

# Probability of Default Calculators

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## Introduction

Obligor risk rating is a quantitative measure of the risk associated with a customer. It is derived by assigning credit scores based on objective and subjective factors. Credit scores aim to translate a customer's financial position, the industry dynamics and the economic factors involved to a score that is comparable across customers and sectors. This forms the basis of probability of default estimates.

Probability of default is the likelihood that a customer will default, given the actual realized experience of customers with similar credit scores. Facility risk ratings further refine the risk rating framework by calculating PDs by customers and products as specified by the central bank. This paper documents the methodology used to assign customer credit scores and probability of default computation.

## Definitions:

### Customer Behaviour:

A schedule of customer payment information, including amount received, amount outstanding, payment due date and payment received date.

### Credit Update:

Any instance of a predefined event. Credit updates are ranked in terms of severity of negative behaviour (with 1 representing the highest risk of default), and are generated from customer behaviour.

### Credit Event:

A credit event is defined as any instance of a customer moving from one credit update to a higher ranked credit update.

### Default:

Any credit event is considered a default.

### Probability of Default (PD):

Probability of default is a function of credit events and credit updates.

### Scoring Elements:

A scoring element can be any information about a customer that is used in predicting default.

### Scoring Engine:

A fully configurable engine used to convert raw scoring elements to a customer score.

### Sample Window:

Historical period over which payment behaviour is analyzed in order to compute probability of default

## Scoring Engine:

Scores can be computed using customer specific information such as industry, sub industry, sector, length of relationship, time since incorporation in addition to financial information.

The first step involves determining which elements to use in the scoring process. The system may be configured to use a different set of scoring elements for each sector. This allows the user to configure the scoring engine to mimic the banks existing scoring methodology by not only having the ability to include or exclude scoring elements, but also determine the weight of each element in order to fine tune the scores by means of a feedback loop.

Next, each attribute or scoring element is scaled and converted to a customer score. The buckets used to scale the weighted scoring elements to customer scores are defined for each scoring element, depending on the sensitivity of graduation required.

Once the scoring elements are weighted and scaled, the final customer score is simply the sum of scores across all scoring elements.

Customer scores serve as a link between PD estimates and customers. Probability of default is calculated for range of scores, and customers, whether existing or new relationships are assigned PDs depending on their individual credit scores.

Probability of default is calculated on a consolidated as well as facility wise basis. In addition, PDs may be computed using number of credit events and credit updates, or amount outstanding for credit events and credit updates.

Finally, PD can be grouped not only by scores, but by any scoring element. This is covered under feedback loop.

Title	Include
Current assets	<input checked="" type="checkbox"/>
Inventory	<input type="checkbox"/>
Prepaid expenses	<input checked="" type="checkbox"/>
Fixed assets	<input type="checkbox"/>
Total assets	<input checked="" type="checkbox"/>
Current liabilities	<input type="checkbox"/>
Long term liabilities	<input checked="" type="checkbox"/>
Total liabilities	<input type="checkbox"/>
Total short term borrowing	<input checked="" type="checkbox"/>
Total long term borrowing	<input type="checkbox"/>
Total Borrowings	<input checked="" type="checkbox"/>
Equity	<input type="checkbox"/>
Sales	<input checked="" type="checkbox"/>
Cost of Sales	<input type="checkbox"/>
Gross Profit	<input checked="" type="checkbox"/>
Operating Profit	<input type="checkbox"/>
Depreciation	<input checked="" type="checkbox"/>
Taxation	<input type="checkbox"/>

## Payment Behaviour:

Payment behaviour is captured for each customer on a facility wise and consolidated basis. The date on which a payment was due and the date on which it was subsequently received, and the amount that was due and the amount of payment received is used to determine customer behaviour. Payment behaviour may be captured at any frequency, be it monthly, quarterly, semi annually or annually.

Using this information and the definition of default, a grid (A) is generated displaying the number of credit updates within the sample window at the desired frequency.

The next step involves the transition from credit updates to credit events. Any update that is ranked higher than the previous update is marked as a credit event. The number of credit events is displayed on a second grid (B).

The same process is repeated a second time, however all credit updates, the amounts outstanding are determined and accumulated for each period within the sample window.

Similarly, total amount outstanding for credit events is also calculated.

## Probability of Default:

$$P(\text{Default}) = \frac{\text{Number of credit events}}{\text{Number of credit updates}}$$

$$P(\text{Default}) = \frac{\text{Amount outstanding for credit events}}{\text{Amount outstanding for credit updates}}$$

PDs are computed using credit events and credit updates corresponding to groups of customers with similar scores. The definition of PD given above may be directly applied to the PD for a given period for a score range. The overall PD is calculated using total credit events and the total credit updates for all periods for a given score range. The same methodology applies to PDs calculated by amount outstanding.

Start Date	01/01/2005	Frequency	Quarterly	Compute PD By	<input checked="" type="radio"/> Number of Defaults <input type="radio"/> Outstanding Exposure				
End Date	31/12/2006	Facility	Consolidated						
Probability of Default				Event Tracking					
<input type="radio"/> No. of Defaults <input type="radio"/> Total Updates <input checked="" type="radio"/> Probability of Default				Generate					
Score Range	31/03/2005	30/06/2005	30/09/2005	31/12/2005	31/03/2006	30/06/2006	30/09/2006	31/12/2006	Total
90-100	9.52%	8.70%	8.33%	2.94%	3.13%	14.29%	46.15%	9.38%	10.11%
80-90	13.04%	11.36%	3.85%	6.25%	4.65%	5.56%	13.04%	6.98%	7.32%
70-80	22.58%	7.32%	13.33%	13.79%	10.42%	6.98%	3.33%	7.50%	9.63%
60-70	17.24%	11.63%	11.32%	11.63%	12.96%	8.16%	3.57%	6.38%	9.89%
50-60	10.45%	7.41%	6.76%	12.73%	15.56%	7.27%	5.56%	5.66%	8.88%
40-50	14.06%	9.68%	17.78%	11.84%	10.23%	4.35%	9.62%	12.31%	10.94%
30-40	15.87%	7.46%	8.11%	12.50%	14.29%	11.69%	12.35%	6.59%	10.96%
20-30	15.94%	11.84%	7.14%	7.21%	11.58%	6.90%	21.67%	11.11%	11.01%
10-20	8.87%	12.15%	11.54%	9.28%	15.96%	5.38%	8.42%	11.69%	10.37%
-100-10	15.05%	13.54%	17.65%	16.13%	9.35%	12.36%	12.77%	12.50%	13.41%

### Feedback Loop:

Overall probability of default increases with deteriorating scores. Any inconsistency in this pattern suggests a need to calibrate and fine tune the scoring model.

The built in feedback loop is used to determine the predictive quality of each scoring element in isolation, and forms the basis of selection and weight assignment for scoring parameters.

The steps involved in calculating PDs are repeated for each scoring element; however credit events and credit updates are filtered by attribute score range as opposed to total customer score range. PDs are then computed using only those customers whose attribute scores fall within a given range.

### Default Definition:

The definition of default is user defined, and provides the flexibility of extending the Basel II definition to any number of days past due, with incremental tracking, as well as definitions for non payments and covenant breaches. Alchemy ORR can be configured and used for IRB PD estimates and capital charge calculation or internal analysis and loan pricing.

Separate default definition for funded and non funded exposures may be accommodated.

<input type="checkbox"/>	Rank	Event	Upper Days	Lower Days	Update
<input type="checkbox"/>	1	Covenant Breach			Default
<input type="checkbox"/>	2	No Payment Received			CCC
<input type="checkbox"/>	3	Late Payment	365	90	BBB
<input type="checkbox"/>	4	Late Payment	90	60	BB
<input type="checkbox"/>	5	Late Payment	60	30	B
<input type="checkbox"/>	6	No Payment Received			

Dropdown menu options for Rank 6:  
No Payment Received  
Late Payment  
Covenant Breach

### References

- “Measuring and managing credit risk” Servigny and Renault, Wiley, 1998
- “Managing credit risk” Caouette, Altman and Narayanan, McGraw Hill, 2004
- “Credit scoring for risk managers” Elizabeth Mays, South-Western, 2004
- “Econometric models and economic forecasts” Pindyck and Rubinfeld, McGraw Hill, 1998

## Process Flow 1.0

