Understanding the demand for assets 1:

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Week 2 / Lecture 3

Goals: where we are headed!

- How economists think about asset selection problem.

- Understand **demand for assets** and the portfolio selection problem.
  - multiple assets combined = **portfolio**

Before proceeding into the topic, let's get to know a little bit about asset class first.

Agenda

Asset class

Decision framework under uncertainty

Assets: what is it used for?

Assets

- Holder of an asset has the right to claim on cash-flow/pay-off/benefit of the asset (in future).
- Financial (bond/stock) VS physical (house)

Why do we hold (purchase) assets?

- To gain some returns from the investment
- To use asset as saving vehicle that protect investor from some types of risks.
  - Laid-off, Retired, Health

Asset: how do classify types of assets?

- Investable assets?
  - Each type of asset has different features and characteristics.
  - Let get to know some common grounds that one typically use for classifying them.
- Two important features of assets
  - Tradable / non-tradable
  - Certain / Uncertain / Contingent

Asset class: mainly classified into 4 groups

- Fixed-income instrument
- Equity instrument
- Derivative instrument
- Hybrid instrument

Asset class: *EQUITY instrument*

Equity instrument

- STOCK offers holders the right to claim all the residual earnings generated by the company issuing the STOCK.
- Typically, cash-flow is delivered to holders of the STOCK in terms of DIVIDEND.
- Return on STOCK = DIVIDEND + Price changes
  - DIVIDEND payment is *uncertain*, depending on two factors: *company's profit and dividend policy*
  - STOCK price is highly volatile, containing huge amount **PRICE risk**.

Assets class: Fixed income instrument

Corporate bonds

- Commit (promise) to pay %c of coupon, and Face value.
- Contingent on the financial conditions of the issuer, at the time of redemption/payment ➔ uncertain.
- Not being able to service for the payment can arise due to the bankruptcy state. ➔ credit risk.

Assets class: Fixed income instrument

Government bonds

- Coupon bond➔ %c of Face value, certain cash-flow ➔ *credit* risk-free.
- Inflation-indexed bond ➔ %c of Face Value, paid back in full amount of face value/principal adjusted with compound rate of realized inflation, (payment is certain, but contingent.) ➔ no *credit* risk + no *inflation* risk
- Zero-coupon bond ➔ no interim payment, paid back in full amount of face value/principal at the maturity date
- Treasury Bill ➔ short-term zero-coupon bond, less than a year ➔ no *credit* risk + no *inflation* risk + no price risk ➔ benchmark for the "risk-free asset".

Assets class: DERIVATIVE instrument

- Risk-management assets (mitigating risk)
- Future contract
  - Financial contract that specifies some conditions of *delivery* and *price* of some physical products or financial instruments.
  - Products/Instruments to be delivered in the future.
    - Future v.s. spot market
    - e.g. Oil future / Commodity future
      SET-index future

Assets class: DERIVATIVE instrument

OPTION

- Right to buy (call) and sell (put) an underlying asset
- At a pre-specified price: exercise (strike) price
- Cash-flow receivable from an option is contingent on the price of the underlying asset.

Assets class: DERIVATIVE instrument

CREDIT default SWAP (CDS)

- OTC trading derivative contract
- Insurance contract.
  - Seller of CDS promises to pay to the buyer of CDS some amount of money under some conditions.
- Eg. CDS on Greece Bond = In case of default,
- SWAP cash-flow between issuer and holder of CDSs

Assets class: HYBRID instrument

Convertible Preferred STOCK

- Preferred STOCK + Convertible bond
- An Option-embedded asset.
- Initial issued as DEBT.
- Convertible into STOCK an a pre-specified converting ratio.

STRUCTURED products

- BOND-liked asset
- Proceeds raised from BOND are invested in other assets.
- Might be designed to be principal protected.

Agenda

Asset class

Decision framework under uncertainty

Framework for Demand for assets

Problem: how to allocate your wealth for the investment (under uncertainty)

Approaches

- Modern portfolio theory (FN312): *Mean-Variance (SD) analysis; Markowitz (1952)*
- Traditional portfolio theory (built upon EE311)

Framework for Demand for assets

Traditional portfolio theory (TPT) ⇔ Modern portfolio theory (MPT) when

1. Return on assets are *normally* distributed.

2. Utility function is quadratic in wealth.

Traditional portfolio theory: Roadmap

Decision under uncertainty

Portfolio selection as an optimization problem

(see note on optimization)

- **Demand for risky asset**
- **Determinants**

Preference: back to EE311

Assumption: Axiom of Rationality

- **Preference set: Complete ranking on the binary basis.**
- **Preference set: Transitivity, consistent preference**

Preference set: testing rational?

Example: Rational preference

- Ask a person to respond binary ranking among the following three options: A / B / C
- # 1st respondent: A > B
- # 2nd respondent: B > C

In the # 3rd time, the person is asked to rank the preference between "A" and "C"

- Rational if A > C (transitive)
- Irrational if stated otherwise

Preference set: Putting into use

- Preference set is a very abstract concept; hard to quantify in terms of level or numbers.
- Technically, rational preference set can be quantitatively constructed using the concept of **utility function.**
  - Don't worry about what sorts of technical conditions required. Go to EE411 if you want to learn more about this.
- Utility function is a mathematical function with the domain defined on sets of consumption bundles.

Preference set: characteristic of the utility function

Example: U(x,y)

- X is the amount of consumption on Pizza.
- Y is the amount of consumption on Sushi.
- (X,Y) = (3,2) is called a consumption bundle

Properties of utility function

- Increasing: more prefer to less
- Concave: prefer diversity/variety

Preference set under uncertainty

- Certainty → how many units of good you can consume.
- Uncertainty → The amount of consumption is uncertain, and it depends.
- Technically, this is called Lottery.
- Lottery is basically defined to include the description of probabilistic outcomes of consumption bundles under the lottery.

Preference set under uncertainty

Lottery 1: An orange with a banana
- Riskless lottery (certain outcome)

Lottery 2: Coin tossing (Risky lottery)
- Head: an orange and two bananas
- Tai: two oranges and a banana.

Lottery 3: Card dealt (risky lottery)
- Black spade dealt: an orange and a banana
- Heart dealt: ten oranges and ten bananas
- Otherwise; nothing.

Preference set under uncertainty

How would you evaluate the desirability of alternative options given by the three lotteries?

Adapted from the idea under deterministic outcome, one can rank the desirability of different lotteries using the "Von-Neuman Morgenstern (VNM) Expected utility"

Preference set under uncertainty

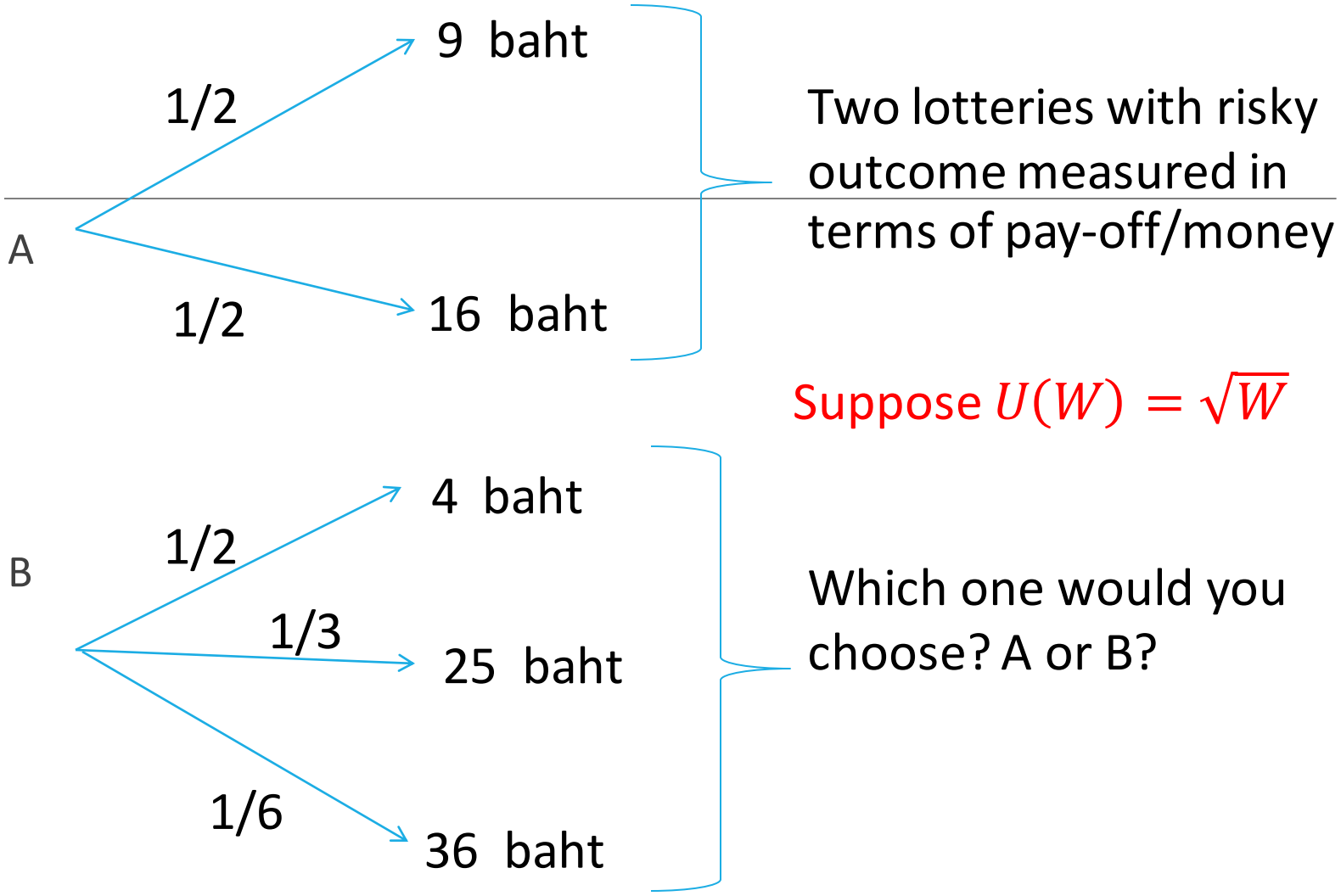
VNM Expected utility

- Weighted average of utility defined over different outcomes/bundles under the lottery

Example:

Preference under uncertainty for financial decision

- An asset does not directly benefit you in terms of utility attained from the consumption.
- The utility is derived from the return/pay-off of the asset measured in terms of monetary values.
- When accumulated over the investment horizon, returns increase/decrease your wealth.
- Mostly, we assume that investor's preference is defined on the level of wealth measured at the terminal period of the investment.


9 baht
1/2
A
1/2
16 baht
Two lotteries with risky outcome measured in terms of pay-off/money
Suppose $U(W) = \sqrt{W}$
4 baht
1/2
B
1/3
25 baht
Which one would you choose? A or B?
1/6
36 baht

Example

Suppose that $U(W) = \sqrt{W}$

Which option?

The answer is _____

Attitude toward risks

Risk-averse

Risk-neutral

Risk-Lover

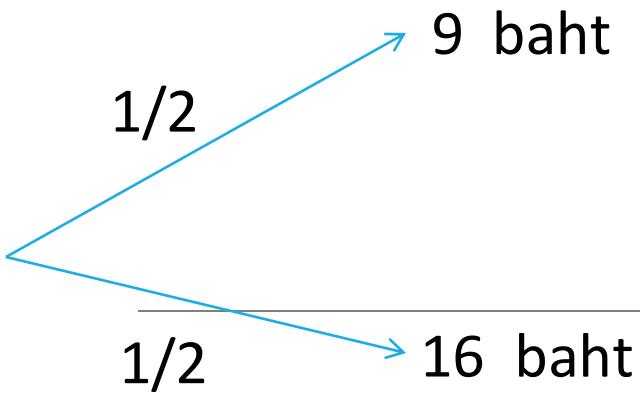
Risk-averse: definition

- Prefer riskless option, rather than risky option
- Fear the downside loss more than the upside gain.

- Back to the risky choice "A"
- Alternative riskless option used to the comparison with "A"?
  - Giving "average" = 12.5
  - $\overline{\mathbf{W}} = \mathbf{E}(\mathbf{W})$ = expected pay-off (NOT, the same as expected utility!)

Risk-averse: definition

- **Definition:**
  - **If the level of utility under the certain pay-off (consuming expected pay-off) is greater than the expected utility under the risky choice in question, agent is classified as a risk averse agent.**
- **prefer safer option/choices**



$U(W) = \sqrt{W}$
What do we know?

Considering A and supposed that $\bar{W}$ = the average pay-off under the risky option = _____.

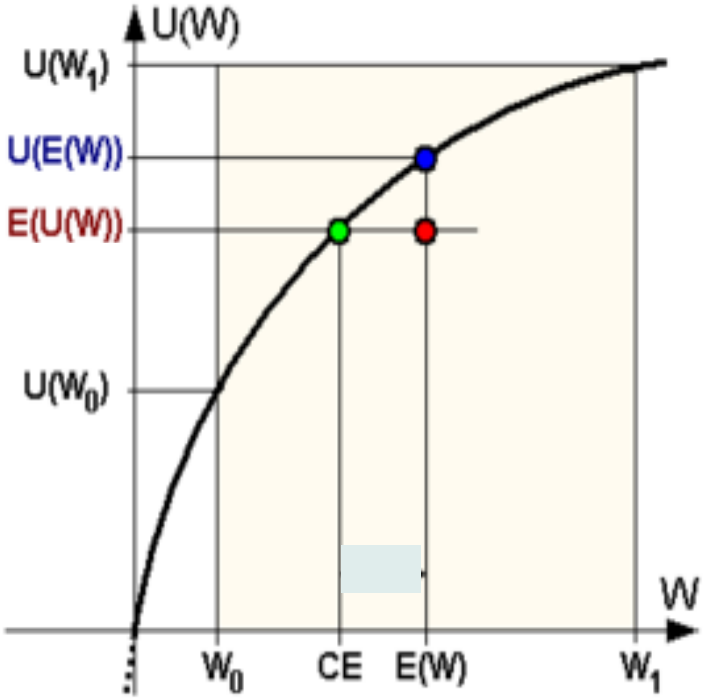
$U(\bar{W})$ = _____.

Note that $\mathrm{E}\big(U(W)\big)$ =_____ $U(\bar{W})$ = _____

Therefore, preference is _____ .

Note further for the shape of the utility function: Is it convex or concave?

Risk aversion and concavity



Certainty Equivalent

Risk premium

Certainty Equivalent

- From the risky option A, suppose a person is offering you an option with secured pay-off.
- How much money would it be needed to ensure that you are feeling indifferent between "accepting A" and "accepting the secured pay-off"
- The level of secured pay-off minimally needed is called the "**Certainty Equivalence**".

$$U(CE) = E(U(W))$$

$$U(W) = \sqrt{W}$$

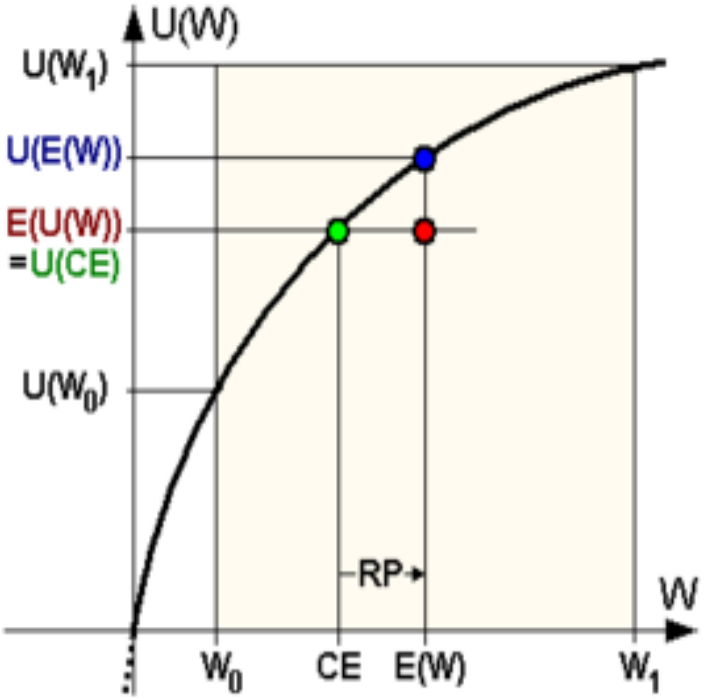
CE = _____.

Comparing with pay-off $\bar{W}$ we will find that

$\bar{W}$ _____ CE

$\bar{W}$ - CE = _____

Risk aversion: summary



$\mathrm{E}\big(U(W)\big)$ _____ $U(\bar{W})$

Utility function is _____.

Certainty equivalent is _____ than $\bar{W}$.

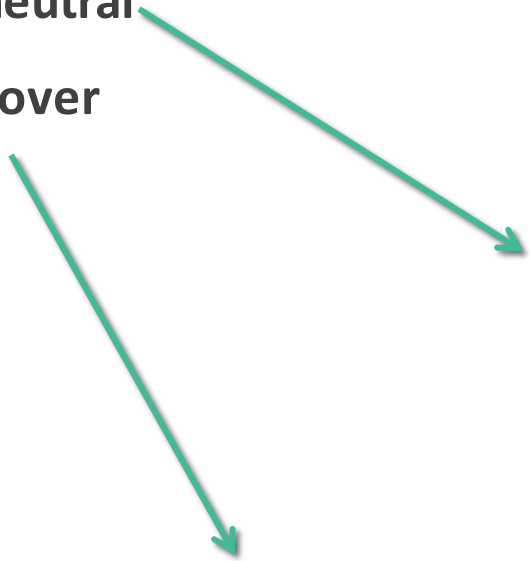
Risk premium is _____.

Attitude toward risks

Risk-averse

Risk-neutral

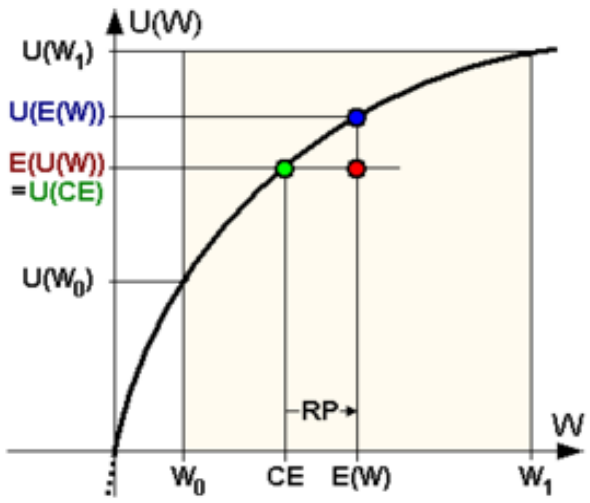
Risk-Lover

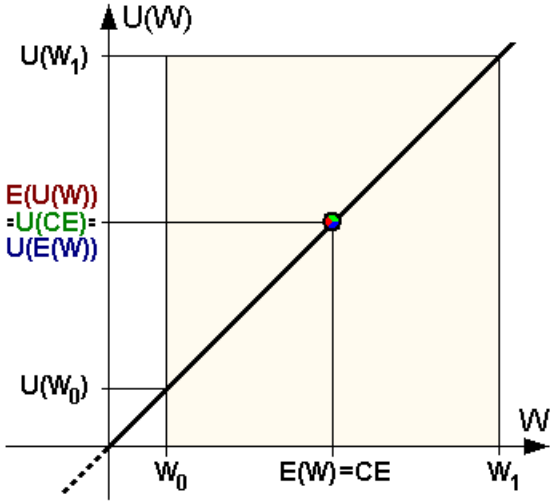


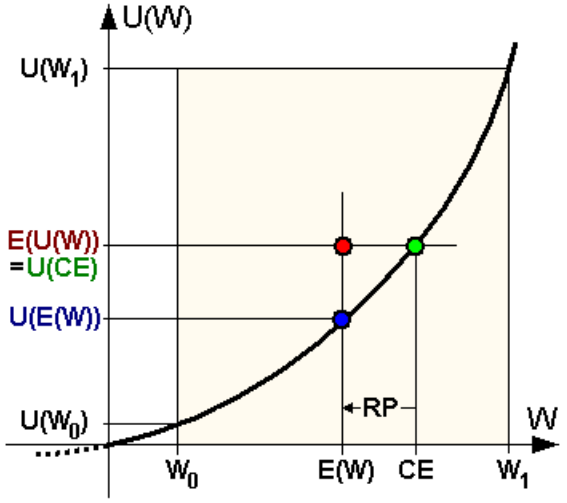
Utility formed under expected pay-off = expected utility

Utility formed under expected pay-off < expected utility

Attitude toward risks







Measuring risk aversions

Most investment theory would assume that investors are risk averse.

But, people are heterogeneity in the way they view the danger of risk, i.e. differences in the level of risk tolerance.

How to measure the degree of risk aversion?

Measuring risk aversions: risk premium

Common sense:

Consider the same risky option:

Highly risk averse person would tend to accept _____ CE, and therefore require _____ risk premium

Measuring risk aversions: risk premium

Brute force approach:

- If we know the form of the utility function, we can do the experiment, asking the agent and measure the level of risk premium.

Measuring risk aversions: risk premium

Risk premium can be calculated using the approximation method.

A key indicator measuring the extent to which people can accept the risk is calculate Arrow-Pratt Coefficient of risk aversion

Measuring risk aversions: coefficient of risk aversion

Coefficient of Absolute Risk Aversion

$$\mathrm{R_A(W)} = -\frac{u''(W)}{u'(W)}$$

Coefficient of Relative Risk Aversion

$$\mathrm{R_R(W)} = -W * \frac{u''(W)}{u'(W)}$$

$$\mathrm{R_R(W)} = W * \mathrm{R_A(W)}$$

Measuring risk aversions: calculating example

$$U(W) = \sqrt{W}$$

- $R_A(W) =$
- $R_R(W) =$

$$U(W) = \ln W$$

- $R_A(W) =$
- $R_R(W) =$

Measuring risk aversions: types of risk aversion

Increasing/decreasing/constant absolute risk aversion if $\mathrm{R}_A(\mathrm{W})$ is increasing/decreasing/constant over W

Increasing/decreasing/constant relative risk aversion if $\mathrm{R}_R(\mathrm{W})$ is increasing/decreasing/constant over W

Measuring risk aversions: what type are they, empirically?

Absolute Risk aversion decreases as Wealth increases!

Relative risk aversion is constant!

http://people.stern.nyu.edu/adamodar/pdfiles/valrisk/ch3.pdf