

Corporate Risk

February 19, 2008

Board of Directors Credit Evaluation Project Results

Austin, TX



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Section 1

Introduction and Results of Credit Practice Review

The entire credit evaluation project covered three workblocks

Workblock 1

Credit practices review

- Assessed ERCOT's current credit management practices
- Assessed ERCOT's current creditworthiness practices
- Examined nodal impacts

Workblock 2

Credit scoring model

- Developed a set of credit rating tools to assess probabilities of default (PD) for each participant
- Identified model factors based on financial data and qualitative assessments
- Tested against available benchmarks





Workblock 3

Credit loss model

- Included collateral limits, price caps, other key assumptions as inputs
- Looked at possible volumetric exposures for each participant
- Simulated market prices, which with the volumes yield exposure at default (EAD)
- Simulated losses from credit failures
- Explored the impact of exogenous variables/ stress events





Credit Practice Review – Summary Results

ERCOT's credit worthiness monitoring & reporting and workout and management practices were found to be very solid. However, in the following areas ERCOT fell short of "best practices":

Category	Priority level	Calibration relative to best practice	Status achieved at the end of the project	Initial practice	Progress achieved during this project	Potential next steps
Risk appetite	High			<ul style="list-style-type: none"> Some internal discussion in market meetings 	<ul style="list-style-type: none"> Risk appetite definition should be explicitly defined to better guide ERCOT's risk policies Estimate credit risk using credit loss model (current OW effort) 	<ul style="list-style-type: none"> Assess market's comfort level with loss estimates and ability to absorb losses Board should develop a formal risk appetite statement Ensure credit policies and procedures are consistent with risk appetite and tolerance
Credit Scoring	Medium			<ul style="list-style-type: none"> Agency ratings used where available but primarily for limit setting purposes Creditworthiness was assessed using risk factors common to credit scoring models. 	<ul style="list-style-type: none"> Internal scoring model fully vetted and now available to supplement agency ratings 	<ul style="list-style-type: none"> Refine credit scoring model as additional data becomes available

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Exposure measurement and monitoring	High			<ul style="list-style-type: none"> Exposure calculations track very recent historical exposure activity Measurement of forward exposure is based on recent history Processes are being automated Response to alerts is rapid and well-defined 	<ul style="list-style-type: none"> Credit loss model can simulate potential future exposure under a variety of assumptions and circumstances 	<ul style="list-style-type: none"> Forward exposure measurement should be based on forward risk factors (e.g. forward price and volume estimates)
Loss reserve and capital	High			<ul style="list-style-type: none"> Some single scenario estimates have been made Based on historical market circumstances 	<ul style="list-style-type: none"> Credit loss model provide best practice capability Credit loss model will estimate loss magnitude 	<ul style="list-style-type: none"> Use economic capital results to foster discussion regarding risk appetite and a more consistent framework for considering loss reserves

Section 2

Credit Loss Model

Credit loss modeling

The questions this type of model addresses center on the potential for credit-related losses

Expected Loss

What level of credit losses is “normal”?

- Quarterly or annually
- This loss amount will vary, and is considered the **expected loss**
- Business must accommodate these

Economic Capital

What is the greatest loss we can expect?

- Over a given period
- For a given level of confidence
- Under a given set of assumptions
- Given a standard for solvency, can be used for determining **economic capital required**

How do changes to inputs affect potential losses?

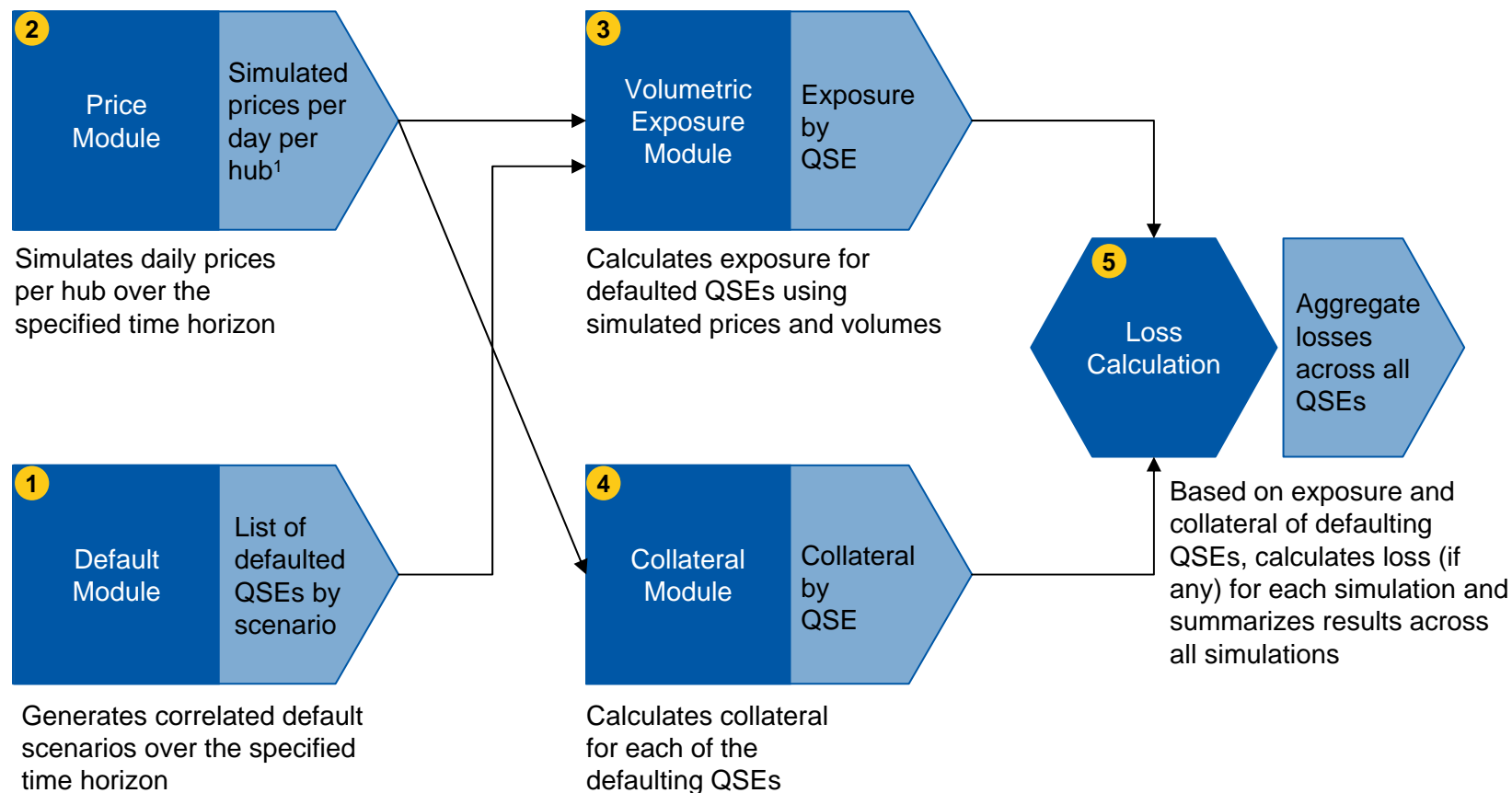
- Price cap levels
- Impact of credit and collateral rules
- Through process changes; billing cycle, mass transition handling, market rules
- Monitoring effort enhancements

Approach

- **Model the inputs of interest in a way that captures the important characteristics and relationships**
- **Simulate the resulting market environment and the occasional default of the participants**
- **Calculate the losses resulting from each simulation, and examine these statistics**

Credit Loss Model – High level credit loss calculation configuration

The model consists of four modules: default, price, volumetric exposure and collateral



The model will be run thousands of times in order to estimate a credit loss distribution – this schematic represents one simulation

1. Hub refers to a zone, settlement point, location or market

The model allows the user to make adjustments to inputs and measure how those changes impact the prospective distribution of credit losses

Global inputs

- Time horizon (in days)
- Number of hubs/zones
- Number of simulations
- Number of QSEs

Default module inputs

- Credit score of each QSE (i.e., probability of default)
- Default correlation types
- Market event sensitivity types

Price module inputs

- Price movement correlation between zones
- Forward prices predicted from forward gas prices, based on local spark spreads
- Frequency and size of jumps
- Jump event types (1-, 3-, 6-day jump series)
- Frequency of jumps common to multiple zones
- Locational differences that drive CRR pricing

Exposure module inputs

- Settlement and billing cycle
- Volume escalation behavior
- Maximum potential volume
- Length of time of mass transition (if applicable)

Collateral module inputs

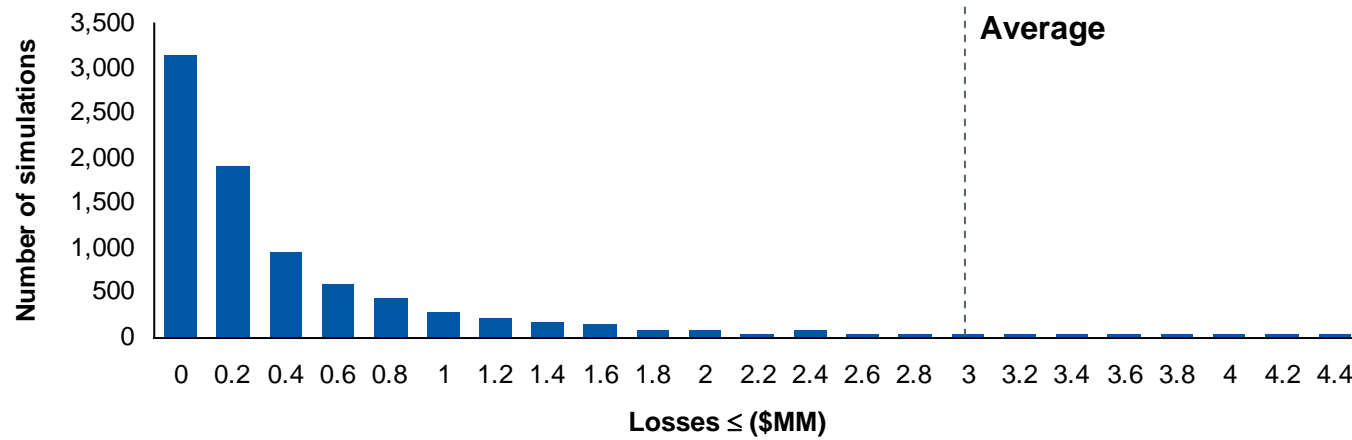
- Number of days to post collateral and cure a breach
- Simplified collateral calculations
- Collateral haircuts

Section 3

Model Results

Confidence levels in Monte Carlo analysis

Results: Baseline case showing 8,500 of 10,000 simulations



- Histogram shows number of simulations with credit losses less than, or equal, to X MM dollars
- Zero, or rather small, losses are the most common result
 - Almost a third (3,134) of the simulations had no losses; either no defaults or defaults with adequate collateral
 - The results show that 80% of the simulations result in losses that are less than \$2,200,000 each (the first 12 bars total 7,993 simulations)
- The average loss across all simulations is about \$3 MM
 - Most simulations are well below this, thus a few, rare, loss simulations have much greater losses
 - “Average” is **not** “most common outcome”, but the long run average across all outcomes (the Expected Loss)
- These results are specific to one set of inputs, and one set of simulations
- The pattern shown here is common to virtually every analysis of ERCOT’s market performed to date
 - All have a most common result of zero loss
 - All are heavily skewed to the right, showing only relatively rare, very large losses

Tabular results and comparison for the same Baseline case

- The baseline scenario reflects a combination of market and behavioral assumptions that are easily conceivable for the current market conditions and yields annual losses of
 - \$16 MM at the once-in-20-years level
 - \$43 MM at the once-in-100-years level
 - \$99 MM at the once-in-1,000-years level
- The comparison stress scenario shown uses identical assumptions to the baseline except that all collateral actually held at the beginning of the period is recognized
 - Baseline assumes that all collateral holdings will meet but not exceed ERCOT's required minimums
- 50% of the annual credit losses were less than \$194,000
- Most larger loss simulations are the result of several participants defaulting within the one year horizon
- While these estimates represent reasonable estimations of potential losses, actual losses may be more or less than these, as all possible scenarios are not addressed

	Baseline	Comparison
Average Loss	2.95	.742
Median	.194	.033
90.0 th %	8.26	1.38
95.0 th %	15.8	3.96
99.0 th %	42.6	10.9
99.9 th %	99.8	29.8
Maximum	213.0	156.0
Collateral held	Min. per Protocols	Actual historic

All losses in \$ Millions

Frame of reference - Confidence levels in corporate finance

- This table shows historical default rates for firms with a variety of S&P credit ratings
- The “1-yr PD” is the likelihood a firm with this rating will default for any reason within one year.
- The “Confidence level” can be thought of as the likelihood that a firm with this rating will still be solvent after one year has passed, or the fraction of firms holding this rating that will remain solvent over the year
- Some firms use a target rating as a solvency standard
 - They manage their business so that the likelihood of bankruptcy within the next year equals the associated 1-yr PD
 - For example, if they target BBB+, the probability of insolvency must be about 0.1%
 - The amount of available assets the firm must hold to achieve this is its **economic capital requirement**

Rating	1-yr PD	Conf level
AAA	0.002%	99.9980%
AA+	0.003%	99.9970%
AA	0.005%	99.9950%
AA-	0.010%	99.9900%
A+	0.018%	99.9820%
A	0.033%	99.9670%
A-	0.059%	99.9410%
BBB+	0.108%	99.8920%
BBB	0.185%	99.8150%
BBB-	0.354%	99.6460%
BB+	0.642%	99.3580%
BB	1.164%	98.8360%
BB-	2.111%	97.8890%
B+	3.828%	96.1720%
B	6.943%	93.0570%
B-	12.59%	87.4080%
CCC+	22.84%	77.1620%

Choosing an appropriate confidence level

Typically driven by the needs of the various stakeholders

- Stakeholders that are typically considered:
 - Board, Management, Regulators, Debtholders, Shareholders,
 - Financial community ,Customers, Suppliers, Employees
- Selection of a confidence level typically hinges on these entities' expectations of solvency, and what level of assurance is needed to retain them as stakeholders
- Many firms with significant borrowing choose historical solvency levels associated with a target debt rating – as a way to drive towards particular bond ratings
- The market participants invest in this region (plant, human capital, etc) with the expectation that the ERCOT market will remain functional
- What expectation of solvency is appropriate for this market?
 - A higher target will increase assurance, and current costs (collateral, etc) for the participants but demand more from them in explicit support
 - A low target will decrease all of these
 - The size and visibility of the market argue strongly for an investment grade target
- Other strategic issues may also impact that choice, such as reputation, similarity to other ISOs, target growth in number of market participants or in a particular market segment

Section 4

Wrap Up and Next Steps

Did ERCOT get everything it wanted?

All of the project's objectives and deliverables have been achieved

- Specific project objectives:
 - Review of credit practices in ERCOT Protocols, Creditworthiness Standards, and credit risk management practices generally
 - Determine whether ERCOT's practices are consistent with best practices.
 - Provide modeling capability to enable quantification of credit risks for the entire credit portfolio.
 - Estimate Probabilities of Default (PDs) for each participant
 - Estimate the credit loss probability distribution using this model
 - Provide a capital adequacy assessment.
- Deliverables:
 - Evaluation of creditworthiness and credit management practices
 - Credit scoring model and documentation
 - Credit loss model with documentation
 - Loss distributions and capital adequacy evaluation

ERCOT also sought answers and insight into broader questions of risk tolerance

- 1) At a specific point in time and for a specific timeframe, we are xx% confident that the market will not have losses in excess of \$xx.
 - The model OW delivered will allow ERCOT and the market to make this kind of statement under various assumption sets
- 2) At a specific point in time and for a specific time frame, we are xx% confident that the market can withstand losses of \$xx.
 - OW explored various ways to accomplish this with ERCOT.
 - Ultimately, OW and ERCOT concluded that a model couldn't do this because ERCOT does not hold a central pool of capital to provide an economic buffer against credit losses (or any losses) and there is no way to know with certainty how each participant will respond to given levels of short pay or uplift.
 - ERCOT agreed that providing "confidence", if there was not a strong basis for the conclusions, would be counterproductive.

Potential next steps

- Examine any specific potential loss scenarios suggested by the Finance and Audit Committee and/or the Board
- Continued education and iteration on scenarios with stakeholders
- Pursue policy decision on level of acceptable credit exposure
 - Define an appropriate confidence level
 - Define a target “not to exceed” amount at the defined confidence level
 - Agree on the modeling assumptions to be used in the analysis

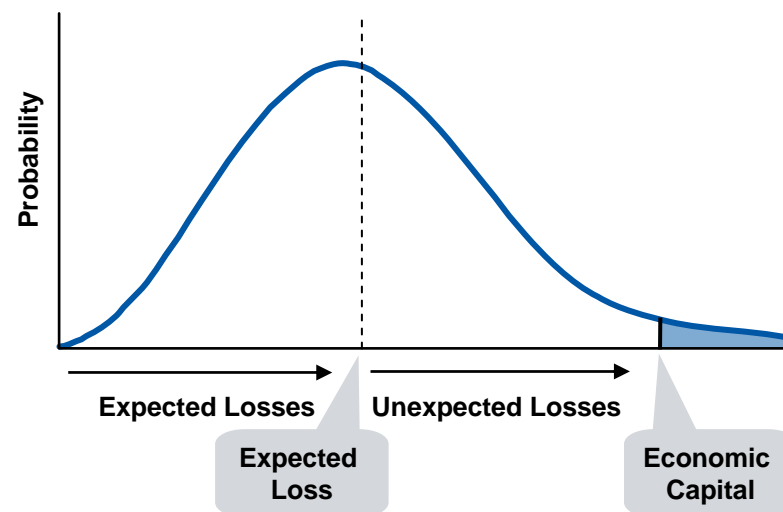
Section 5

Appendix

Credit loss and capital adequacy definitions

- **Capital adequacy (economic capital):** Based on the **portfolio analysis** and an assessment of the market, it is the amount of losses you may lose over a specified time period with probability X%
- **Expected Loss:** Long run statistical average of potential credit losses across a range of typical economic conditions
- **Portfolio analysis:** Aggregation of losses by counterparty across the market

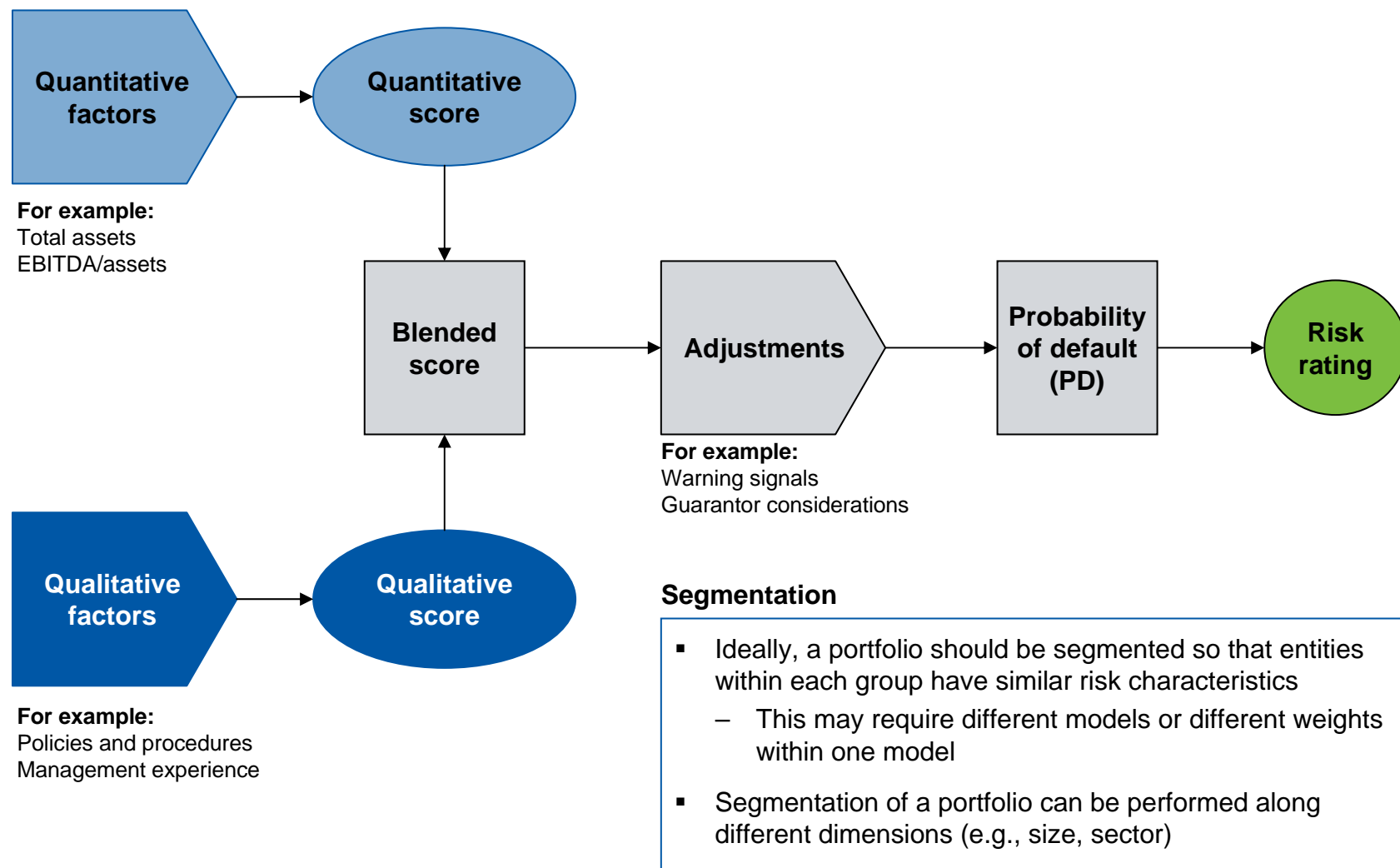
Illustrative Loss Distribution



Terms used when measuring credit loss

- **Probability of default:** The probability that a counterparty will default at some point in a specified time horizon
 - **Default correlation:** Similarity of the counterparty to other counterparties in the portfolio in terms of common drivers of default (e.g. geography, industry, business model)
- **Exposure at Default:** Sum of the exposures at time of default for each counterparty over the specified time horizon
- **Loss given default:** Sum of exposures **in excess of collateral and other risk mitigation** at time of default for each counterparty over the specified time horizon

A standard credit scoring approach blends quantitative and qualitative scores and potential adjustments, to arrive at a PD and risk rating



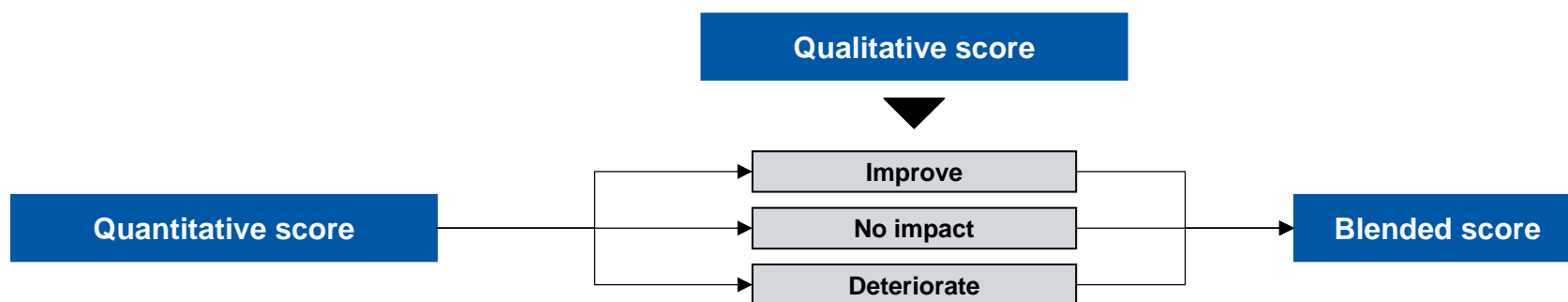
Selected financial and qualitative factors and weights

Quantitative factors	
Proposed factor	Weight
Working Capital/Sales	30%
Current Ratio	10%
Equity/Assets	20%
EBITDA/Interest Expense	10%
EBITDA/Sales	10%
Net Income/Assets	10%
Total Assets	10%

▼ 70% weighting

Qualitative factors	
Proposed factor	Weight
Ability to access funding in difficult market environment	25%
Margin call and late payment history	20%
Experience of company leadership	15%
Recent growth	15%
Risk management policies and practices	10%
Quality and timeliness of reporting of financial information	10%
Length of time as QSE	5%

▼ 30% weighting



Key Stress Tests – Zonal market design

Many variations in inputs and assumptions have been examined

- Primary stress tests focused on market (price) and participant (escalation and sensitivity) behaviors
- Withdrawal of excess collateral (above ERCOT requirements) prior to default
 - This assumption directly increased net losses
 - Primarily for larger participants, whose defaults tend to drive the tails of the loss distribution
 - Greatly accentuates the impact of all other stress factors
- Ability and likelihood of defaulting participants increasing their exposure to the market toward (or to) their maximal potential (volume escalation)
 - Losses are very sensitive to this parameter choice, since the largest counterparties are orders of magnitude bigger than the smaller counterparties
 - Collateral is based on recent invoicing, thus recent activity rather than potential activity
- Higher prices and/or more, higher and longer duration price spikes
 - Alone, this stress test produced only slightly higher losses
 - In conjunction with enhanced escalation, impact increased noticeably
- Correlation of defaults with price spikes (aka, market event sensitivity)
 - Increasing this correlation increased losses in the loss distribution tails, but not in the extreme tails
 - Extreme tail losses were likely already caused by default on high price days
- Credit quality or rating of the participants
 - Increasing credit quality decreases the number of defaults in any single simulation
 - Also shifts the loss distribution down as there are more cases with no defaults
 - Loss given default is unchanged, although the multiple defaulting entity cases are diminished

Key Stress Tests – Nodal market design

Additional situations should be studied when data become available

- Nodal market design version of the credit loss model differs somewhat from the Zonal market version
 - Both RT and DAM markets can be represented
 - Price modeling at RT and DAM locations is identical to the Zonal BES market model (mean reversion, jumps, correlations, etc)
 - The spirit of the current market rules for collateral have been reflected in the model logic
 - CRR holdings can be accommodated, with valuations for the realized and unrealized portions
- The reasonableness of the overall credit loss results from this model are currently difficult to assess, because there is no firm basis for many of the required assumptions
 - Volume of participation by each counterparty in each DAM and each RT market
 - Price behavior at the DAM and RT locations
 - Number of DAM and RT locations to consider
 - Number, tenor, size and location of the CRRs held by each counterparty
 - Collateral is based on recent invoicing, thus recent activity rather than potential activity
- As data is collected, some of these parameters can be estimated
- Initial model runs can test some of the remaining assumptions, by varying those parameters
- Credit scoring and the estimation of counterparty PDs will be unchanged