# EDF Estimation:

## A "Test-Deck" Exercise

In June 1999, the Basel Committee on Banking released a Consultative Paper on proposed revisions to its 1988 Capital Accord establishing minimum capital requirements. Much has transpired since 1988, as technology has allowed banks' internal rating systems to gain considerable sophistication. As stronger risk management techniques and more reliable data emerge, capital requirements can be more closely aligned with underlying risk. For a number of months, RMA and Mingo & Co. have worked with 11 banks on a response to the Consultative Paper that factors these internal rating systems into the equation.

In a March 2000 response to the Basel consultative paper, the RMA Capital Working Group expressed its views regarding the development of an "internal ratings-based" (IRB) replacement for the Basel Accord.[1] While such an approach is laudable, at least as an interim solution in the process of evolving toward a full, internal models-based capital regulation, an IRB approach should be multi-dimensional—that is, the minimum regulatory capital requirements should be based on several of the important, measurable *risk characteristics* that typically are used by advanced-practice institutions as inputs into so-called "economic capital" (for credit risk) models. Two of the most important such risk characteristics (of any given credit position) are expected-default-frequency (EDF) over a given horizon and expected loss-given-default (LGD). The Capital Working Group therefore suggested that, at least for commercial credits, a two-dimensional risk-characteristic-based (RCB) approach, initially focused on EDFs and LGDs, be used instead of basing the new Accord literally on internal "ratings."[2]

A natural question arises in the context of such a risk characteristic approach (indeed in any, finely tuned "bucketing" approach in which banks are responsible for doing the bucketing). Specifically, how can the supervisor be assured that the

 *This paper is the result of the collective efforts of the RMA Capital Working Group. Appendix 1 provides a list of the banks and personnel contributing to this project.*

bank's own measurements of a risk characteristic (such as credits' EDFs) are reasonable? Moreover, if the measured risk characteristic for a given shared loan facility (or a group of credits of similar quality and type) varies significantly across banks, how can an equitable RCB approach be crafted? That is, how can the regulator be assured that the rule of "equal capital for equal risk" is reasonably applied? Further, the regulator must be assured that the bank cannot simply lower its regulatory capital requirements by artificially lowering its measured EDFs or other risk characteristics. These legitimate concerns are the primary focus of this paper, with respect to the *EDF estimation process for commercial credits.*

To begin the discussion, several principles should be established. First, so long as a "sound-practice" bank's EDF estimates for regulatory capital purposes are the same as those used within the bank's economic capital model(s), there is no natural incentive for the bank to "game" the EDF-estimation process. In particular, an advanced-practice bank focuses on developing *accurate* EDF estimates, because estimates that are *either* too high or too low will result in suboptimal risk vs. return performance. For example, if the bank systematically estimates EDFs that are too low (in relation to the "true" EDF), all other things equal the bank's resulting estimate of economic capital (which is importantly based on EDF) will be correspondingly low. Low economic capital in turn generates incorrectly high RAROC estimates and causes the bank to underprice the associated credit. The bank is then subject to an adverse-selection process in which truly risky obligors choose the bank because it offers low rates on loans, relative to risk. Over the longer run, shareholder-value-added will not be maximized, nor will the bank meet its targeted insolvency probability standard (but, in fact, will face a higher insolvency probability than it desires).

Neither should a sound-practice bank be overly "conservative" in its estimation of EDFs. Such a tactic would cause the bank to overestimate, in turn, the economic capital associated with credits, raising required yields, thus causing "good" obligors to look elsewhere. Over time, the bank would experience a decline in earnings relative to risk, a decline in retained earnings relative to risk, and a level of capital relative to risk that was suboptimal. Thus, persistent overestimation of EDFs (again, relative to "true" EDFs) would, other things equal, reduce shareholder-value-added and might possibly lead to higher than desired insolvency probability.[3]

While the sound-practice bank can be expected to focus on accurately estimating EDFs, not all banks are "sound-practice" institutions, let alone "best-practice." Thus, any RCB approach, as well as any IRB approach, would require supervisors to monitor the quality of each bank's risk-characteristic estimation process and, indeed, to engage in an *accreditation* program. Under such a program not all banks could or should be qualified to participate in an RCB approach. Presumably, such less-than-sound-practice institutions would be subjected to a revised standardized approach to bank capital, as suggested within the Committee's June, 1999 Consultative Paper.

While the details of an accreditation process are still to be worked out—and presumably would require a significant supervisor/industry dialogue—one point seems clear at the outset. No one particular method or group of methods is clearly "best-practice" when it comes to estimating risk characteristics such as EDFs. Indeed, diversity of results (different banks assigning different EDFs to the same obligor) is an indicator that banks are seeking to improve their default risk assessment capabilities to achieve competitive advantage. Conversely, uniformity of practice—especially a uniform process imposed by the supervisor—would be suspect as "stale" and lacking in innovation. Thus, the supervisors must walk a tight line between, on the one hand, identifying institutional practices that are substandard versus choking off beneficial innovation that would result, for the innovators, in their EDF estimates being either higher than or lower than those of other sound-practice banks.

One technique that supervisors could use within the accreditation process is the so-called test-deck exercise. In this approach, the bank is asked to apply its EDF-estimation techniques to a particular sample of obligors, whose EDFs have been or are being estimated by a peer group of creditor banks. If statistically significant differences then arise

between the bank's estimated EDFs and those estimated by its peers, the supervisor will have a basis on which to proceed with a further investigation. As discussed above, however, some degree of diversity in EDF estimates should be expected. Such diversity will arise if for no other reason than sound practices tend to vary. For example, among the eight institutions participating in this survey, EDF-estimation practices tend to group themselves within the following three categories or combinations of categories.

1. EDF estimates based on historical performance of credits grouped by internal *rating*. The reader should make a distinction between the EDF-estimation process and the rating process. Traditionally, for the commercial portfolio, banks have used "expert" internal rating systems in which the loan officer rates the credit in a somewhat subjective fashion, based on financial and nonfinancial information available at the time of the loan application (and at intervals subsequent to the origination of the loan). The bank then uses one of two broad methods (or combination of methods) for associating an EDF with an internal rating. In the first method, the internal rating is "mapped" to an external rating category of Moody's or S&P's. Then, historical bond default data for externally rated corporate securities are used to estimate mean EDFs over, say, a one year horizon for credits of a given rating. Alternatively, the bank can use its own internal historical data on defaults to measure EDFs for loans of a given internal rating. Typically, banks use external bond default data for highly rated credits, because observations of defaults for such credits within the bank's own portfolio are so scarce. EDF estimates based on internal historical data tend to be more robust for the lower quality "grades" in which more defaults have been observed.
2. EDF estimates based on internally developed or vendor-supplied statistical credit scoring models. Scoring models tend to produce an EDF estimate as a function of a small number of financial and nonfinancial variables—the coefficients of the model having been estimated by applying discriminant analysis or logistic regression to historical data encompassing both defaulted and nondefaulted credits. Examples include models sold by Moody's, S&P's, and KMV (PrivateFirmModel™), as well as any number of internally developed scoring models based on external or internal default versus nondefault data.
3. EDF estimates, for publicly traded obligors, based on the implied default probability associated with the equity market's valuation of the company's stock (e.g., KMV's CreditMonitor™).

Note that statistical scoring models and/or equity-based processes may be used either within the rating process or within the EDF-estimation process or both. For example, a particular bank might use an "expert" system for arriving at a credit's rating, with little or no input from a scoring model or an equity-based model. But then, for purposes of estimating EDFs for a given rating, the bank might use (for public obligors) the mean KMV EDF™ for all obligors of a given internal rating. Other banks might not associate EDFs (for use within economic capital models) with ratings at all. For example, a bank might use KMV's PortfolioManager™ as its economic capital model, which assigns EDFs on an individual obligor name basis, regardless of the internal rating. This "disconnect" between the internal ratings process and the process of estimating EDFs used within economic capital models occurs to varying degrees within a number of the banks participating in this study. It is one of the reasons why we believe it is essential that the next iteration of the Accord be based on *numerical* estimates of key risk characteristics, rather than on ordinal internal ratings.

## A Test-Deck Exercise Using Large Corporate Credits.

The data. The eight large, advanced-practice institutions participating in this study intended to choose a sample of loans from a "universe" of corporate credits having two characteristics. First, a significant number of the loans should be credits participated in by two or more of our members. Alternatively, for a significant number of the loans at least two or more of our members should have estimated an EDF for the obligor

as part of the process of deciding whether the bank wished to participate in the credit. Second, the loan facilities should have identification numbers associated with them so that there is no question which loans (and therefore which obligors) were being analyzed. Also, by providing ID numbers, some of our member banks might be able to conduct the study in automated fashion rather than through a more labor-intensive fashion involving the matching of names and addresses of obligors.

Originally, the RMA group's intent was to develop two separate universes—a group of loans to publicly traded obligors and a group of loans to private obligors (each of which would satisfy the two conditions above). For the "public" universe, the KMV list of publicly traded obligors within CreditMonitor™ was chosen. For the "private" universe the group chose the shared-credit/traded-credit database of Loan Pricing Corporation (LPC) to which all eight of the participating banks subscribe. From this list of credits, obligors with ticker symbols were excluded to keep the LPC list primarily a "private obligor" list. Nevertheless, the resulting LPC list contains both private and publicly traded obligors (those without ticker symbols).

In the pre-survey tests it became apparent that the participating banks could not easily assign EDFs to the obligors with ticker symbols on a consistent basis, because many credits are issued to an affiliate or subsidiary of the publicly traded company, not the parent company itself. Thus, EDFs used by the bank within its economic capital models—the key risk characteristic on which this study focuses—were often available only for the affiliate and for a *different* affiliate than loans made by other participating banks. For this reason, the test-deck exercise focused *only* on the LPC database, which consists of specific credits with agreed-upon obligor names, addresses, and ID numbers.

The test-deck universe consisted of 627 loan facilities that were in place as of March 31, 2000.[4] For these facilities, the participating banks estimated 1,163 EDFs, an average of less than two banks' EDFs per credit. Of the 627 loans, 304 loans had estimated EDFs provided by *at least* two banks (and thus could provide a measure of EDF diversity). For these 304 loans, there were a total of 840 EDFs provided by the eight banks. All EDFs provided were as of March 31, 2000.

Methodology, results, and critical issues. An important finding associated with the survey is that for many loans, only one or two of our banks calculated EDFs for the obligors. That is, even among the universe of loans represented by the LPC database (typically large corporate credits) we could not generate large numbers of loans for which EDF-dispersion could be comfortably measured. Granted, our participating eight banks do not represent the universe of large, advanced-practice institutions. Nevertheless, the number of loans on which, say, at least three of our member banks calculated EDFs is surprisingly low—only 136 loans out of the universe of 627 loans. This suggests that, for the typical bank in the typical commercial loan market, EDF-dispersion is difficult to quantify, because the number of banks "looking" at the same loan (preparing EDF estimates on the same loan) is limited. Correspondingly, this limited ability to address EDF-dispersion in empirical fashion places even more emphasis on the need for supervisors to develop reasonable methods for assessing the quality of EDF-measurement practices at banks that wish to be subject to an RCB capital regulation.[5]

Given the data available to us, we wanted to be able to answer several questions:

1. In how many of our eight banks was the institution systematically generating higher (or lower) EDFs than its peers? That is, for how many of the eight banks were the differences between its EDFs and the group's mean EDFs statistically significant?
2. How large were the differences? Were the high-estimate (low-estimate) banks higher (lower) than the mean by one "grade", by two "grades," etc?
3. Were the banks that tended to estimate low EDFs also assigning low (high) economic capital for a given EDF, thereby compounding (offsetting) the effect on assigned economic capital and resulting RAROCs?

These and related questions were answered by applying a series of simple statistical tests to the raw data.

First, for each of the 304 loans for which at least two banks calcu-

lated EDFs, the raw data consist of each bank's ($bank_i$'s) EDF on the jth loan ($EDF_{ij}$). From these data, we calculated for each $EDF_{ij}$ the mean $EDF_j$ for the other banks' EDFs (calling this difference the bank's "$residual_{ij}$").[6] Next, we calculated each bank's mean residual and the standard deviation of its residuals, in order to estimate a standard error for its residuals and apply a t-statistic test. The results of this test are shown in Table 1, in which four of the eight banks generate EDFs that are statistically significantly higher than or lower than the other bank's mean EDFs (at the 95% confidence level) for the 304 loans.

These results are not surprising and, in and of themselves, do not present a problem for supervisors.

- As indicated above, the eight banks use varying methods for estimating EDFs; no two banks' methods could be expected to provide identical EDFs, yet each bank uses generally accepted "sound-practice" techniques.
- While every bank provided the EDF estimate as of March 31, 2000, the eight banks estimate their EDFs at different points in the calendar year. The March 31 data may be the latest available EDF but that particular EDF may have been generated two months prior to March 31 at one bank while the EDF may have been calculated on March 31 at another bank.
- Finally, some differences in the definition of default used either for determining the rating or for determining the EDF associated with a rating could lead to EDF differences across banks (for the same obligor). Thus, even if two banks both used the same historical database (e.g., a shared corporate loan performance database), the bank with the more expansive definition of default generally would estimate higher EDFs for loans of a given set of financial and nonfinancial characteristics. Two additional tests further

Table 1

**Differences Between Each Bank's EDFs and Mean EDFs for the other Banks ("Residuals")**

| | Bank 1 | Bank 2 | Bank 3 | Bank 4 | Bank 5 | Bank 6 | Bank 7 | Bank 8 |
|---|---|---|---|---|---|---|---|---|
| **Residuals** | | | | | | | | |
| Mean | -0.24% | 0.47% | 0.34% | -0.62% | -0.44% | 0.00% | 0.71% | 0.11% |
| Std Dev | 1.98% | 5.94% | 0.73% | 4.89% | 1.91% | 1.07% | 2.18% | 1.11% |
| Count | 79 | 160 | 29 | 235 | 90 | 59 | 164 | 24 |
| SE | 0.22% | 0.47% | 0.14% | 0.32% | 0.20% | 0.14% | 0.17% | 0.23% |
| t-Stat | (1.08) | 0.99 | 2.48 | (1.93) | (2.18) | (0.03) | 4.15 | 0.49 |
| Count <0 | 41 | 103 | 9 | 116 | 69 | 42 | 51 | 17 |
| Count >0 | 38 | 57 | 20 | 118 | 21 | 17 | 112 | 7 |
| p-value | 0.3265 | 0.0001 | 0.0307 | 0.4481 | 0.0000 | 0.0003 | 0.0000 | 0.0113 |
| **Weighted Residuals** | | | | | | | | |
| Mean | 0.05% | -0.20% | 0.51% | 0.08% | -0.49% | -0.29% | 0.39% | -0.37% |
| Std Dev | 0.92% | 0.87% | 0.83% | 0.94% | 0.85% | 0.76% | 0.85% | 0.96% |
| Count | 79 | 160 | 29 | 235 | 90 | 59 | 164 | 24 |
| SE | 0.10% | 0.07% | 0.16% | 0.06% | 0.09% | 0.10% | 0.07% | 0.20% |
| t-Stat | 0.45 | -2.91 | 3.23 | 1.33 | -5.45 | -2.91 | 5.91 | -1.84 |

Notes:
1) Number of cases in which $EDF_{ij}$ differs from mean EDFj by *more than one* EDF "grade" is 74 (or 8.8% of 840 observations of $EDF_{ij}$). Number of cases in which $EDF_{ij}$ differs from mean $EDF_j$ by *one or more* grades is 428.
2) "Residual" = $EDF_{ij}$ - mean $EDF_j$ (for banks not including ith bank) where *i* represents the *i*th bank and *j* represents the *j*th loan.
3) "Weighted Residual" = $Residual_{ij}$ divided by the following "weight" = [standard deviation of $EDF_j$/mean $EDF_j$].
4) p-values less than 0.05 represent statistical significance at the 95% confidence level.
5) t-statistics more than about (absolute) 1.97 represent statistical significance at the 95% confidence level.

bolster the conclusion that there are statistically significant differences across banks with respect to EDF-generation processes. First, a p-value test is also shown in Table 1. In this test, we simply count the number of cases in which $bank_i$'s EDFj is above the other banks' mean EDFj, versus the number of times the bank's EDF is below the other banks' mean. A standard binomial distribution is then used to test whether the number of positive (or negative) residuals is statistically significantly different from 50% of the total residuals for each bank. Second, to account for the existence of heteroscedasticity,[7] we weight the residuals of each bank by a term that takes into account the degree of dispersion across the EDFs for a particular loan. This test accounts for the fact that low quality loans will have absolutely high EDFs and thus each bank's residual for each such loan will be absolutely high.

The results of these two additional tests support the first test. Indeed the additional tests indicate that *six* of the eight banks generate EDFs that statistically differ from the means of their peers. The next question, of course, is "by how much?" Table 1 shows that, in absolute terms, the mean residuals range from less than one bp to 71 bp (the first line of the table). The mean of the mean residuals is about 4 bp. This would be a very significant (in the economic sense not the statistical sense) set of differences if, for example, the typical obligor were very high quality (very low EDF).

To see how important the EDF residuals really are, we can assign each EDF estimate (for each bank's estimate of the EDF on each loan) a numerical "grade" or "rating category." Then, we can count the number of cases in which a particular bank's EDF on a particular loan differs from the mean EDF for that loan by more than one grade. We do that by assigning a grade to each EDF based on the recommended EDF/LGD matrix developed by the RMA group within the March 2000 response to Basel. This matrix is reproduced in Table 2 (which also contains the median capital allocations of the RMA group for each EDF-LGD cell). Treating the EDF ranges as "grades" one sees that the EDF range approximately doubles between grades. At very high quality grades, the increase in EDF going from one grade to the next represents only a few basis points of increase. But in the lower quality grades, going from one grade to the next represents an increase in EDF of several *thousand* basis points.

Table 2

**Median Economic Capital for Credit Risk, in Percentage Points**
**(One-year horizon, one-year loan, 99.5% confidence level)**

| EDFRanges | LGD Ranges | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0- 10% | 10-20% | 20-30% | 30-40% | 40-50% | 50-60% | 60-70% | 70-80% | 80-90% | 90-100% |
| 0-0.04% | 0.050 | 0.150 | 0.170 | 0.200 | 0.230 | 0.270 | 0.310 | 0.350 | 0.400 | 0.430 |
| 0.04-0.08% | 0.080 | 0.250 | 0.340 | 0.420 | 0.530 | 0.650 | 0.700 | 0.820 | 0.920 | 1.040 |
| 0.08-0.16% | 0.170 | 0.390 | 0.650 | 0.910 | 1.170 | 1.200 | 1.220 | 1.400 | 1.590 | 1.770 |
| 0.16-0.32% | 0.230 | 0.590 | 0.990 | 1.380 | 1.500 | 1.770 | 2.090 | 2.400 | 2.710 | 3.020 |
| 0.32-0.64% | 0.370 | 0.920 | 1.450 | 1.970 | 2.460 | 3.000 | 3.550 | 4.090 | 4.640 | 5.180 |
| 0.64-1.28% | 0.590 | 1.300 | 2.200 | 3.050 | 3.710 | 4.530 | 5.320 | 6.000 | 6.670 | 7.340 |
| 1.28-2.56% | 0.990 | 2.300 | 3.590 | 4.590 | 5.570 | 6.540 | 7.490 | 8.440 | 9.390 | 10.340 |
| 2.56-5.12% | 1.540 | 3.250 | 5.050 | 6.450 | 7.610 | 9.170 | 10.510 | 11.840 | 13.170 | 14.490 |
| 5.12-10.00% | 2.340 | 4.870 | 7.250 | 9.630 | 11.900 | 13.600 | 15.400 | 17.300 | 19.200 | 21.100 |
| >10% but not default | 4.000 | 8.630 | 13.450 | 17.610 | 20.790 | 25.080 | 28.540 | 28.540 | 29.300 | 32.200 |
| Default | 8.840 | 18.590 | 26.200 | 29.250 | 29.250 | 31.510 | 36.420 | 29.250 | 29.250 | 26.200 |

Note: This table contains the median results from the RMA survey. For a more complete description of the results and assumptions, see Appendix 1, "Response to the Basel Committee's Consultative Paper on a New Capital Adequacy Framework," RMA, March 30, 2000.

A note for Table 1 shows that, when using the RMA grid as the basis for assigning "grades" to each EDF, there are 74 instances in which a bank's EDF for a loan differs from the mean EDF for that loan *by more than one grade*. This represents 8.8% of the 840 observations (total number of EDFij's). This degree of dispersion is not as great, for example, as the degree of year-to-year dispersion in default rates for a particular rating grade for corporate bonds.[8] Thus, we do not consider the EDF dispersion in our study to be of great significance.

However, at least two questions naturally arise. First, do the banks with generally higher (lower) EDFs "compound" matters by also assigning higher (lower) capital for any given EDF? Second, how much of an economic capital difference is represented, all things equal, by even *one* grade difference?

The answer to the first question is that, for the six banks that measure EDFs generally higher (or lower) than their peers, four tend to *offset*, not reinforce, their EDF estimates with their economic capital estimates. That is, two banks that measure EDFs *higher* than their peers also assign economic capital for a given EDF that is *lower* than their peers. Similarly, another two banks that assign EDFs that are *lower* than their peers also assign economic capital for a given EDF that is *higher* than their peers.[9] This suggests that, to some extent, market forces act to keep economic capital estimates (for a given loan facility) within fairly narrow ranges (assuming away portfolio effects on economic capital). For two of the eight sample banks, however, the bank's economic capital estimation process reinforces its EDF estimation process. One bank systematically estimates lower EDFs than its peers *and* estimates lower economic capital for a given EDF/LGD cell than its peers. For another bank, the opposite is the case. These results provide support for the view expressed by RMA within its March 2000 response—no risk-characteristic-based capital system can be implemented without an accompanying supervisory process that ensures that individual banks adhere to sound practice standards. We definitely do not mean by this that two of the eight banks may be engaging in less-than-best practices. Rather, where significant differences in practice exist, it is the reasonable function of supervisors to enter into a dialogue with the banks to determine the source of the differences in practice. As indicated earlier, to the extent a best-practice innovation is the source of the difference, we laud the innovation. Nor does it matter the direction in which the innovation moves the economic capital estimate. Accurate economic capital estimates contribute to maximizing shareholder value added and to meeting a defined soundness standard. Inaccurate economic capital estimates—whether too low or too high—reduce bank earnings relative to true risk and may reduce bank soundness.

The second issue—whether a one-grade difference itself is "too much" for supervisors to live with—can be answered by viewing the actual median economic capital estimates for each cell of Table 2. Note that for a given LGD column—say, LGD of 30-40%—economic capital rises substantially going from one EDF "grade" to the next. Indeed, economic capital often doubles from one EDF grade to the next, while at other times the increase in economic capital is on the order of 50%. Indeed, these economic capital results constitute the major reason why we have argued that EDF is a key indicator of economic capital and that the next Basel Accord should be based on specific, *numerical* estimates of EDF—and LGD—not on ordinal letter grades. But large absolute economic capital differences across banks (flowing primarily from significant, one-grade differences in EDF estimates) still can be consistent with a workable RCB regulatory approach—especially if these differences tend to average out across the portfolio or otherwise constitute a small percentage of banks' portfolios.

To see this, note that about half (412) of the 840 EDFij's represent differences from the mean that, nevertheless, *are within-grade* differences. Note further that the "average" corporate credit is around BB to BB- quality, which corresponds roughly to the 0.64%-1.28% EDF range or "grade" in the RMA matrix. At a typical LGD level of 30-40%, the mean economic capital allocation is approximately 3% in Table 2. For the next higher EDF "grade" (and at the same LGD level), the economic capital allocation is around 4.6%. Thus, if a bank

were to consistently estimate EDFs (for about *half* its portfolio) that were one grade higher (lower) than peer-estimated EDFs, its associated economic capital would be roughly 80 basis points (one-half of the 1.6 percentage point difference in economic capital between the two EDF "grades") higher (lower) than that of its peers, all other things equal. However, the study shows that only a limited number of banks (often only one or two) actually analyze any given credit to the point of calculating EDFs. As pointed out earlier, for less than half of the LPC credits do even two of the participating banks calculate EDFs, and for these credits about half of the observed EDF differences are within-grade differences. Thus, perhaps a quarter or less of the typical large bank's portfolio might involve even one-grade differences from that of its peers. For smaller, more regionally focused credits, the subject of EDF-dispersion should be even less germane and the effects on capital differences even less important. ❐

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## Appendix 1

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## Notes

1 See "Response to the Basel Committee's Consultative Paper on A New Capital Adequacy Framework," RMA (formerly, Robert Morris Associates), March 30, 2000.

2 See pp. 22-30 of the March, 2000 document for a discussion of why the Risk-Characteristic-Based approach is preferred to the literal Internal-Ratings-Based approach.

3 If a bank began to overestimate capital for a class of assets it would lose the opportunity to book earnings at RAROCs above its hurdle rate. If the bank already held sufficient capital to be at its desired insolvency probability, this lost income would not affect insolvency probability (but would prevent the bank from reaching higher shareholder-value-added). However, if the bank held less-than-desired (mark-to-market) capital, the loss of earnings (relative to risk) may prevent it from reaching its desired capital level.

4 These facilities represent substantially less than the entire LPC database, both because of the exclusion of obligors with ticker symbols and because many shared credits have not been assigned i.d. numbers.

5 Despite this caution, we believe "test-deck" exercises can be a very important tool for supervisors (and for banks, if the anonymous results of the exercises are published). However, supervisors may not be able to use samples of EDFs actually computed (in the day-to-day business practice of banks). Rather, it may be necessary to devise test samples of obligors for which banks are required to compute EDFs (based on obligor characteristics provided by the supervisor) even though the banks had not previously analyzed the obligor(s) in the course of their lending business.

6 Since the statistical test for each bank regards whether its EDFs are significantly higher or lower than those of its peers, the mean EDFj for the t-test was calculated as the mean of the other banks' EDFs. In the case of a loan having only two banks' EDFs, the comparison "mean" was the EDF calculated by the other bank for that loan.

7 The implied assumption in the first t-statistic test is one of homoscedasticity -- the variance of the disturbance term is equal across observations. This is clearly violated when we have EDFs representing obligors of greatly varying quality (absolute EDFs vary from a low of 2 bp to as high as 1475 bp within our sample).

8 Begin by matching the default rate ranges within Table 2 with the average default rates for S&P grades (as provided by the 1999 S&P default study). The S&P grade of BBB, for example, is approximately equivalent to Grade 4 in Table 2 (EDF of 16-32 bp). In the 19 years analyzed by the S&P study, for 9 of those 19 years the actual default rate was equivalent to more than one grade higher or lower than the BBB average.

9 These results flow from confidential bank-by-bank data behind the median capital estimates appearing within the cells of Table 2, as published in RMA's March, 2000 response to the Consultative Paper.