Risk Aggregation
23Mar2018
Risk information can never be aggregated into any meaningful and useful way due to the complex and multi-dimensional nature of risks.

Some risk information can be aggregated but accept that all the information about a risk cannot be aggregated into one number. Also accept that all aggregation methods will have pros and cons.

All risk information can be aggregated into meaningful and useful way. Aggregation can also be automated without requiring any manual intervention.
Why aggregate?

Risks exist at multiple levels within an organisation structure.
Risks also exist at different levels of other hierarchies (some highlighted below).
Risks typically exist at intersection of multiple hierarchies.
Stakeholders at each level want to view aggregated level of risk exposure for specific risks or categories e.g. External Fraud, Improper Conduct etc. This can be useful for monitoring changes in risk profile over time.
Stakeholders at each level want to easily identify whether any risks or portfolio of risks are approaching risk appetite limits or have already breached the risk appetite limits.
Why aggregate?

At Each Level in a hierarchy

Which risks need escalation/attention?

Risk Exposure vs. Risk Appetite Misalignment

Business Division Risk Profile

BU 1 Risks

BU 2 Risks

BU 3 Risks
Challenges
Criticality threshold for each levels are typically different e.g. a £1mln exposure at the business unit level may be High but at the group level may be Low. Considering this across intersection of different hierarchies makes the challenge further complicated.

There may be multiple thresholds e.g. financial, reputational etc.
Combining qualitative & quantitative information.

Majority information is qualitative.

Time horizon for information is typically different.

Statistical functions (e.g. SUM, AVERAGE) cannot be used for most quantitative information.
Aggregation Approaches
Risks

Information available for each risk

Aggregation Path

Retail Bank

Credit Cards

Personal Banking
Perform risk assessments to aggregate all information available about each risk.

- Likelihood
- Financial Impacts
- Non-Financial Impacts

- Alignment with Risk Appetite (e.g. Within appetite or outside appetite)

- Completeness of present controls
- Percentage of Preventative vs. Detective vs. Responsive controls
- Design and operating effectiveness of controls

- Open Issues
- Open Action Plans

- Risk indicators
- Control indicators

- Internal incidents
- External incidents

- Independent testing of controls

- Changes in internal business environment
- Changes in external business environment
Risk assessments will provide an aggregated view of risk exposure at an individual risk level.
Switch to spreadsheet.
Real-life Aggregation Examples

Weather Forecasts

<table>
<thead>
<tr>
<th>London 22:00</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>20°C</td>
<td>Min. night 14°C</td>
<td>23°C 15°C</td>
<td>22°C 15°C</td>
<td>22°C 16°C</td>
<td>22°C 14°C</td>
</tr>
</tbody>
</table>

Credit Score

- BAD: Only secured loans are given for people in this range
- FAIR: Creditors will give you a loan, but with high interest rates
- GOOD: You will be approved almost everywhere with good rates
- BEST: You will get the best interest rates everywhere
## Corporate Credit Ratings

<table>
<thead>
<tr>
<th>Long-Term Bond Ratings</th>
<th>Grade</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Moody’s</strong></td>
<td><strong>S&amp;P/Fitch</strong></td>
</tr>
<tr>
<td>Aaa</td>
<td>AAA</td>
<td>Investment</td>
</tr>
<tr>
<td>Aa</td>
<td>AA</td>
<td>Investment</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>Investment</td>
</tr>
<tr>
<td>Baa</td>
<td>BBB</td>
<td>Investment</td>
</tr>
<tr>
<td>Ba, B</td>
<td>BB, B</td>
<td>Noninvestment</td>
</tr>
<tr>
<td>Caa/Ca/C</td>
<td>CCC/CC/C</td>
<td>Noninvestment</td>
</tr>
</tbody>
</table>
Country GDP

UK Real GDP

Compounded Annual Percent Change

Percent

-10 -8 -6 -4 -2 0 2 4 6 8


-2.8
Stock Market Index

**DAX**
10198.24 *
+50.78
▲ +0.50%

**FTSE**
6710.13 *
-20.35
▼ -0.30%

**CAC**
4388.00 *
+6.90
▲ +0.16%
• Large amounts of detailed information is aggregated
• A distinct measure is defined for aggregated information, which can be different to the measurement units of detailed information
• Some aggregated measures typically update in real-time (e.g. stock index)
Risk Index Approach
**Risk Index Approach**

**Step 3** – Aggregate the measures into a single risk measure

**Step 2** – Aggregate the measures for each type of information into a single aggregated measure

**Step 1** – Convert different types of risk information into a single measure which can be aggregated (e.g. SUM, AVG)
State of risk management is deficient. Immediate responses required.

State of risk management is deteriorating. Preventative actions should be considered.

Early signs of problems. Review and respond appropriately.

Minor concerns
Develop rules to convert risk related information into aggregated measures

Rule Example 1: -

- If a risk is mapped to one or more high priority open issues, score = 100
- If a risk is mapped one or more medium priority open issues, score = 70
- If a risk is not mapped to any open issues, score = 0

Rule Example 2: -

- If 81% or more controls mapped to a risk are not effective, score = 100
- If 41% to 80% of controls mapped to a risk are not effective, score = 75
- If 1% to 40% of controls mapped to a risk are not effective, score = 45
- If all controls mapped to a risk are effective, score = 0
<table>
<thead>
<tr>
<th>Risk</th>
<th>Score at each rule level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk = Identity fraud</td>
<td>Risk Assessments&lt;br&gt;Rule 1 = 10&lt;br&gt;Rule 2 = 75&lt;br&gt;Rule 3 = 40 &lt;br&gt;&lt;br&gt;Control Assessments&lt;br&gt;Rule 4 = 80&lt;br&gt;Rule 5 = 90 &lt;br&gt;&lt;br&gt;Issues &amp; Action Plans&lt;br&gt;Rule 6 = 0&lt;br&gt;Rule 7 = 10</td>
</tr>
<tr>
<td>Risk = Online banking fraud</td>
<td>Risk Assessments&lt;br&gt;Rule 1 = 10&lt;br&gt;Rule 2 = 10&lt;br&gt;Rule 3 = 0 &lt;br&gt;&lt;br&gt;Control Assessments&lt;br&gt;Rule 4 = 0&lt;br&gt;Rule 5 = 0 &lt;br&gt;&lt;br&gt;Issues &amp; Action Plans&lt;br&gt;Rule 6 = 80&lt;br&gt;Rule 7 = 0</td>
</tr>
</tbody>
</table>
## Score at each rule category level

### Risk = Identity fraud

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Assessments</td>
<td>125</td>
</tr>
<tr>
<td>Rule 1</td>
<td>10</td>
</tr>
<tr>
<td>Rule 2</td>
<td>75</td>
</tr>
<tr>
<td>Rule 3</td>
<td>40</td>
</tr>
<tr>
<td>Control Assessments</td>
<td>170</td>
</tr>
<tr>
<td>Rule 4</td>
<td>80</td>
</tr>
<tr>
<td>Rule 5</td>
<td>90</td>
</tr>
<tr>
<td>Issues &amp; Action Plans</td>
<td>10</td>
</tr>
<tr>
<td>Rule 6</td>
<td>0</td>
</tr>
<tr>
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### Risk = Online banking fraud

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<tr>
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<tr>
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<tr>
<td>Issues &amp; Action Plans</td>
<td>80</td>
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<td>Rule 6</td>
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<tr>
<td>Rule 7</td>
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</tr>
</tbody>
</table>
## Risk Index Approach

### Score at risk level

<table>
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<tr>
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<tbody>
<tr>
<td><strong>Risk Assessments</strong></td>
<td><strong>Control Assessments</strong></td>
</tr>
<tr>
<td>305</td>
<td>90</td>
</tr>
<tr>
<td><strong>Issues &amp; Action Plans</strong></td>
<td><strong>Issues &amp; Action Plans</strong></td>
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<td>125</td>
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<td>Rule 1 = 10</td>
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<td>Rule 6 = 0</td>
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<tr>
<td></td>
<td>Rule 7 = 10</td>
</tr>
</tbody>
</table>

- **Risk Assessments** = 125
- **Control Assessments** = 170
- **Issues & Action Plans** = 10

Score at each level of hierarchy

Risk Index Approach

Retail Bank

Credit Card

Personal Banking

Risk = Identity fraud 305
Risk = Online banking fraud 90

Risk = Identity fraud 30
Risk = Online banking fraud 10

Risk = Identity fraud 435

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Risk Index Approach

Similar to stock prices or stock market index, aggregated scores can be tracked over time to identify changes in the strength of the risk and control environment.
Overtime as the usage of this approach matures, escalation limits can be defined for the aggregated score at multiple levels.

Implementing this approach in software can provide a real-time or near real-time update of scores. This can support continuous monitoring of risk and control environment between the qualitative aggregation assessments.
Thank you.
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