mon·ey (m¾n“¶) *n.*, *pl.* **mon·eys or mon·ies. 1. A commodity, such as gold, or an officially issued coin or paper note that is legally established as an exchangeable equivalent of all other commodities, such as goods and services, and is used as a measure of their comparative values on the market. 2. The official currency, coins, and negotiable paper notes issued by a government. 3. Assets and property considered in terms of monetary value; wealth. 4.a. Pecuniary profit or loss:** ***He made money on the sale of his properties.*** **b. One's salary; pay:** ***It was a terrible job, but the money was good.*** **5. An amount of cash or credit:** ***raised the money for the new playground.*** **6. Often moneys or monies. Sums of money, especially of a specified nature:** ***state tax moneys; monies set aside for research and development.*** **7. A wealthy person, family, or group:** ***to come from old money; to marry into money.*** **--**

for (one's) money. According to one's opinion, choice, or preference: ***For my money, it's not worth the trouble.***

on the money. Exact; precise.

put money on. ***Sports. Games.*** **To place a bet on.**

put (one's) money where (one's) mouth is. ***Slang.*** **To live up to one's words; act according to one's own advice.**

u·til·i·ty (y›-t¹l“¹-t¶) *n.*, *pl.* **u·til·i·ties.** 1. The quality or condition of being useful; usefulness: *“I have always doubted the utility of these conferences on disarmament”* (Winston S. Churchill). 2. A useful article or device. 3. *Abbr.* util. a. A public utility. b. A commodity or service, such as electricity, water, or public transportation, that is provided by a public utility. **--u·til·i·ty** *adj.* 1. Used, serving, or working in several capacities as needed, especially: a. Prepared to play any of the smaller theatrical roles on short notice: *a utility cast member.* b. Capable of playing as a substitute in any of several positions: *a utility infielder.* 2. Designed for various often heavy-duty practical uses: *a utility knife; a utility vehicle.* 3. Raised or kept for the production of a farm product rather than for show or as pets: *utility livestock.* 4. Of the lowest U.S. Government grade: *utility beef.* [Middle English *utilite*, from Old French, from Latin *¿tilit³s*, from *¿tilis*, useful, from *¿t°*, to use.]

3

fi·du·ci·ar·y (f¹-d›“sh¶-µr”¶, -sh…-r¶, -dy›“-, fº-) *adj.* 1.a. Of or relating to a holding of something in trust for another: *a fiduciary heir; a fiduciary contract.* b. Of, relating to, or being a trustee or trusteeship. c. Held in trust. 2. Of, relating to, or consisting of fiat money. 3. Of, relating to, or being a system of marking in the field of view of an optical instrument that is used as a reference point or measuring scale.

--**fi·du·ci·ar·y** *n.*, *pl.* fi·du·ci·ar·ies. One, such as an agent of a principal or a company director, that stands in a special relation of trust, confidence, or responsibility in certain obligations to others. [Latin *fºd¿ci³rius*, from *fºd¿cia*, trust. See FIDUCIAL.]

Utility Analysis: Knowing what you want!

Money as a Medium of Exchange

Money and Fiduciaries

Money and "Tradeoffs:" A Market Inside Your Head

Monetary Objective Functions in Linear Programming

EMV Viewed as a Linear Objective Function

Using Percent Probabilities:

$$\frac{\text{Dollars}}{\text{per oily site}} * \frac{\text{oily sites}}{\text{per 100 sites}} + \frac{\text{Dollars}}{\text{per dry site}} * \frac{\text{dry sites}}{\text{per 100 sites}} = \frac{\text{Dollars}}{\text{per 100 sites}}$$

(*If you drill, $ per oily site is positive, $ per dry site is negative;*
If you don't drill, $ per oily site and $ per dry site are both zero.)

Using Fractional (or Decimal) Probabilities

Declining Marginal Utility of a Particular Good

Declining Marginal Utility of Money

Risk Aversion and Declining Marginal Utility

Driving a $10,000 car is more like driving a $60,000 car than it is like walking.

Eating canned food at home every day is more like eating in a five-star restaurant every day than it is like starving.

Living in a cheap apartment is more like living in a mansion than it is like living on the street.

Using a $1000 PC is more like using a % million supercomputer than it is like using a pencil and paper.

In each case, if we take the dollar value of the three possibilities, the EMV of a 50-50 chance between the best and the worst is substantially higher than the monetary value of the middle alternative, but nearly everyone would prefer the middle alternative to the gamble.

This shows that money is not an adequate "medium of exchange" for decision making under uncertainty.

Economic Effects of Risk Aversion

Microeconomic Benefits — **minimize "probability of ruin"**

Macroeconomic Costs — **entrepreneurship vs. "Failure of nerve"**
“A nation of risk averters is a nation at risk"

Risk Sharing to Mitigate Risk Aversion

Syndicate: members share all winnings & losses

Mutual Insurance: winners cover losers' losses, keep what's left

Basic Reference Lottery Tickets (BRLTs)

(BRLT = Basic Reference Lottery Ticket) In the context of a particular monetary decision or set of decisions, let
W = a dollar amount greater than or equal to the best potential payoff. L = a dollar amount less than or equal to the worst potential payoff.

If the decision maker would rather take a 40% chance at W and a 60% chance at L than receive $X - 1¢, but would rather receive $X + 1¢ for sure than take the same gamble, then we say that the utility of $X is 40%, or U(X) = .4. Note that X is typically less than the EMV of the 40% gamble on W versus L.
On general, we say that if a lottery on W versus L is preferable to $X for any probability of winning that is >p but $X is preferable to the lottery for any probability of winning that is <p, then U(X) = p

Lottery Tickets as a Medium of Exchange

"Von Neumann Morgenstern Utility Theory"

Decision 1: Would you rather:

1. **Toss a fair coin and get $190 on heads or $10 on tails, or**
2. **Get $99 for certain.**

Decision 2:
Suppose there is a lottery, with 1,000 tickets numbered 1-100. One of these tickets will be drawn at random tomorrow, and the person who holds the winning number will receive $1,000.
Would you rather:

1. **Toss a coin today and get 190 tickets on heads or 10 tickets on tails, or**
2. **Get 99 tickets today for certain.**

Risk Neutrality for Lottery Tickets

Your chance of winning the lottery is identical if you have

1 ticket for sure,

10% chance at 10 tickets,

1% chance at 100 tickets, etc

Von Neumann and Morgenstern showed that you can take risk aversion into account by using the following procedure to analyze a decision under risk:

1. convert all the payoffs to utilities,

2. find the action or strategy with the best expected utility just as we formerly found the decision or strategy with the best EMV

3. convert the best expected utility to a dollar amount known as the Certain Monetary Equivalent: the amount of cash whose utility equals the . calculated expected utility of the selected action or strategy.

This "CME" expresses how much cash the venture is worth to a risk-averse decision maker in the same way the EMV expresses how much cash the venture is worth to a risk-neutral decision maker.

The Utility Function for Money

Typically, we will approximate the function U(X) for a particular decision maker in a particular context by fitting parameters to a standard functional form. Once this is done, it is generally no longer necessary to refer back to the concept of a basic reference lottery.

The most common functional form for risk-averse utility functions is U(X) = a-be-rx

Using this formula, we analyze a decision as follows:

1. **convert all the payoffs to utilities,**
2. **find the decsion or strategy with the best expected utility just as we formerly found the decision or strategy with the best EMV**
3. **convert the best expected utility to a dollar amount known as the Certain Monetary Equivalent, CME(u) =** $-\ln\left(\frac{a-u}{b}\right)/r$**, which expresses how much cash the venture is worth to a risk-averse decision maker in the same way the EMV expresses how much cash the venture is worth to a risk-neutral decision maker.**

Value of Information to a Risk-Averse Decision Maker

The gross certain monetary equivalent value of a potential source of information to a risk-averse decision amker is the difference between the CME of the decision using the information, and the CME of the decision withour the information.

The net monetary value of the information is found by subtracting the cost of the information from its gross certain monetary equivalent value.

(This only works if the decision maker has "constant risk aversion," which is guaranteed by the functional form $U(X) = a - be^{-rx}$. Otherwise, we would only be able to find the net monetary value of the information by subtracting its cost from all the endpoints of the tree that follow from buying the information, but with constant risk aversion this is equivalent to subtracting the same amount form the CME.)

How to Find Value of Information if You're Risk Averse

1. **Deduct Cost of Information from all Payoffs that Use the Info.**
2. **Convert all Net Payoffs in the Problem to Utilities**
3. **Find the Prior EU of Each Alternative Action**
4. **Prior EU of Problem = Highest EU in Step 3.**
5. **Prior CME of Problem = $ value of Prior EU**
6. **For Each “Datum”**

- Find Marginal Probability
- Find Posterior Probabilities of States

7. **Find Posterior EU of Each AlternativeFor Each "Datum,"**

- Posterior EU = Highest EU For that Datum in Step 8

8. **Use Marginal Probabilities to Find Preposterion EU**
9. **Preposterior CME of Problem = $ Value of Preposterior EU**
10. **Net Value of Information = Preposterior CMS - Prior CME**
11. **Gross Value of Information = Net Value of Info + Cost of Info**

Note: this works whether you have constant (exponential) risk aversion or not!