Risk definition, risk behavior, risk management and the role of firms and governments.

RISK
UNCERTAINTY
RISK BEHAVIOUR
RISK AVERSION
RISK MANAGEMENT
INSURANCE
Risk and Insurance:  
A story as old as time
References

• Article

• Text books


Classification of Risks

- Pure
- Static
- Particular
- Systematic

Speculative
Dynamic
Fundamental
Diversifiable
Risk and uncertainty...concepts

- Certainty (perfect information) (Prob=0 or 1)
- Objective probability (statistical law)
- Subjective probability
- Ignorance (lack of information)
Risk and uncertainty...history

Frank H. Knight (1885–1972) is usually credited for having presented the distinction between decisions under “risk” (known chance) and decisions under “uncertainty” in his 1921 book.

The remarkable story of risk and uncertainty touches on the most profound aspects of psychology, mathematics and statistics. Knight discussed several biases in human decision-making and described features of risky choice (a function of anticipatory futures) that were to become key components of prospect theory.

Bernstein (1998) walks that path. “Against the Gods” follows the intellectual development of risk management and how people throughout the centuries have changed their views of what constitutes risk and how risk can be mitigated.
Risk and uncertainty...policies

• Risk = prevention
  • The role of risk management

• Uncertainty = the precautionary principle
  • The role of politics

• Unknown situation=exoneration from responsibility
  • Example: economic and social development
The precaution principle and corporate social responsibility (CSR)

• Examples:
  – Environmental risks:
    – Transports (tankers), products (many examples), mobile phones, …
  – Human and social risks
    – Health, safety at work

• Role of the State, governments
• Role of international organizations
Risk behavior

• Risk-taking
  - to engage in behaviors that have the potential to be harmful or dangerous, yet at the same time provide the opportunity for some kind of outcome that can be perceived as positive.

• Attitudes towards risk
  – What are the factors affecting risk taking?
  – Individual
  – Group
  – Business (*the prudent man rule*)
Risk Behavior...psychology

Figure 14: Triandis’ Theory of Interpersonal Behaviour
Utility theory and risk aversion

• What is the shape of a utility function?
\[ u(w_0 + h) \]
\[ u(E(\tilde{w}_f)) = u(w_0) \]
\[ Eu(\tilde{w}_f) \]
\[ u(w_0 - h) \]
RISK MANAGEMENT: An organizational setting

RISK IDENTIFICATION
RISK MEASUREMENT
RISK CONTROL
RISK FINANCING
Risk management...historical perspective

- Multinational firms after World War II
- American Society of Insurance Management (1955)
- Risk and Insurance Management Society (RIMS) (1975)
- From operational risks to financial risks and strategic risks
Identification of Risks

• The individual risk and the risks of business
• Organization charts
• Flows charts
• Accounting information, operating accounts and balance sheets
Identification of Risks
Classification of business risks

• Operational risks
• Market risks
  – Prices, exchange rates, rates of return
• Credit risks
  – Bad debts, liquidities
Operational business risks

- 10 important risks today
  - Occupational injuries
  - Fire
  - Machine breakdown
  - Wastage in the company
  - Theft, fraud and negligence
  - Industrial espionage
  - Product liability
  - Data processing risks
  - Environmental risks
  - Transport accidents
Why should a company be concerned by risk management?

- Business risks are diversifiable risks
  - Example (3 toys companies: Yotoys, B.S.Toys and Zodi)
- 3 major reasons
  - Bankruptcy costs
  - Taxes
  - Corporate stakeholders (managers, employees, clients, suppliers)…Corporate social responsibility
Risk Measurement

• Frequency and Severity
• Maximum probable loss
• Value at risk
## Frequency and Severity

### Frequency distribution

<table>
<thead>
<tr>
<th>Nb accidents</th>
<th>Nb insured</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>800</td>
</tr>
<tr>
<td>1</td>
<td>160</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1000</strong></td>
</tr>
</tbody>
</table>

### Severity distribution

<table>
<thead>
<tr>
<th>Losses amount</th>
<th>Average value</th>
<th>Nb accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-400</td>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>400-1,000</td>
<td>700</td>
<td>70</td>
</tr>
<tr>
<td>1,000-3,000</td>
<td>2,000</td>
<td>23</td>
</tr>
<tr>
<td>3,000-7,000</td>
<td>5,000</td>
<td>6</td>
</tr>
<tr>
<td>&gt;7,000</td>
<td>10,000</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>250</strong></td>
<td></td>
</tr>
</tbody>
</table>
Frequency and Severity

Social and Private Insurance

22/J.F. Outreville
## Accidents: Poisson distribution

### Poisson probability distribution

<table>
<thead>
<tr>
<th>Nb of car accidents</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00674</td>
</tr>
<tr>
<td>1</td>
<td>0.0337</td>
</tr>
<tr>
<td>2</td>
<td>0.08425</td>
</tr>
<tr>
<td>3</td>
<td>0.14042</td>
</tr>
<tr>
<td>4</td>
<td>0.17552</td>
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<td>5</td>
<td>0.17552</td>
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<tr>
<td>6</td>
<td>0.14627</td>
</tr>
<tr>
<td>7</td>
<td>0.10448</td>
</tr>
<tr>
<td>8</td>
<td>0.0653</td>
</tr>
<tr>
<td>9</td>
<td>0.03628</td>
</tr>
<tr>
<td>10</td>
<td>0.01814</td>
</tr>
<tr>
<td>11</td>
<td>0.00824</td>
</tr>
<tr>
<td>12</td>
<td>0.00514</td>
</tr>
</tbody>
</table>
Measurement problems

- Overvaluation vs. under evaluation
- Law of large numbers
- Maximum probable loss
Distribution: extreme values

Length of stay in an hospital for a given pathology and for a sample of patients

Social and Private Insurance
Some distributions with heavy tails

A common example: the log normal distribution
Maximum probable loss

- In Finance, the Value at Risk (VaR) is the Maximum loss with a given probability (defined as the confidence interval), over a given period of time.
The VaR is based on a normal distribution

Mean = 1.23% and Standard deviation = 4.3%
Normal distribution confidence interval at 95% = 1.65 (at 99% 2.33)
Absolute VaR (0) = $-1.23\% + 1.65\sigma = 1.23\% + 1.65(4.3\%) = 5.9\%$
Risk Control

• Avoidance
• Loss prevention (pre-loss)
• Loss control (post-loss)
Examples of risk control programs

- Property conservation
- Personnel safety and health
- Product safety
- Environmental protection
## Examples of risk control measures

### PHYSICAL DEVICES
- Safety devices and protective equipments
- Security locks, boxes, etc.
- Alarms, sprinklers, etc.
- Any other risk reduction devices

### PROCEDURES
- Separation of potential hazards
- Maintenance and repair system
- Proper procedures and training
- Enforcement of safety rules
- Inspection and audit
- Fire brigade procedures
- Guards, Patrols routine
Risk Financing

• Retention (internal loss financing…planned or not planned)
• Self Insurance
• Captive insurance companies
• Risk transfer
  – Non-insurance transfer (Contractual agreement)
  – Hedging (financial instruments)
  – Insurance
Risk management and social protection

• Identification
  – Health, Death, Survival, Family, Education, …

• Measurement

• Control
  – Role of the government
  – Role of the firm

• Financing
  – State programs
  – Role of firms
Risk behavior and risk aversion: a complex postulate that affect demand and supply for social protection

- Research in the field of behavioral finance and insurance (experimental economics)
- Insurance demand, public goods, free rider problem
- Moral hazard, behavior towards fraud