Prospering in an Information Economy

What is an Information Economy?
Information As A Producer Good

Is information Scarcer or more Plentiful?

Cost of Information: Time, Mental Energy, and other resources

Subjective Probability
Three Sources of Probability

Ultimately they are All Subjective

Rules for Subjective Probability?

Value of Information
Perfect Information

Worthless Information

Value of Imperfect Information

Bags & Chips Exercise
1. What is an Information Economy?

Information As A Producer Good

Is information Scarcer or more Plentiful?
Data is Plentiful, Information is Scarce relative to need

Cost of Information
Time, Mental Energy, and other resources
2. Information As A Producer Good

Education costs money, but then so does ignorance.


A little knowledge that acts is worth infinitely more than much knowledge that is idle.


Private information is practically the source of every large modern fortune.

*Oscar Wilde* (1854– Anglo-Irish playwright, author. Sir Robert Chiltern, in *An Ideal Husband*, act 1.)

Knowledge is the most democratic source of power.

3. Is information Scarcer or More Plentiful than 100 years ago?

There is obviously far more data available than ever before

**BUT**

A global, dynamic, chaotic world requires decision makers to acquire the knowledge necessary for wise action in time to avert oncoming disasters and exploit transitory opportunities, then repeat the process in rapid succession.
4. Cost of Information

Paying for Data

Paying for "Data that have been processed into a format that is understandable by its intended audience." -Wiktionary "Information"

Costs of Delay while keeping options open until more is known

Scarcity of Time and Mental Energy of Decision Makers
5. Subjective Probability

Three Sources of Probability

Ultimately they are All Subjective

Rules for Subjective Probability?
6. Three Sources of Probability

Historical Data (Relative Frequency)  
(e.g. Insurance)

Cause and Effect Models (Classical Probability)  
(e.g. casinos, weather forecasting)

Subjective Probability
  Creedal Probability: Disciplined Personal Opinion
  Pignistic Probability: "Put your money where your mouth is"

Often, the decision maker must rely on subjective probabilities.  
Don't dismiss this as mere intuition. If you are familiar with the domain in which the problem arises, you can assess very useful, if imperfect, probabilities.
7. Ultimately they are All Subjective

The only absolutely "objective" probability that something will happen is 1 if it happens, or 0 if it doesn't.

Any other probability is an expression of the incomplete information possessed by a particular decision maker at a particular point in time.

Historical "Relative Frequency" probability is based on the subjective hope that the future will be like the past.

Cause and Effect "Classical" probability is based on the theory that supports the cause and effect model, and the data that drive the model
Subjective Probability must obey the same mathematical laws as classical probability

\[ 0 \geq P(x) \geq 1 \quad \Sigma P(x) = 1 \quad P(x \text{ OR } y) = P(x) + P(y) - P(x \text{ AND } y) \]

\[ P(x \text{ GIVEN } y) = \frac{P(x \text{ AND } y)}{P(y)} \quad P(x \text{ AND } y) \leq P(x) \]

Why should my personal opinion be forced to follow these rules?

Dutch Book Theorem:
9. Value of Information

Perfect Information

Worthless Information

Value of Imperfect Information

Bags & Chips Exercise
10. Perfect Information

If I already possess perfect information about a risky venture, it is no longer risky at all; I know what state will occur and I will act accordingly.

If I am about to get perfect information, I don't yet know the value of the venture; I can find the venture's expected value under perfect information by multiplying the probability of each state times the payoff of the best action for that state.

If I have the opportunity to get perfect information at some cost, the most I should "pay" is the difference between the expected value of the venture with the information I already have and the expected value under perfect information.

Snack Vendor Spreadsheet
11. Worthless Information

When you acquire information, you don't know what message you're going to get.
To decide how much the information is worth "paying" for, you need to know what messages you MIGHT get.

If you will do the same thing no matter which of the messages you MIGHT get is the one you actually DO get, the information value is ZERO as a produced good!

Sometimes "Data" has some other value as a producer good e.g. regulatory compliance.

Value of Information as a Consumer Good
12. Value of Imperfect Information

Equation and tables showing decision-making under imperfect information with probabilities and expected returns for different strategies and outcomes.
### Prior Probabilities

<table>
<thead>
<tr>
<th>Light bags</th>
<th>Dark Bags</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 = 0.375</td>
<td>5/8 = 0.625</td>
</tr>
</tbody>
</table>

### Payoffs

<table>
<thead>
<tr>
<th>Bet L</th>
<th>Bet D</th>
<th>Best Bet</th>
</tr>
</thead>
<tbody>
<tr>
<td>$100</td>
<td>($50)</td>
<td>$6.25</td>
</tr>
<tr>
<td>($50)</td>
<td>$100</td>
<td>$43.75</td>
</tr>
</tbody>
</table>

**Best Bet:** $43.75

### Likelihoods

- **P(W|L):**
  - 4 White per light bag = 0.8000
  - 2 White per dark bag = 0.4000

- **P(B|L):**
  - 1 Blue per light bag = 0.2000
  - 3 Blue per dark bag = 0.6000

### Joint Probabilities

- **P(W&L):**
  - 12 White in Light bag = 0.3
  - 3 Blue in Light bag = 0.075

- **P(W&D):**
  - 10 White in Dark bag = 0.25
  - 15 Blue in Dark bag = 0.375

### Marginal Probabilities

- **P(W):**
  - 22 White Chips = 0.55

- **P(B):**
  - 18 Blue Chips = 0.45

### Posterior Probabilities

- **P(L|W):**
  - 12 White in Light bag = 0.545
  - 3 Blue in Light bag = 0.167

- **P(D|W):**
  - 10 White in Dark bag = 0.455
  - 15 Blue in Dark bag = 0.833

### Paper Bags and Poker Chips

An example of "Bayes Theorem"