Modeling Individual Choice

Part 2 of the course:

Underpinnings of WTP, WTA and decision-making more generally

- Will allow analysis of more complex policies
  Example: raise tax on energy and lower tax on income

- Provides tools for complex decisions
  Involving long periods of time or uncertainty

- Overall, basis for advanced benefit-cost analysis (BCA)

Base model has four conceptual components:

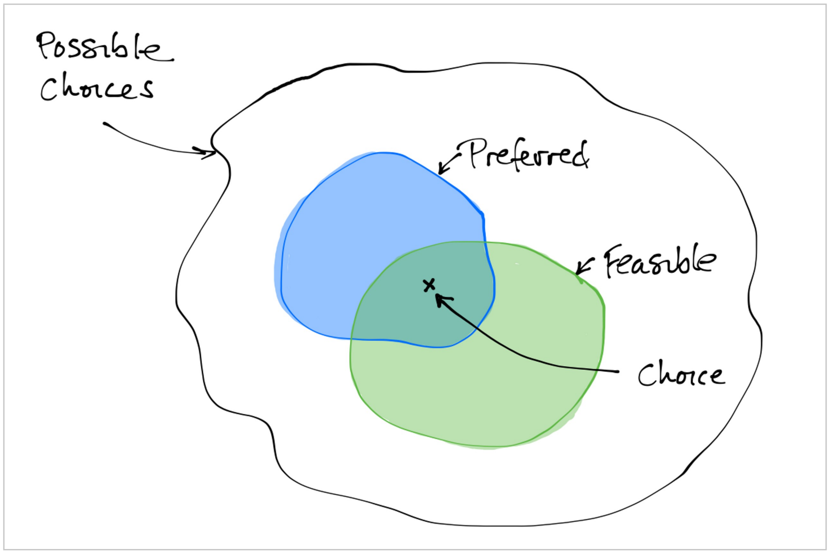
1. Set of options available
   What is the choice over?
   Terminology: ***consumption bundles***

2. Ranking
   How does the decision maker feel about the options?
   Terminology: ***preferences***

3. Feasibility
   What can the decision maker actually do?
   Terminology: ***budget constraints*** and ***feasible sets***

4. Choice
   What does the decision maker choose?
   Terminology: ***optimum*** or ***equilibrium*** bundle

Abstractly:



Consumption Bundles and Preferences

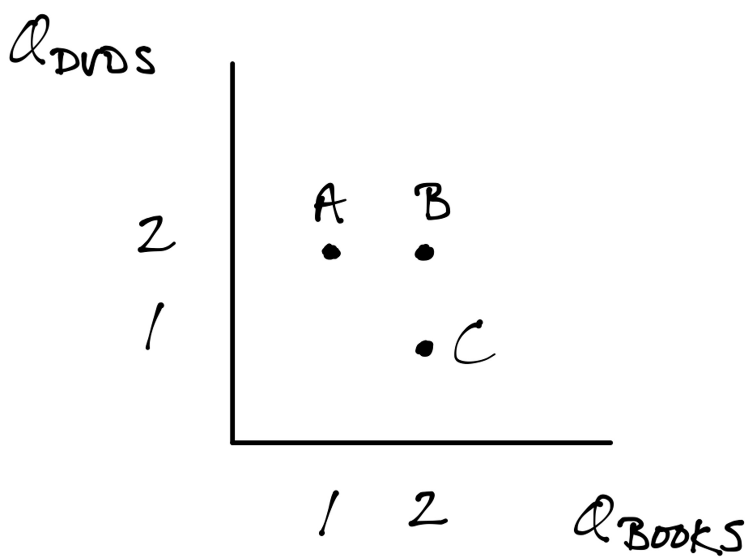
Bundles:

A bundle is a combination of goods

Examples:

Bundle	Books	DVDs
A	1	2
B	2	2
C	2	1

Graphing:



⚠ Y axis:
Quantity of DVDs
Not dollars

Preferences:

Decision makers have preferences over bundles

Notation:

Ranking of bundles X and Y	Notation	Alternate
Prefers X to Y	$X \succ Y$	$Y \prec X$
Prefers Y to X	$Y \succ X$	$X \prec Y$
Indifferent between X and Y	$X \sim Y$	$Y \sim X$

Will also use $X \succcurlyeq Y$ when X is at least as good as Y

Two axioms about preferences:

1. **Completeness**

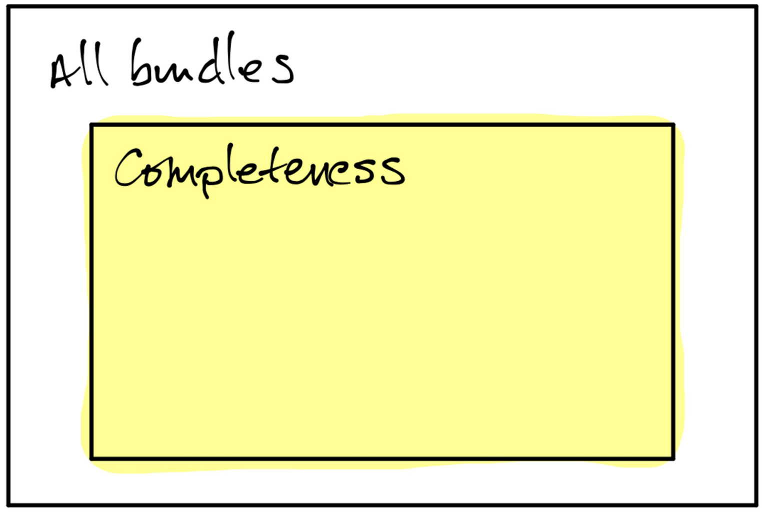
Preferences are *complete* if any two bundles can be compared.

If offered X and Y, decision maker will say:

X is better	$X \succ Y$
Y is better	$Y \succ X$
X and Y are equally good	$X \sim Y$

Does **not** say "I don't know"

Conceptually, axiom limits the domain of the model:



Purpose:

Can't model choice if the decision maker can't choose

2. Transitivity

Preferences are *transitive* if the following is true when ranking any three bundles X, Y and Z:

If decision maker reports: $X \succcurlyeq Y$ and $Y \succcurlyeq Z$

Then they *also* report: $X \succcurlyeq Z$

Person does **not** say $Z \succcurlyeq X$

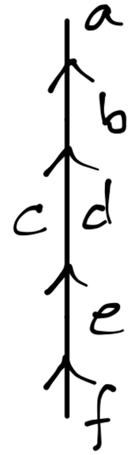
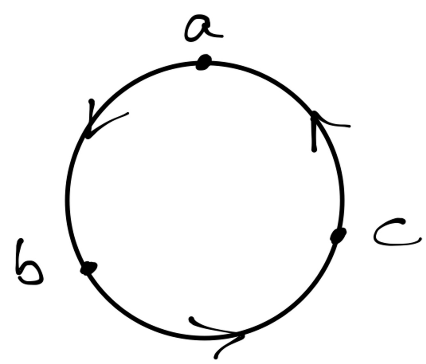
Special cases:

If $X \succ Y$ and $Y \succ Z$ Then $X \succ Z$ (Not $Z \succ X$)

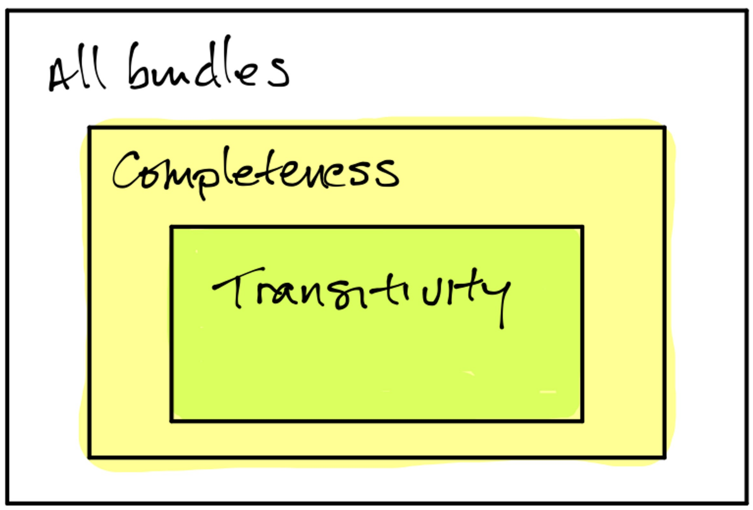
If $X \sim Y$ and $Y \sim Z$ Then $X \sim Z$ (Not $X \succ Z \text{ or } Z \succ X$)

Implication: bundles can be put in unambiguous order

No loops in ranking

Transitive		Not transitive
		
$a \succ b \succ c \sim d \succ e \succ f$		$a \succ b \succ c \succ a$

Second limit on the domain of the model:



Similar purpose to completeness:

Can't model choice if the decision maker can't choose

Rational Preferences

If preferences satisfy *completeness* and *transitivity*:

Then in economic terminology they are said to be **rational**

Economic definition of rational means **only** that a person has complete and transitive preferences.

Implies person makes purposeful, systematic choices.

Does **not** imply person is prudent, responsible, self-interested, or anything else. Can encompass a *very* wide range of preferences.

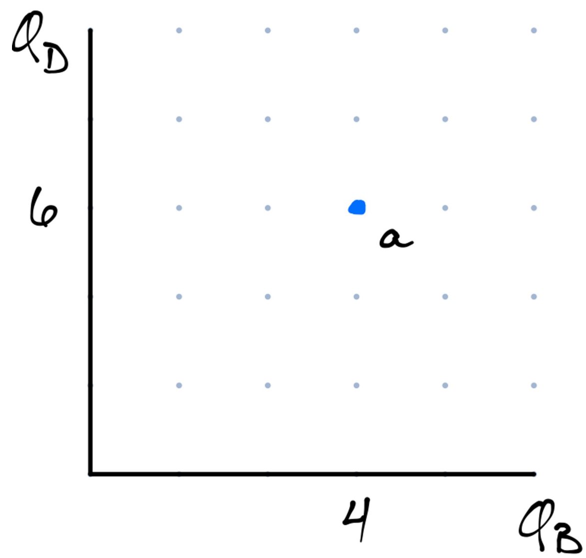
Indifference Curves

Completeness and transitivity:

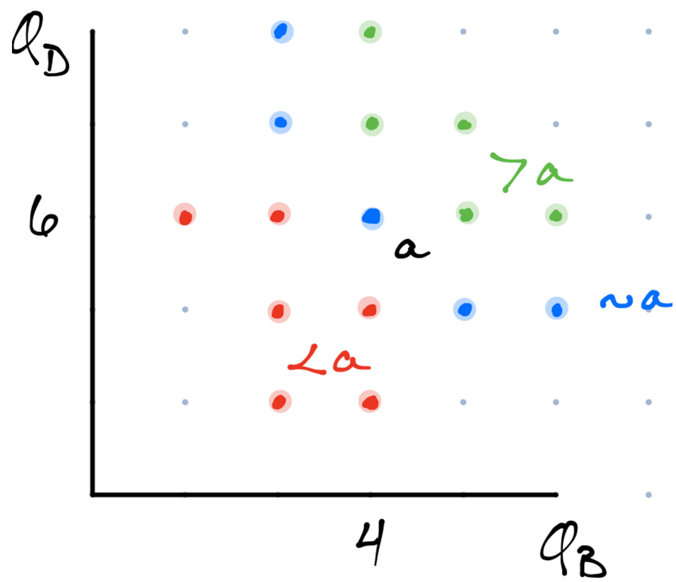
Allow preferences to be mapped using indifference curves (ICs)

Constructing an IC:

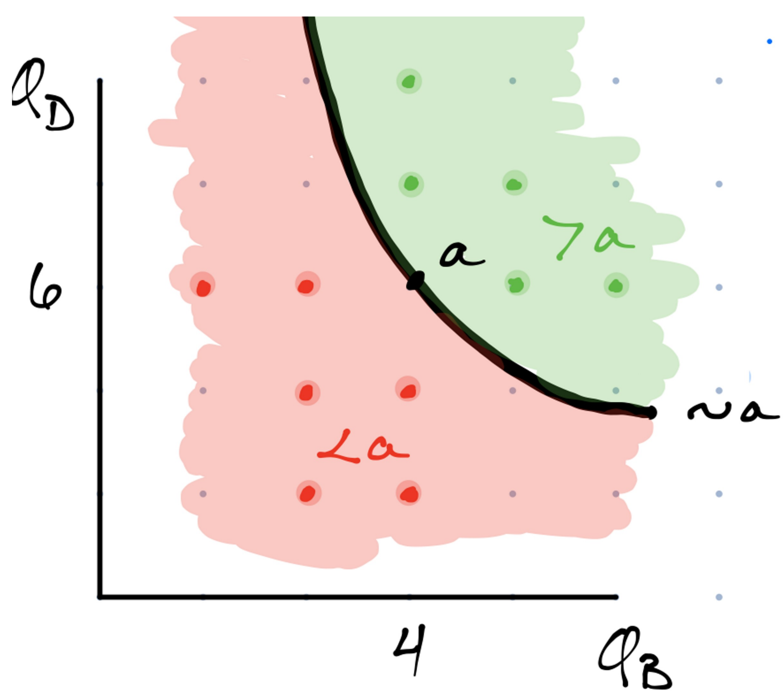
Suppose have bundle *a* and compare all other bundles to it:



Each will be better ($\succ a$), worse($\prec a$) or the same ($\sim a$):



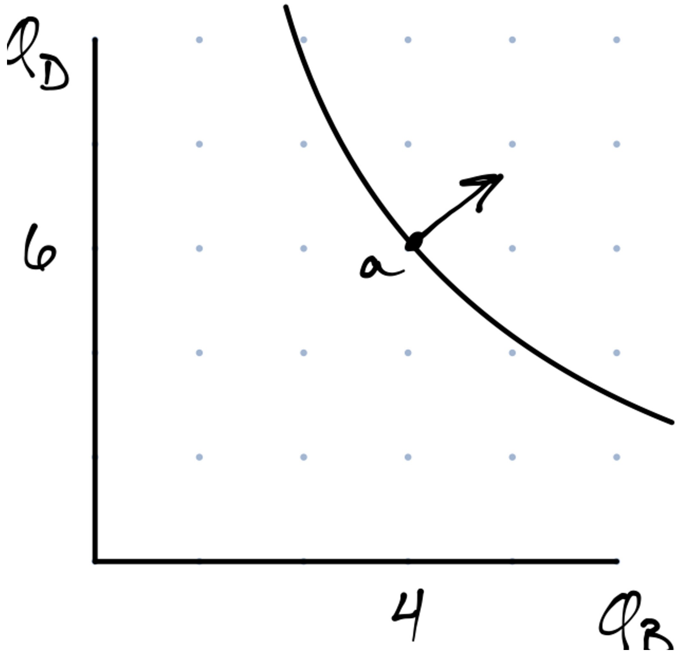
Connecting the dots equal to *a* gives indifference curve for *a*:



Three regions:

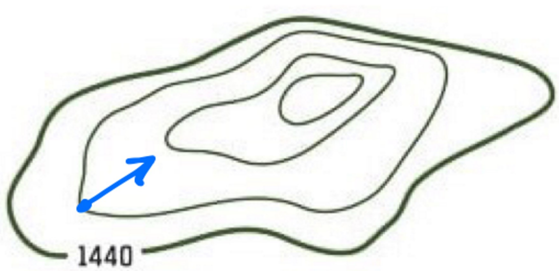
1. Worse (red)
2. Equal (black)
3. Better (green)

Usually show preferred region with an arrow:



Physical analogy:

Like a contour line on a topographic map and arrow points uphill.



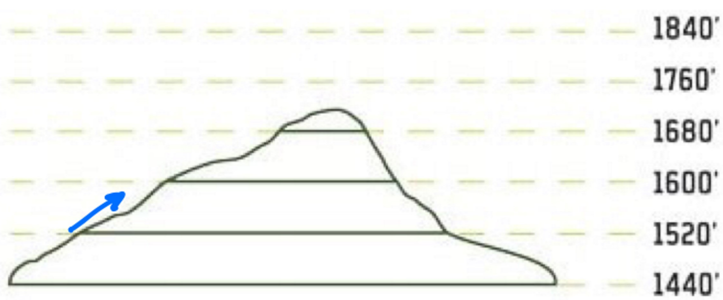
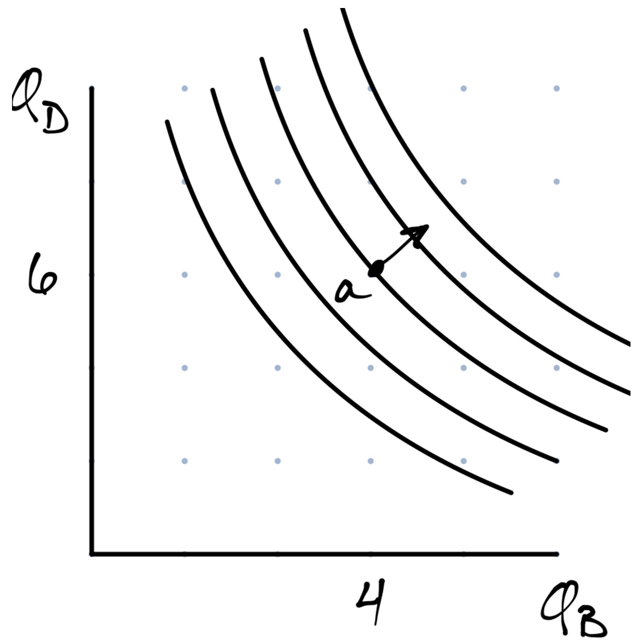


Image courtesy of rei.com

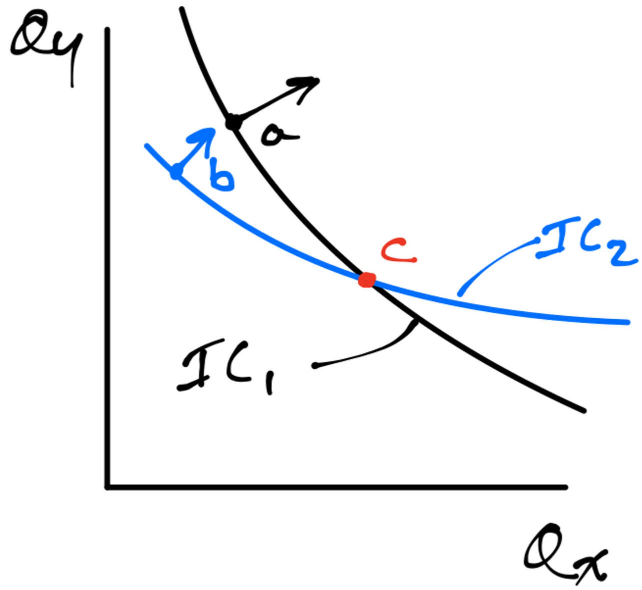
Plane has a family of ICs; every bundle is on one:



Two key properties:

1. ICs can't cross: each bundle is on a single IC

   To see why, suppose they did:



IC1:
$a \sim c$
$a, c \succ b$

IC2:
$b \sim c$
$a \succ b, c$

Implications:

From IC1: $a \sim c$

From IC2: $b \sim c$

By transitivity: $a \sim b$

However, *both* IC1 and IC2 say $a \succ b$, contradicting $a \sim b$.

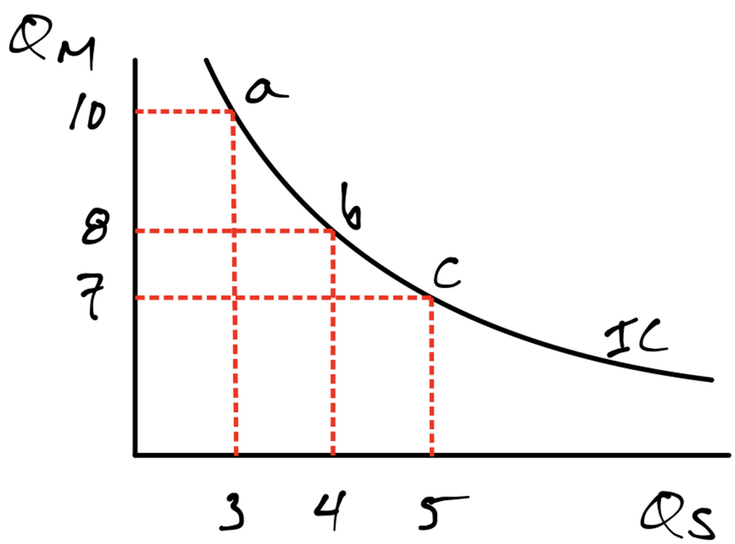
Therefore, ICs can't cross:
 Doing so violates transitivity

Physical analogy:
 Every point has only one altitude

2. Slope of IC shows willingness to trade the goods

Known as the *marginal rate of substitution* (MRS)

Example: trading movies (M) for shows (S)



a to b:

$$MRS = \frac{\Delta Y}{\Delta X} = \frac{-2}{1} = -2$$

b to c:

$$MRS = \frac{-1}{1} = -1$$