An Internal Ratings Migration Study

by Michel Araten, Michael Jacobs Jr., Peeyush Varshney, and Claude R. Pellegrino

This article discusses issues in evaluating banks' internal ratings of borrowers, drawing upon six years of internal ratings data from JPMorgan Chase's wholesale exposures to perform a ratings migration analysis. While ratings agencies have previously conducted these studies based upon publicly rated debt, this is the first published study based on a bank's internal ratings.

Ratings migration analysis entails the actuarial estimation of transition probabilities for obligor credit risk ratings, with emphasis on estimation of empirical default probabilities. Measurement of changes in borrower credit quality over time is important as obligor risk ratings are a key component of a bank's credit capital methodology. These analyses permit banks to more accurately assess and price credit risk, as well as improve their assessment of loss reserves and portfolio capital requirements. Key objectives of an internal ratings migration study include:

- Evaluating how well a bank differentiates risk on an ordinal basis.
- Examining the consistency of obligor ratings across different lines of business (LOBs) or customer types, to suggest guidance in the risk-rating process.
- Evaluating the extent to which a bank's rating philosophy is influenced by current conditions or longer-term, through-the-cycle considerations.
- Exploring how to satisfy Basel II regulatory requirements for validating the use of probabilities of default (PDs) associated with a bank's ratings.

Measurement of rating accuracy includes the notions of ordinal as well as cardinal accuracy. Ordinal accuracy tests the effectiveness of the ratings system in distinguishing credit risk on a relative basis. One can gauge ordinal accuracy by comparing agency ratings or default probability estimates (e.g., KMV EDFs™) for a common universe of obligors. Cardinal accuracy is related to the validation of risk ratings by comparing realized default rates to assumed default rates.

Analysis of a bank's rating and

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default experience is carried out over a historical period by forming annual cohorts at the parent level and observing their credit rating at the beginning of the year. The number of parents in each rating category is determined at each year-end, and the transitions to other ratings categories, including default, are measured. Estimates of the transition probabilities for a given category can be derived from 1) aggregation of the transition counts in a given category and 2) computation of the proportions of these out of the total number of starting observations across all cohorts. One-year and multiyear average transition matrices can be computed for the firm as a whole as well as for individual business units. Further differentiation can be performed on the basis of public versus private status, industry group, geographic region, and loan exposure level.

Data and Methodology

The principal source of information for ratings transition data in this study by JPMorgan Chase (JPMC) was its exposure system, which tracks ratings data for the wholesale bank at the family, obligor, and facility levels. Various customer demographic and loan detail information also is available. The indicator for default is the appearance of a borrower on the system that records those borrowers deemed to be in default and for which the bank is no longer accruing interest on these facilities (nonaccruals). Supplemental information was obtained from credit surveillance reports containing comprehensive details on customers and their facilities, which are prepared when customers reach a grade equivalent to Standard and Poor's (S&P) "B."

Various data filters were applied to ensure that data was of high and consistent quality. First, the study period (1997-2002) encompassed the longest historical period for which reliable and reasonably consistent data was available. Second, a size cutoff of $100M in exposure was imposed in order to avoid observations that are more of a retail character.[1] Finally, the unit of observation is at the parent level to avoid multiple counting of distinct subsidiaries with characteristics similar to the parent's. In line with the practice of ratings agency studies, there is no weighting by either the value of the loan or by the number of facilities to the customer, though this data was captured and could be analyzed.

The issue of withdrawn ratings (WRs), observations for which there is no ending state, is important in ratings migration analysis in general and particularly in this study, given data and systems issues. Withdrawn ratings are observed when customers have a rating as of the beginning of a year but do not have a rating or any exposure at year-end. These are clearly non-defaulters, as the bank would have had a record of their defaulting. They represent a combination of firms that no longer need to borrow or that roll over their debt with another lender. This differs somewhat from the case of a WR in ratings agency studies, as in some cases agencies may either decline or are asked by a company not to publish a rating. The frequency of WRs in this study is on the order of fourfold that observed in ratings agency studies (see References 3, 4, and 5 at end). The approach followed here, similar to one used by S&P, is to adjust for withdrawn grades by subtracting all of the "withdrawn" observations from the denominator.[2] Ignoring all beginning ratings that transitioned to a withdrawn status will result in a conservative proportional scaling-up of default probabilities. On the other hand, new credit exposures that arrive in the middle of the year and have a year-end rating also are not included in the analysis. Withdrawn rates in a bank portfolio, particularly for low-rated credits, often reflect skilled credit risk management in denying customers continued access to credit when their quality is declining. In addition, highly rated credits may have been discouraged from refinancing if their returns are inadequate. Here, it is important to separate the assessment of ratings consistency and accuracy from credit management skills.

Many firms have evolved their rating scale and methodology over time, often as a result of mergers in which they have had to reconcile different ratings systems employed by predecessor banks. Under these circumstances, it is often a challenge to develop a database of ratings history that fairly represents a consistent ratings philosophy. This also occurred at JPMC, which revised its risk-grading methodology with a view toward promoting consistency in risk grading to facilitate comparisons with external benchmarks and to develop explicit estimates of recovery rates. Prior to this point, "split" rating cate-

gories existed, which required mapping to the new ratings scale.[3]

Care must be taken in this type of analysis to investigate whether a bank's rating philosophy has changed over the study period. Basel II (see Reference 2 at end) requires a clear statement of rating philosophy for banks seeking to employ an Advanced Internal Ratings Based (IRB) system for regulatory capital. The bank must stipulate whether a grade represents the borrower's current condition (point in time, or PIT) or the borrower's condition evaluated over a longer period of time that incorporates a business or economic cycle (through the cycle, or TTC).

As previously noted (see Reference 1 at end), "While banks may now be moving toward a mark-to-market view of the value of their portfolios, the bulk of the current historical data that a bank typically possesses is likely to be based on the TTC view." However, different business units in an organization may be more exposed to and be more influenced by current conditions than other business units. A ratings migration analysis will help expose these issues.

Results and Analysis

Exhibit 1 presents the one-year average transition matrix for JPMC for about 33,000 distinct obligors covering approximately 100,000 transitions. Aggregate default rates at JPMC increase monotonically with risk grades.

This holds across all time periods and demographic measures. The transition matrix is diagonally dominated with transition rates generally decreasing with transition steps. The stability of ratings, as measured by the magnitude of the diagonal entries, diminishes with deteriorating credit quality, although not monotonically. Estimated transition matrices by individual cohort years between 1997 and 2002 are qualitatively similar with respect to ratings volatility (that is, the diagonals), default, and withdrawn rates across grades, as compared to the overall results. A time trend analysis of overall default rates reveals an increasing trend during the study period that also holds by risk class and is more pronounced for investment than for speculative grades. While the investment-grade default rates do not appear to be strongly differentiated, there are too few defaults in these categories to draw a firm conclusion. This pattern holds across all time periods and demographic measures, and the lack of statistical differentiation among the investment grades is confirmed by formal tests.

Observations consisting of ratings of companies subject to default and subsequently withdrawn constitute 22% or approximately four times the proportion of the total as observed in ratings agency studies (see References 3 to 5 at end). The withdrawn rate increases monotonically with deteriorating risk grade. This pattern holds across all time periods and demographic measures. Overall, the probability of an upgrade only slightly exceeds that of a downgrade. However, the upgrade/downgrade ratio is below 1 for all grades except for - rated credits, where it is 2.5.

JPMC's internal ratings can be shown to effectively discriminate credit risk on an ordinal basis, as measured by a Cumulative Accuracy Profile (CAP) and Cumulative Accuracy Ratio.

The CAP is a graphical representation of the effectiveness of a

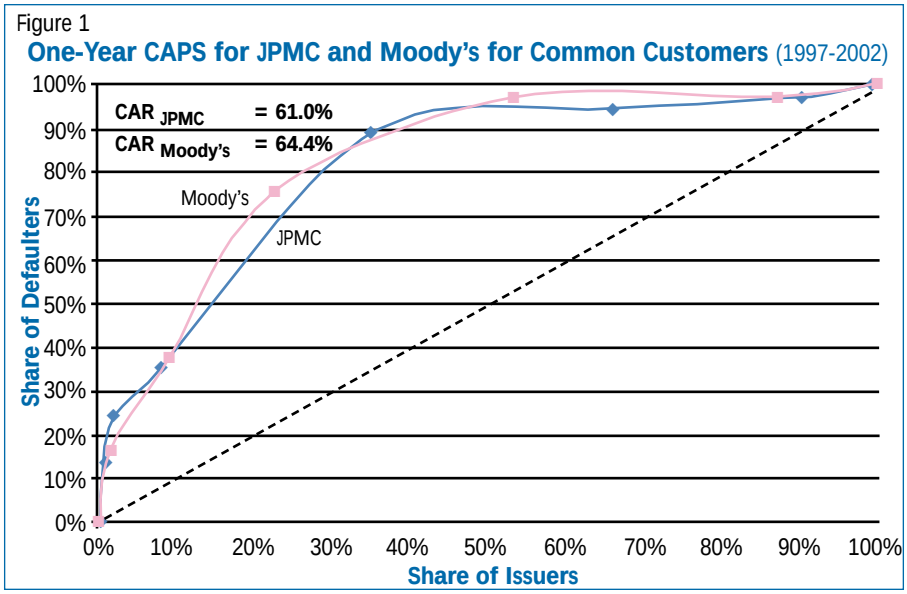
Exhibit 1

One-Year Average Transition Matrix (JPMC 1997-2002)

Initial Risk Rating	AAA-AA	A	BBB	BB	B	CCC	CC	Default	Total	WR	Up-Grades	Down-Grades	Up/Down Grades
AAA-AA	91.30%	5.62%	0.84%	1.03%	1.11%	0.03%	0.00%	0.08%	100.00%	14.85%	0.00%	8.70%	0.00
A	5.98%	85.91%	5.71%	1.67%	0.53%	0.09%	0.03%	0.09%	100.00%	15.45%	5.98%	8.11%	0.74
BBB	0.66%	7.02%	84.31%	6.96%	0.78%	0.11%	0.05%	0.10%	100.00%	17.19%	7.68%	8.01%	0.96
BB	0.08%	0.58%	3.99%	89.28%	4.81%	0.43%	0.26%	0.57%	100.00%	20.84%	4.65%	6.07%	0.77
B	0.12%	0.08%	0.26%	10.95%	84.07%	1.61%	1.06%	1.86%	100.00%	27.61%	11.40%	4.53%	2.51
CCC	0.00%	0.18%	0.09%	1.99%	15.10%	63.47%	9.13%	10.04%	100.00%	36.08%	17.36%	19.17%	0.91
CC	0.10%	0.10%	0.10%	1.40%	4.60%	1.40%	74.57%	17.72%	100.00%	40.84%	7.71%	17.72%	0.44
Total									100.00%	21.98%	6.88%	6.49%	1.06

ratings system in detecting defaults in a population. It is " …constructed by plotting for each rating category, the proportion of defaults accounted for by firms with the same or a lower rating against the proportion of all firms with the same or a lower rating." (See Reference 5 at end.) The CAR is a summary measure, defined as the ratio of the area beneath the CAP curve and above the 45° line to the entire area above the 45° line. Overall, the CAR for JPMC is 60%.

Figure 1



These curves also can be used to compare different ratings systems. This comparison requires an identical population of borrowers and time periods to measure ratings. Figure 1 presents a comparison of JPMC's ratings against Moody's for approximately 1,000 common customers over the study period. JPMC's ratings methodology appears just as powerful in ranking relative credit risk with a CAR of 61% as compared to 64% for Moody's. However, current market-based estimates over a one-year period have greater power to differentiate credit risk as compared to internal ratings. Figure 2 highlights a comparison of CAPs for JPMC with KMV EDFs™ for a universe of approximately 2,400 common customers over the study period. The CAR of 71% for KMV compared to 60% for JPMC demonstrates the innate ability of a market-based ratings measure to better discriminate default risk at a one-year horizon than JPMC's presumed through-the-cycle (TTC) ratings system.

Cardinal accuracy, or the ability to predict the level of defaults, is measured by comparing JPMC's observed default rates with its assumed default rates. The assumed rates are modified TTC rates (MTTC). They are obtained as weighted combinations of long-term average ratings agency default rates and median KMV EDFs over the previous three months. Over the study period, one-year default rates for risk grades AAA to A and for CC were found to be slightly above the MTTC default rates, whereas the default rates for risk grades BBB through CC were found to be significantly below.[4] However, results of this comparison for investment-grade borrowers should be interpret-

Figure 2

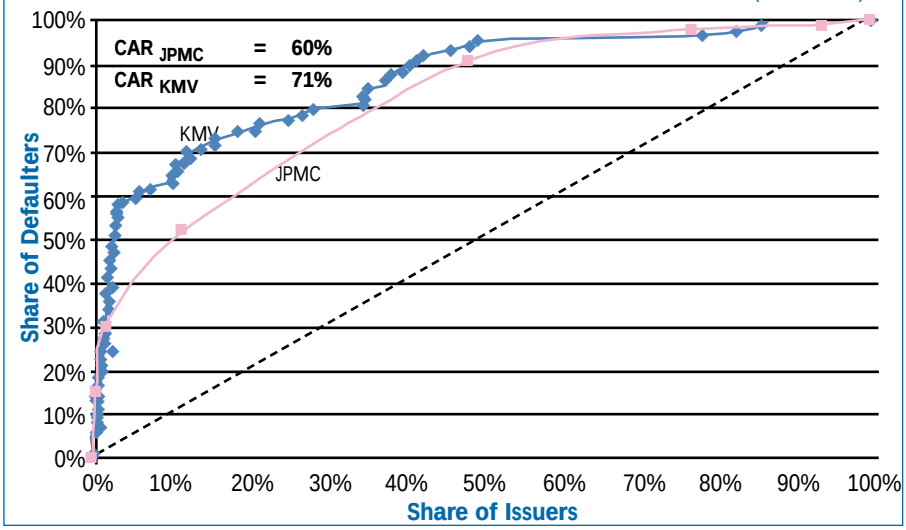


Exhibit 2

Observed One-Year Default Rates (JPMC 1997-2002)

Internal Rating	Business Segment and Borrower Type					
Rating	IB–All	MM	IB Public	IB Private	IB-US	IB-Non-US
AAA-AA	0.06%	0.00%	0.18%	0.04%	0.00%	0.14%
A	0.06%	0.14%	0.07%	0.06%	0.12%	0.00%
BBB	0.12%	0.00%	0.22%	0.08%	0.15%	0.10%
BB	0.48%	0.43%	1.04%	0.33%	0.81%	0.31%
B	1.58%	1.17%	2.24%	1.48%	2.88%	1.11%
CCC	10.17%	8.92%	10.59%	10.06%	14.75%	6.52%
CC	15.42%	23.39%	19.15%	14.93%	13.75%	18.80%

ed with care due to the paucity of their defaults.

Migration matrices were differentiated by various borrower demographics: Line of Business (Investment Bank—IB versus Middle Market—MM), Public vs. Private in IB, and U.S. versus non-U.S. domicile in IB (Exhibit 2). While in general the transition matrices were qualitatively similar, differences were observed in the cardinal accuracy of the respective risk ratings systems.

In the LOB comparison, default rates for all risk grades in MM appear to be lower than default rates for IB, with the exception of risk grade CC. A plausible explanation may be that smaller firms reach a state of heightened vulnerability to default once a certain credit quality threshold is breached with few exit opportunities. For large companies, at the same level of credit distress there may be additional options to avoiding default. The differences observed for all grades above CC might be attributable to a more conservative grading philosophy in MM. Default rates for public borrowers in IB are higher than those for private borrowers for all risk grades. This may be due to systematic severity or leniency, with respect to grading private and public customers, respectively.

U.S. entities have higher observed default rates as compared to non-U.S. entities. In particular, this holds across all grades, again, except for risk grade CC. A plausible explanation for more severe grading of non-U.S. customers could be to compensate for lower perceived quality of information. The higher default rate for non-U.S. borrowers for grade CC may be attributed to the same effect as noted in the IB versus MM comparison, i.e., a lack of exit options during times of extreme distress.

A rough indicator of ratings stability[5] or "stickiness" and perhaps the degree to which ratings are more influenced by current conditions (PIT) versus longer-term considerations (TTC) can be estimated by the percent staying in the same grade[6] over a one-year period (Exhibit 3). Here, MM with 87.6% versus IB with 85.0% remaining in the same grade shows a slightly greater propensity for stable ratings.

Withdrawn rates for public companies of 6.7% are much lower than the 26.7% observed for private companies. This rate is more in line with that reported by the ratings agencies, particularly for non-investment-grade borrowers. Private-company ratings appear to be slightly more stable than ratings for public companies (85.5% versus 83.3%). This may be a sign of less current market information availability for private companies. There is also a much lower upgrade to downgrade ratio of 0.89 for public companies versus 1.40 for private companies. This may be due to greater attention paid to ratings agency outlook indicators and market spread information availability for public companies.

Multiyear (2 through 5)

Exhibit 3

One-Year Transition Matrices for LOB and Borrower Types

Line of Business	Percent Same Grade (Excluding Defaults)	Upgrade/Downgrade (Including Defaults)	Percent Withdrawn
Investment Bank	85.0	1.25	22.0
Middle Market	87.6	1.04	19.5
IB—Public Corporates	83/3	0.90	6.7
IB—Private Corporates	85.5	1.40	26.5
IB—US	84.5	1.15	23.4
IB—Non-US	85.4	1.31	21.1

migration matrices were also computed. They naturally are more susceptible to change, exhibiting higher default and withdrawn rates as compared with average one-year transitions. While the speculative grades have the highest default rates for longer horizons, the rate of increase in investment-grade default rates is greater. As horizon increases, the investment-grade names show the most stability and speculative grades show the least stability, as measured by the percent remaining unchanged.

To better illustrate the degree of ratings consistency, both default rates and non-default migration rates can be evaluated around various demographic details. The consistency-of-ratings approach of individual raters throughout the banking organization is of great interest. If there is concern with potential ratings bias, feedback can be given to raters to help them achieve better consistency of approach and philosophy. If current market information is available for some companies and not for others, it may be natural for the ratings for these companies to reflect more of a PIT orientation versus those private companies without such information. The performance of historical ratings may be important to validate PD estimates for Basel II. Moreover, the review of migration rates and their volatility even on a quarterly basis may help point out different ratings philosophies and potential biases by the raters.

Conclusion

This article has highlighted issues associated with conducting and interpreting a ratings migration analysis based upon a bank's internal history. A ratings migration analysis allows a bank to evaluate how well it differentiates risk compared to external benchmarks, to study the consistency of its grading across segments of the organization, and to provide a basis for satisfying Basel II requirements for validating the use of PDs associated with internal ratings. This is illustrated by a study of JPMC's risk-rating system over the last six years. This study shows how one can assess the consistency and relative performance of the ratings systems across segments of a firm. Differences can be noted that may suggest business unit review of grading policies with regard to organization, public or private entities, and geographic domicile. Ratings philosophy indicative of favoring a PIT versus a TTC approach can be better understood in the light of a migration analysis. This study and similar ones in the future should serve as a guide to banks seeking to better understand and fine-tune their credit processes and practices. ❐

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Footnotes

1 Criteria for incorporating an observation in this study included any parent with a valid rating and both internal guidance and external committed facilities to its family that added up to $100M or more.

2 The Moody's approach subtracts half of the withdrawn issuers from the denominator (i.e., the total available-to-default), assuming that issues of debt exit uniformly throughout the year.

3 For a portion of the data, an old whole grade of 4 mapped to an agency grade of BBB- to BB+ and an old grade of 6 is mapped to BB- and B+. Further analysis enabled individual assignments to a ratings-agency-equivalent whole grade.

4 The AAA to A and CC rates were within a 95% confidence interval, while the BBB to CCC were outside the 95% confidence level, under the assumption of time-independent default rates.

5 A more quantitative treatment of stability or mobility and comparison of transition matrices may be found in Jafry and Scheuermann. [see Reference 7, below.]

6 Percent staying in the same grade calculated by excluding defaults.

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