Black Swan Theory: We know absolutely nothing & the finding of atypical events

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Black Swan Theory
Unexpected Events
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Unexpected Events

Non-experienced based occurrence
Unexpected Events

Non-experienced based occurrence

All available information is useless
All available information is useless

Non-experienced based occurrence

Inability to forecast

Unexpected Events
Impossible Occurrence
Black Swan Event
Black Swan features

Retrospective Explanation
Retrospective Explanation
Black Swan features

Retrospective Explanation

Extreme Impact
Extreme Impact
Black Swan features

- Retrospective Explanation
- Extreme Impact
- Unexpected or not Probable
Unexpected or not Probable
Forecasting Techniques

\[ Pr(\mu - 3\sigma < Z < \mu + 3\sigma) \approx 0.997 \]
Forecasting Techniques

Gaussian Assumption

\[ Pr(\mu - 3\sigma < Z < \mu + 3\sigma) \approx 0.997 \]
9/11 Attacks
Financial Crisis
Social Variables

Stock Price
Experience is not enough
Turkey Paradox
Restrictions and Opportunities

- Negative empiricism – Black Swan.
- Consciousness of the existence of black swan.
- Adequate use of statistical tools.
Black Swans Atypical
Atypical Events
Atypical in Risk Management

- Negative Impact
- Not Expected
Catastrophic Hurricane
¿Atypical Event?

- Establish an fair limit to distinguish past black swan events
- Segmentation between Typical & Atypical Events
Experienced based limits

- Fixed Amount $%
- Fixed Percentile 5%
- The last n events
Atypical Event

Given a distribution, the data does not belong to the behavior of the distribution.
Atypical events optimization-method
Data Set

X original data set – amount associated
First Step

$m$ subsets $S_i$ – Percentile $P_i$
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$S_i \subset S_j$ if $i < j$
First Step

$m$ subsets $S_i$ – Percentile $P_i$

$S_i \subseteq S_j$ if $i < j$

$|S_j| = k$
Establish a measure

- Goodness of fit test
Establish a measure

Goodness of fit test

Kolmogorov-Smirnov
Family F

\[ |F| = n \]

Parameter \( \theta \)

\[ f(\theta) \]
Adjustment level

$$B(X_{S_i}, f_j)$$
Better adjustment

\[ B(X_{S_k}, f_i) \geq B(X_{S_k}, f_j) \]
Better adjustment

\[ B(X_{S_k}, f_i) \geq B(X_{S_k}, f_j) \]

Best adjustment for every subset

\[ B(X_{S_k}, f^*) \]
$\max_{S} B(X_{S_i}, f^*)$

$i = 1, \ldots, n.$
Best Adjustment

\[ B(X_{S^*}, f^*) = \max_S B(X_{S_i}, f^*) \]
### Best Adjustment

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentile</th>
<th>Amount</th>
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<tbody>
<tr>
<td>HYDRO</td>
<td>0.95</td>
<td>863'071 €</td>
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<tr>
<td>FIRE</td>
<td>0.93</td>
<td>237'888 €</td>
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<td>MISC</td>
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<td>RC</td>
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<td>TEC</td>
<td>0.96</td>
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<tr>
<td>EQ</td>
<td>0.83</td>
<td>480'000 €</td>
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<tr>
<td>TRANSPORT</td>
<td>0.98</td>
<td>709'488 €</td>
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</table>
Weakness of the method
Size Penalization - Percentile

\[ B(X_{S_i}, f_j) = B(X_{S_i}, f_j) \ast Per_{S_i}^2 \]

\[ 0 \leq Per_{S_i} \leq 1 \]
Risk Management Applications
Data Set
Typical Data
Solvency

Best Estimate Liabilities

99.5 Percentile
Economic Capital
Atypical Data
Atypical Data
Applications in RM

- Claim Control Strategies
- Reinsurance Policy
- Economic Capital Modeling
Mixture of distributions
Mixture of distributions
Mixture of distributions
Mixture of distributions
Conclusions