commitment and usage but did not represent an actual pay-down. Both the commitment and used amounts were reinflated to more accurately reflect the bank's true exposure at default. In the case of charge-offs, the reduction in book exposure was clearly not an actual reduction in exposure. In the case of the bank liquidating collateral, the application of the collateral was more properly viewed as part of a recovery. Determining the adjustment amount required utilizing independent data sources, such as relationship managers or special workout reports.

(TTD) in years and facility grade (FG) on a scale of 1-8 was derived:

LEQ = 48.36 - 3.49(FG) + 10.87(TTD)

Applying the equation to the various facility grades and time-to-default categories yields a smoothed table as seen in Table 2.

Table 2
Regression Model Predicted LEQ by Facility Risk Grade and Time-to-Default for Revolving Credits

	Time-to-Default (in years)					
Facility Risk Grade	1	2	3	4	5-6	Total[2]
1 (AAA/AA-)	55.7%	66.6%	77.5%	88.4%	99.4%	60.5%
2 (A+/A-)	52.2%	63.1%	74.0%	85.0%	95.9%	57.0%
3 (BBB+/BBB)	48.7%	59.6%	70.6%	81.5%	92.4%	53.5%
4 (BBB+/BBB)	45.2%	56.2%	67.1%	78.0%	88.9%	50.0%
5 (BB)	41.8%	52.7%	63.6%	74.5%	85.4%	46.6%
6 (BB-/B+)	38.3%	49.2%	60.1%	71.0%	82.0%	43.1%
7 (B/B-)	34.8%	45.7%	56.6%	67.6%	78.5%	39.6%
8 (CCC)	31.3%	42.2%	53.2%	64.1%	75.0%	36.1%
Total[1]	38.6%	49.5%	60.5%	71.4%	82.3%	43.4%

1—Evaluated at the sample average of 5.9 for facility grade.
2—Evaluated at the sample average of 1.44 for time-to-default.

Other Variables Considered

While other variables were considered both in various forms of regression and in simple cross-tabulations, these were not found to be significant:

- Lending organization. While there appeared to be some differences in LEQs between large corporate and middle market organizations, these were better explained by facility grades
- Domicile of borrower. Only 53 out of the 834 observations were for borrowers outside the US and their LEQ was 39% versus 44% in the US.
- Industry. There was a fair amount of variation in LEQs by industry, with the higher LEQs (ranging from 77% to 50%) for governments, insurance, business services, and energy.
- Type of revolver. Distinctions in LEQs by long-term, short-term, and convertible revolvers were 43%, 49%, and 31% respectively.
- Commitment size. Overall, LEQs did not show any strong pattern with respect to commitment size. Commitments in excess of $25MM had 50% LEQs but so did commitments below $1MM. Commitments between $10-$25MM had LEQs of 34%, while commitments between $1MM and $10MM had LEQs averaging 44%.
- Percent utilization. Percent utilization showed significant distinctions in LEQs. However, utilization was closely related to facility grade as the weaker grades had higher average utilization.

Analysis of Advised Lines

This section looks at the relationship between the estimated LEQs and various facility and obligor characteristics for advised lines. By definition, advised lines are cancelable at any time by the bank, require approval prior to draw, and are generally reviewed annually. If not cancelled, the borrower may draw down on the line and if credit conditions are deemed stable, the bank may renew the line.

Characteristics of interest are risk ratings, time to default, usage levels, commitment levels, facility types, borrower industry, borrower domicile, and lender organization.

All observations have been part of the analysis, including those with times-to-default in excess of one year. LEQs for these observations imply that the bank has voluntarily renewed the advised line.

There were 187 observations for 87 obligors for 87 facilities.

Table 3
Average LEQ by Facility Risk Grade and Time-to-Default for Advised Lines
(number of observations in parentheses)

	Time-to-Default (in years)					
Facility Risk Grade	1	2	3	4	5-6	Total
2 (A+/A-)	17.2% (2)	23.8% (2)				20.5% (4)
3 (BBB+/BBB)		2.7% (1)	2.7% (2)			2.7% (3)
4 (BBB+/BBB)	0 (1)	51.1% (5)	50.0% (2)	56.3% (2)	100.0% (1)	51.7% (11)
5 (BB)	32.6% (18)	43.0% (30)	49.5% (14)	71.8% (11)	78.1% (1)	46.5% (74)
6 (BB-/B+)	8.8% (23)	39.4% (25)	66.4% (11)	81.1% (3)	70.7% (1)	35.4% (63)
7 (B/B-)	16.9% (13)	38.1% (9)				25.6% (22)
8 (CCC)	10.0% (10)	100% (1)				18.2% (11)
Total	17.1% (67)	41.4% (73)	54.5% (28)	73.4% (19)	82.9% (3)	37.9% (187)

The average LEQ in the sample is 38% with a relatively high standard deviation of 42.6%. The distribution is bimodal with 47% of the sample in the 0-10% range, and 22% of the sample in the 90-100% range. Excluding all truncated observations would have the effect of increasing the average LEQ to 47%. Again, given the conservative practice of truncating negative LEQs to 0, it was felt best to utilize all the data.

Table 3 shows the average and count of estimated LEQs by time-to-default (rounded back in time to the nearest year) and risk grade.

We can see the paucity of data at the better risk grades (BBB and better). The strongest pattern that emerges is the increase in average LEQ with longer times-to-default. The relationship between LEQ and credit quality is seen to be an inverse (although not monotonic) one, as the right-most margin shows a decrease in average LEQ from 52% to 18%, going from BBB+ to CCC, respectively.

Given that advised lines are cancelable by the bank and that careful review is made periodically, LEQs should be primarily based on one year time-to-default results. With only 67 observations, it may be best to consider a flat LEQ regardless of grade. Alternatively, to reflect the pattern of decreasing LEQs as grades worsened, a slightly higher LEQ could be assessed for risk ratings BB and better.

Conclusions

The following conclusions are offered:

1. This analysis offers a foundation to better risk differentiate facilities based on their specific attributes. The importance of carefully screening and cleaning data cannot be overemphasized.

2. It is clear that while there is a high volatility of LEQs for revolving credits, LEQs are influenced both by rating category and time-to-default. Maturity can be an effective proxy for time-to-default as the longer the maturity, the greater the opportunity in time for ratings to downgrade and borrowers to draw down on unused facilities. Table 2, derived from the regression, can serve as a smoothed lookup table based on facility grade and maturity.

3. While other factors may also be important in better differentiating LEQ, the lack of meaningful data has restricted its exploration here. For example, borrowing base facilities may set an effective lower limit to drawing capability than the legal commitment.

4. While less robust, the results for advised lines reconfirm the need to assess LEQs for these facilities, though the risk of drawdown is less and should be based on the one-year results.

5. Credit capital models are currently based on uncertainty of default and volatility of loss severity. They could be expanded to incorporate volatility of LEQ using these estimates. ❐

Notes

1 Asarnow, Elliot, and James Marker. "Historical Performance of the U.S. Corporate Loan Market: 1988-1993," The Journal of Commercial Lending, Vol. 10 No. 2, (Spring 1995), pp.13-32 and private communication.

2 Some revolving credit facilities could be used for off balance sheet exposures (for example, letters of credit). When such instruments were issued these were counted as a drawn outstanding and reduced the unused.

3 Overall R2= .11 with a standard error of 39.1%

Values	Intercept	Facility Grade	Time to Default
t-values	6.1	-3.0	7.8
p-values	.0000	.0027	.0000