Risk Measurement and Management

Prepared for the Federal Reserve Bank of Chicago/DePaul University Risk Symposium
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by

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Price Risk

Retail Price Index for England

(1850 = 100)

1700 1750 1800 1850 1900 1950
Response to FX Risk

Percent change in U.S. dollar—Deutsche mark exchange rate (month-end).
Response to IRR

Five-year U.S. Treasury rate (month-end change).
Response to Commodity Risk

Percentage change in West Texas Intermediate
Posted Prices (beginning of month).
Responses to Known Risks

Source: Counterparty risk in credit markets, Barclays Capital, Quantitative Credit Strategy, 20 Feb 2008
Few of these products are “new”

- Hybrid Securities
  - Cotton bonds issued by the Confederate South.
  - Denominated in Confederate $ as well as French francs and pounds sterling.
  - Convertible into cotton at bondholder’s request.
  - Essentially dual-currency cotton-indexed bonds.
Implementing a Risk Management Program

Five Step Risk Management Cycle

1. Make sure you know how much is at risk.
2. Make sure that everyone is on the same page.

Define Philosophy

Implement Program

Quantify Exposures

Identify/Develop Goals

Evaluate and Control
## Critical Corporate Risks

<table>
<thead>
<tr>
<th>Risk</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activist Attacks on Global Brands</td>
<td>5%</td>
</tr>
<tr>
<td>Employee Fraud or Sabotage</td>
<td>8%</td>
</tr>
<tr>
<td>Natural Disasters</td>
<td>8%</td>
</tr>
<tr>
<td>Theft of Intellectual Property</td>
<td>17%</td>
</tr>
<tr>
<td>IT Disruptions</td>
<td>17%</td>
</tr>
<tr>
<td>Product Quality and Safety Problems</td>
<td>19%</td>
</tr>
<tr>
<td>Terrorist Attacks</td>
<td>21%</td>
</tr>
<tr>
<td>Security Threats to Employees and Assets</td>
<td>22%</td>
</tr>
<tr>
<td>Corporate Governance Issues</td>
<td>25%</td>
</tr>
<tr>
<td>Disruption of Supply Chain</td>
<td>33%</td>
</tr>
<tr>
<td>Absence of Rule of Law</td>
<td>34%</td>
</tr>
<tr>
<td>Political and Social Disturbances</td>
<td>62%</td>
</tr>
<tr>
<td>Currency Risk</td>
<td>63%</td>
</tr>
<tr>
<td>Country Financial Risk</td>
<td>67%</td>
</tr>
<tr>
<td>Government Regulations</td>
<td>72%</td>
</tr>
</tbody>
</table>
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- Define Philosophy
- Implement Program
- Evaluate and Control
- Develop Goals
- Identify/Quantify Exposures
Epidemic/Pandemic ERM Visualization

- Rate of potential infectious contacts
- Rate that people contact other people
- Contacts between infected and unaffected
- Fraction of population infected
- Initial susceptible
- Initial infected
- Total population
- Fraction infected from contact
- Infections
Financial Crisis ERM Visualization

Diagram:
- Unemployment rate
- House price index
- Initial unemployment rate
- Interest rate
- Equity market prices
- Consumer confidence
- Personal credit availability
- Market factors

Connections:
- Unemployment rate to House price index
- House price index to Unemployment rate
- Interest rate to Unemployment rate
- Initial unemployment rate to Interest rate
Millennium Bridge

Credit Crisis 2007-8

- Margin Calls
- Unwind Leveraged Trades
- Distress
- Adverse Price Move

Diagram showing the interconnectedness of financial market events.
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Implementing a Risk Management Program

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Evaluate and Control → Develop Goals

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Stress Testing: Space Shuttle Main Engine LOX Turbopump

This photo shows the exhaust from the pre-burner that is used to generate the hot gases to drive the space shuttle engine LOX (Liquid Oxygen) turbopump during the test. For a typical turbopump test, the low pressure tank is pressurized to simulate the NPSH (Net Positive Suction Head) of the space shuttle turbo pump inlet. The high pressure LOX and hydrogen tanks are pressurized to approximately 1500 psi in order to control the starting flows into the pre-burner. The valve resolution problems experienced when controlling a wide range of flows are solved by controlling three fast acting electro-hydraulic valves in parallel in each propellant line. The acceleration of the turbopump is less than 4 seconds to simulate main engine operation which requires the high pressure propellant tanks to be ramped in pressure to 9000 psi. The liquid hydrogen is conditioned by a liquid/gas mixer to simulate shuttle main engine inlet temperatures. The high response control system controls the tank pressurization, propellant flow, temperature and turbopump speed. The abort system monitors over 200 parameters and calculations and initiates shutdown or test termination if an anomaly is detected.

Key Scenario: Does It Work When You Push the Button?

Test: Mike Operation: Ivy
Date: 31 October 1952
Yield: 10.4 Megatons

Site: Elugelab Island, Enwetak atoll, Marshall Islands
Detonation: Surface Type: Fission/Fusion
The device called Sausage, detonated in the Mike test was the first true thermonuclear bomb ever tested. However, the Sausage was not a deliverable weapon. It was an enormous, complex device, 80 inches wide and 244 inches long. The entire assembly weighted 82 metric tons. Sausage was built using Teller-Ulam principles of staged radiation implosion. Interestingly Teller himself didn't participate in development. Los Alamos Panda Committee, directed by J. Carson Mark did the job. TX-5 fission bomb was used as a fuse (primary stage). Super cooled, liquid hydrogen was used as a thermonuclear fuel. The Cab, the building which housed the device, was located on the zero island. A plywood tube was assembled from the Cab to the furthest island, where the detection station was, some 2 miles away. The tube was filled with Helium, to allow radiation rays travel faster before it was consumed by the fireball.

The explosion yielded 10.4 Mgt. Mike's fireball measured 3 miles. The cloud formed by Mike shot was immense. Stabilized, it reached 135,000 ft high, and stretched 60 miles in diameter, which eventually spread over 1000 miles.

Mike destroyed the entire Elugelab island. The crater formed as a result of the explosion measured 6240ft (1.5Km) across and 164ft (53m) deep. Following the test, high levels of radiation covered most of the Enwetak atoll.

This was 4th largest test ever conducted by US, (the largest at that time). For comparison, this is more then all allied bombs dropped during WW II together.

source: http://zvis.com/nuclear/dimg.php3?ivymike5,ivymike
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What happens when you don’t follow the cycle?


Nick Leeson – £827m loss brought Barings bank to insolvency overnight in 1995

Joseph Jett – Dismissed by Kidder-Peabody in 1994 after hundreds of millions of dollars made from his bond trading were found to be phantom profits.
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