Engineering Economic Analysis

2019 SPRING

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Chap. 3

PREFERENCES

Rationality in Economics

- Behavioral Postulate:
  A decision maker always chooses its most preferred alternative from its set of available alternatives (optimality principle).
- So to model choice we must model decision makers' preferences.

Preference Relations

- Comparing two different consumption bundles, $\tilde{x} \in X$ and $\tilde{y} \in X$:
  - strict preference: $\tilde{x}$ is more preferred than is $\tilde{y}$.

$$\tilde{x} \succ \tilde{y}$$

  - weak preference: $\tilde{x}$ is as at least as preferred as is $\tilde{y}$.

$$\tilde{x} \succsim \tilde{y}$$

  - indifference: $\tilde{x}$ is exactly as preferred as is $\tilde{y}$.

$$\tilde{x} \sim \tilde{y}$$

Preference Relations

- Note that
  - If $\tilde{x} \succsim \tilde{y}$ and $\tilde{y} \succsim \tilde{x}$, then $\tilde{x} \sim \tilde{y}$
  - If $\tilde{x} \succsim \tilde{y}$ and $\tilde{x} \nsim \tilde{y}$, then $\tilde{x} \succ \tilde{y}$

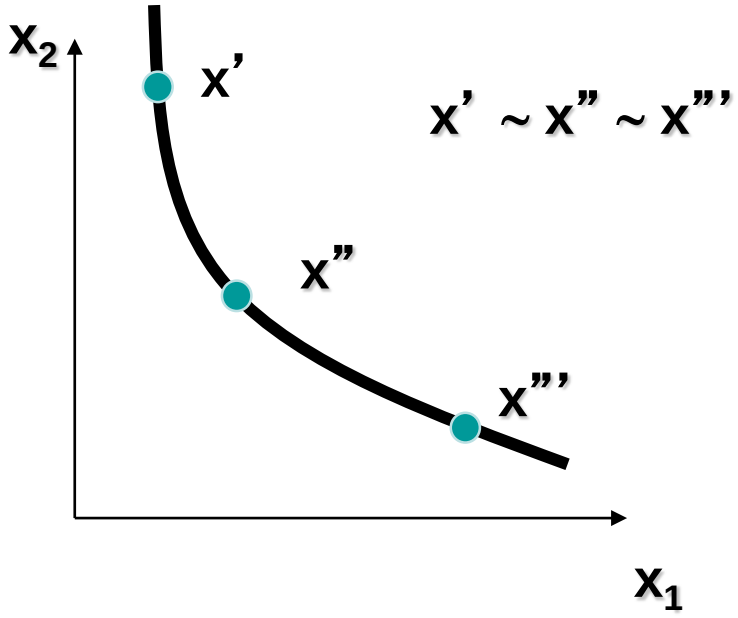
- Particularly, they are ordinal relations; *i.e.* they state only the order in which bundles are preferred.

Assumptions (or Axioms) about Preferences

- Completeness: For any two bundles $\tilde{x} \in X$ and $\tilde{y} \in X$, it is always possible to make the statement that either $\tilde{x} \succsim \tilde{y}$ or $\tilde{y} \succsim \tilde{x}$ or both.
- Reflexivity: Any bundle $\tilde{x}$ is always at least as preferred as itself; *i.e.* $\tilde{x} \succsim \tilde{x}$
- Transitivity : If $\tilde{x} \succsim \tilde{y}$ and $\tilde{y} \succsim \tilde{z}$, then $\tilde{x} \succsim \tilde{z}$

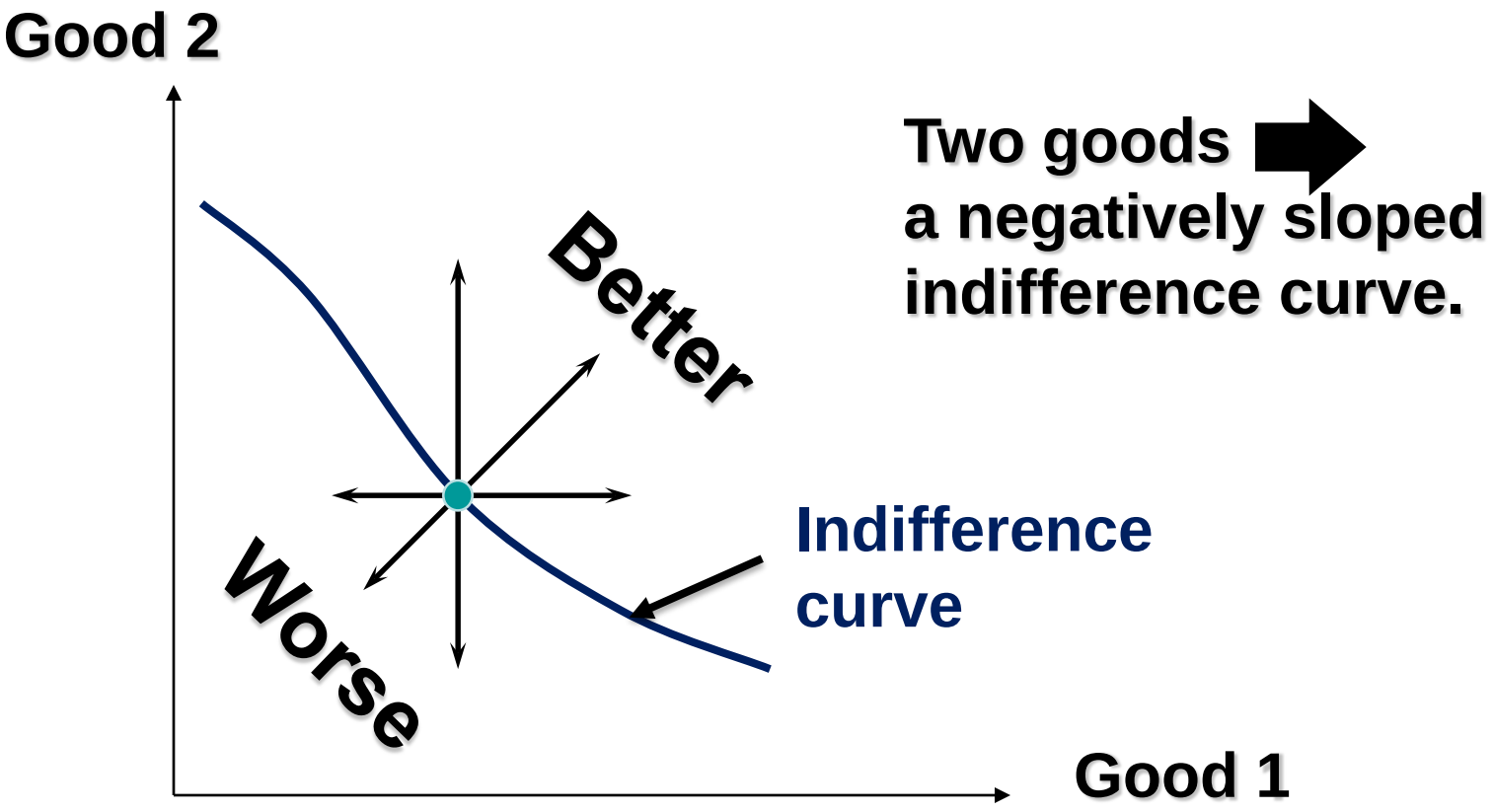
Indifference Curves

- Indifference curve (I.C.)
  - a way to describe preferences graphically
  - The set of all bundles equally preferred to some given bundle, say $\tilde{x}'$
  - I.C. containing $\tilde{x}'$: $\mathrm{I}(\tilde{x}') = \{\tilde{x} \in X | \tilde{x} \sim \tilde{x}'\}$

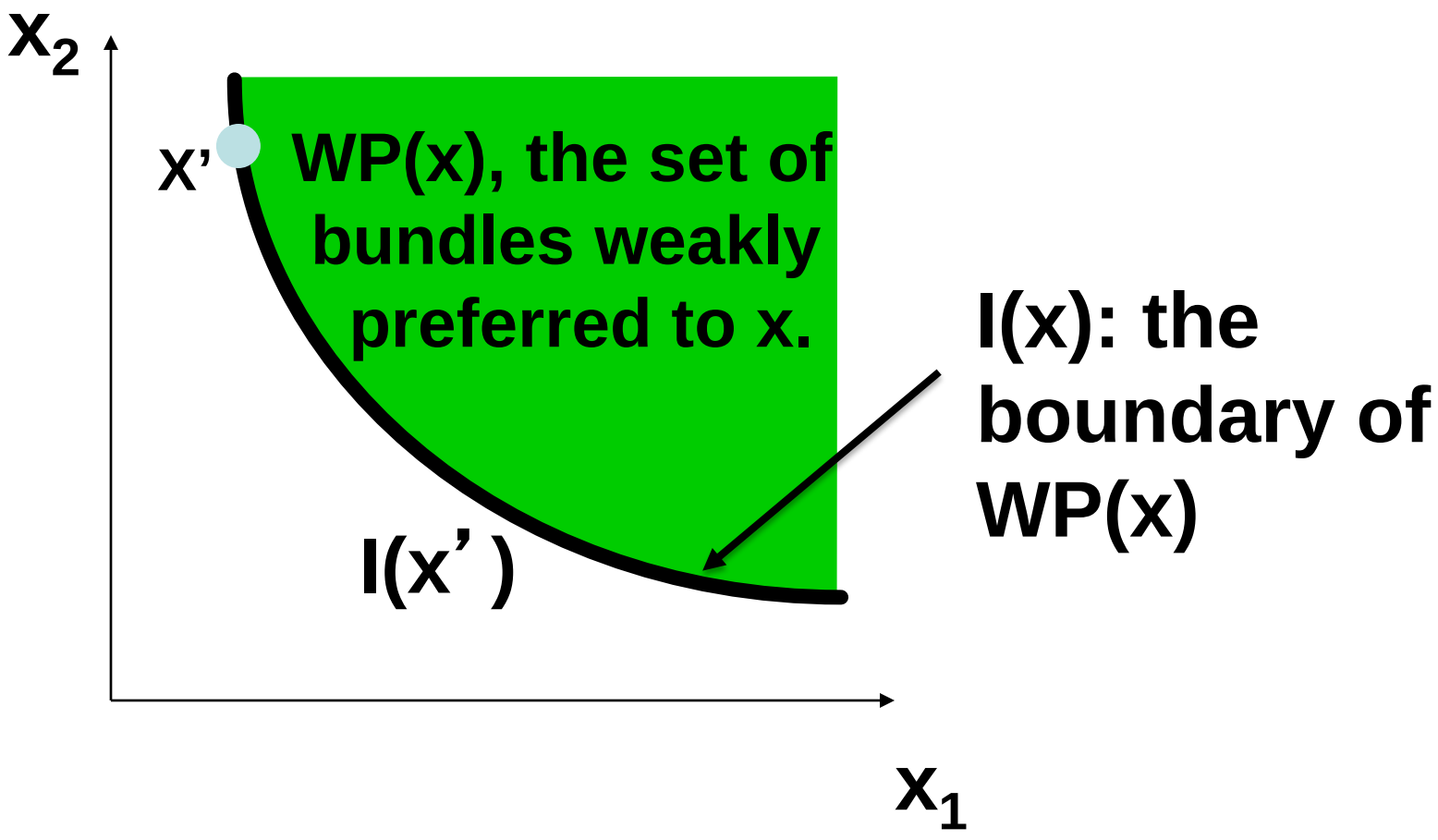


Slopes of Indifference Curves

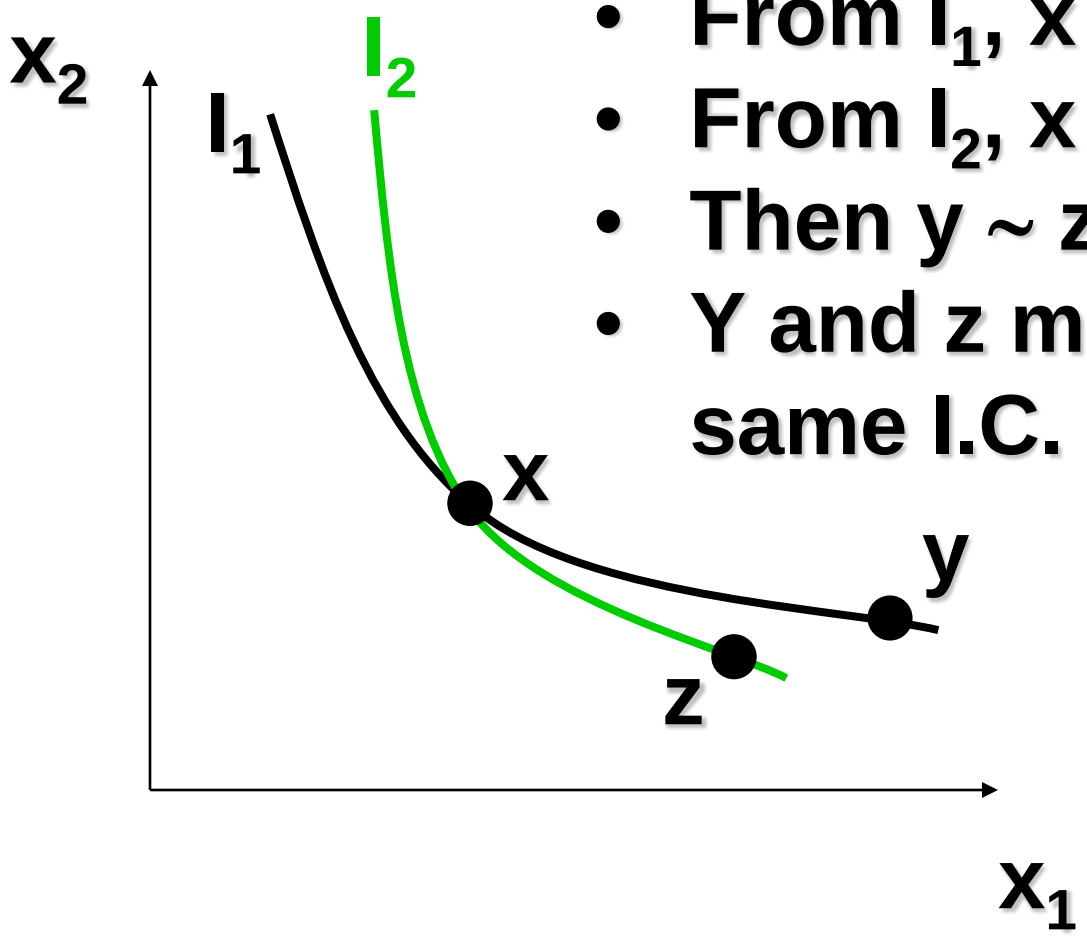
- When more of a commodity is always preferred, the commodity is a good.



Indifference Curves



Indifference Curves Cannot Cross

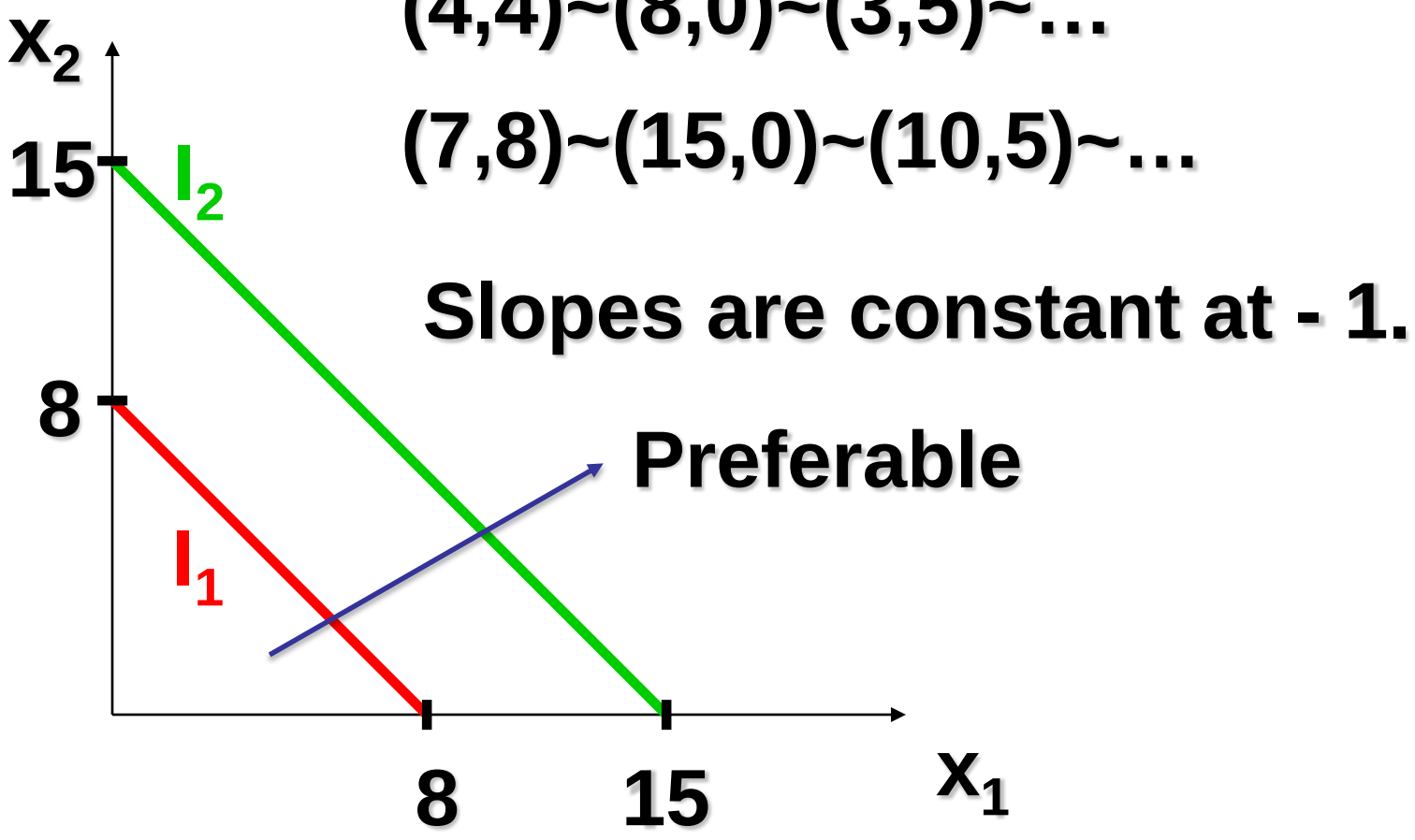


- From I_1, x ~ y.
- From I_2, x ~ z.
- Then y ~ z (by transitivity)
- Y and z must be on the same I.C. Contradiction.

Examples of preferences; Perfect Substitutes

- Perfect substitutes
  - If the consumer is willing to substitute one good for the other as a constant rate
  - Coffee vs. Tea, Ale vs. Larger, Blue vs. Red pencils etc.
- If a consumer always regards units of commodities 1 and 2 as equivalent, then the commodities are perfect substitutes and only the total amount of the two commodities in bundles determines their preference rank-order.

Examples of preferences; Perfect Substitutes



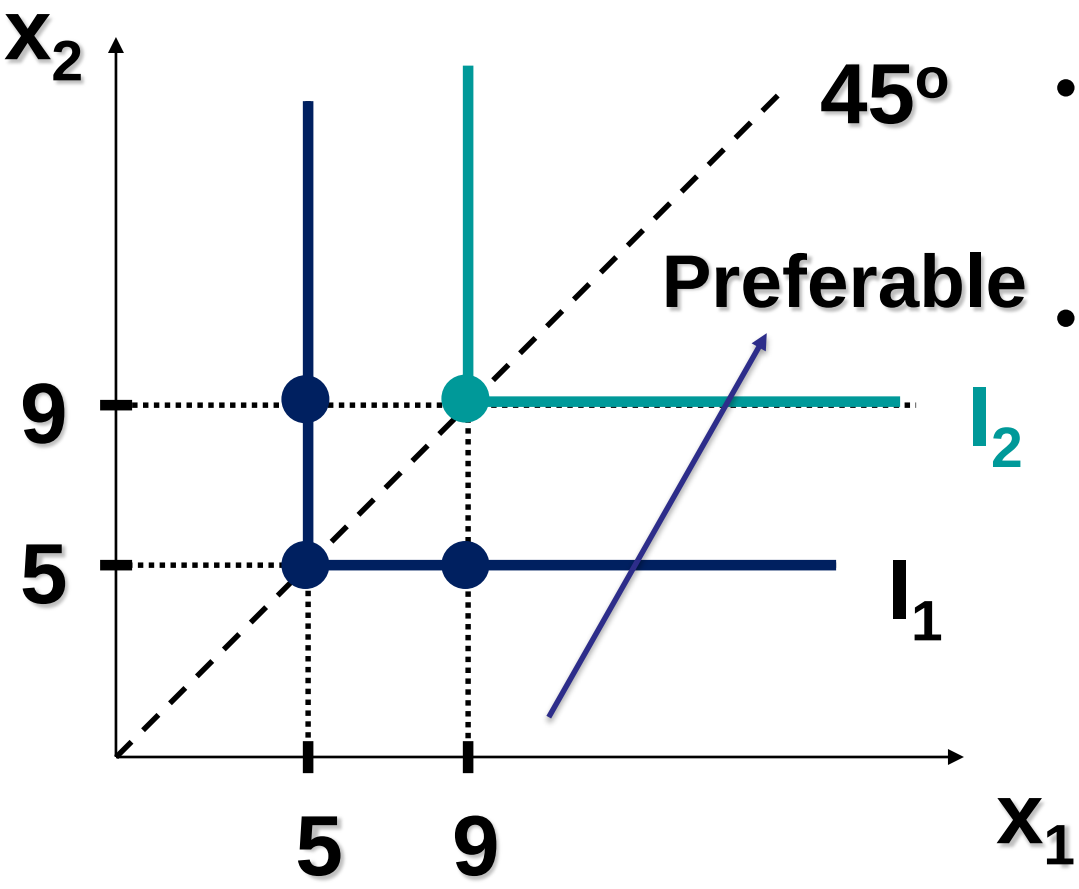
Examples of preferences; Perfect Substitutes

- The important fact about perfect substitutes is that the indifference curves have a constant slope
- How about the case where the consumer would be willing to give up two x_1 to get one more x_2?

Examples of preferences; Perfect Complements

- Perfect complements
  - Goods that are consumed together in fixed proportions
  - Right shoes vs. Left shoes, Remote controller vs. Batteries
- If a consumer always consumes commodities 1 and 2 in fixed proportion (e.g. one-to-one), then the commodities are perfect complements and only the number of pairs of units of the two commodities determines the preference rank-order of bundles.

Examples of preferences; Perfect Complements



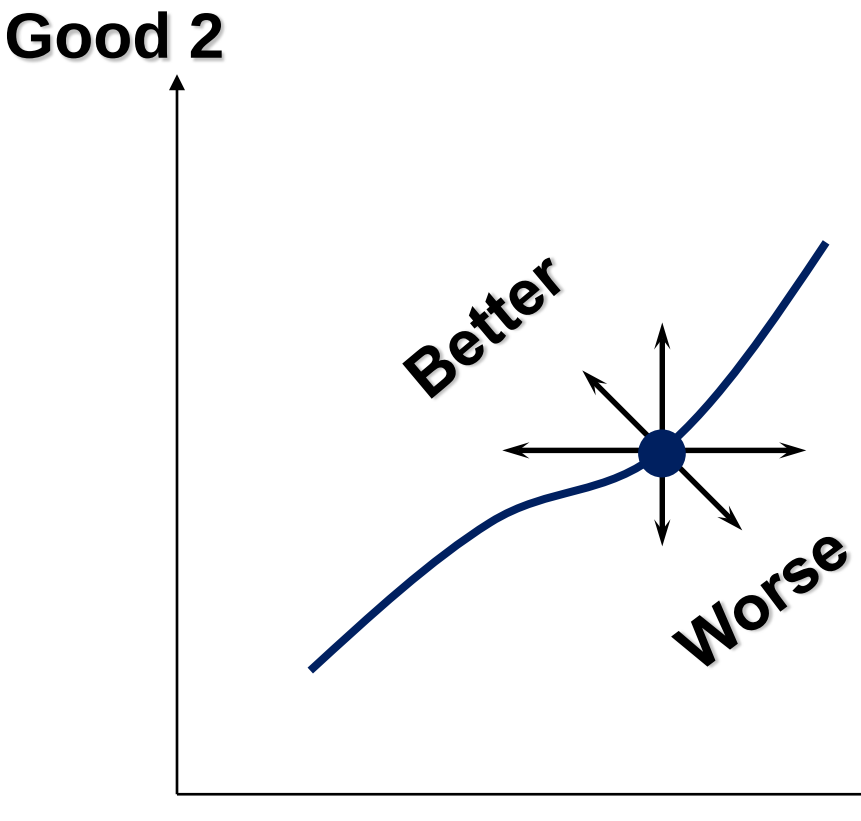
- Each of (5,5), (5,9) and (9,5) contains 5 pairs
- so (5,5)~(5,9)~(9,5)

Examples of preferences; Perfect Complements

- The important fact about perfect complements is that the consumer prefers to consume the goods in fixed proportions, thereby the indifference curves are L-shaped
- How about the case where the consumer prefers to consume the goods in fixed proportions which is not one-to-one?

Examples of preferences; Bads

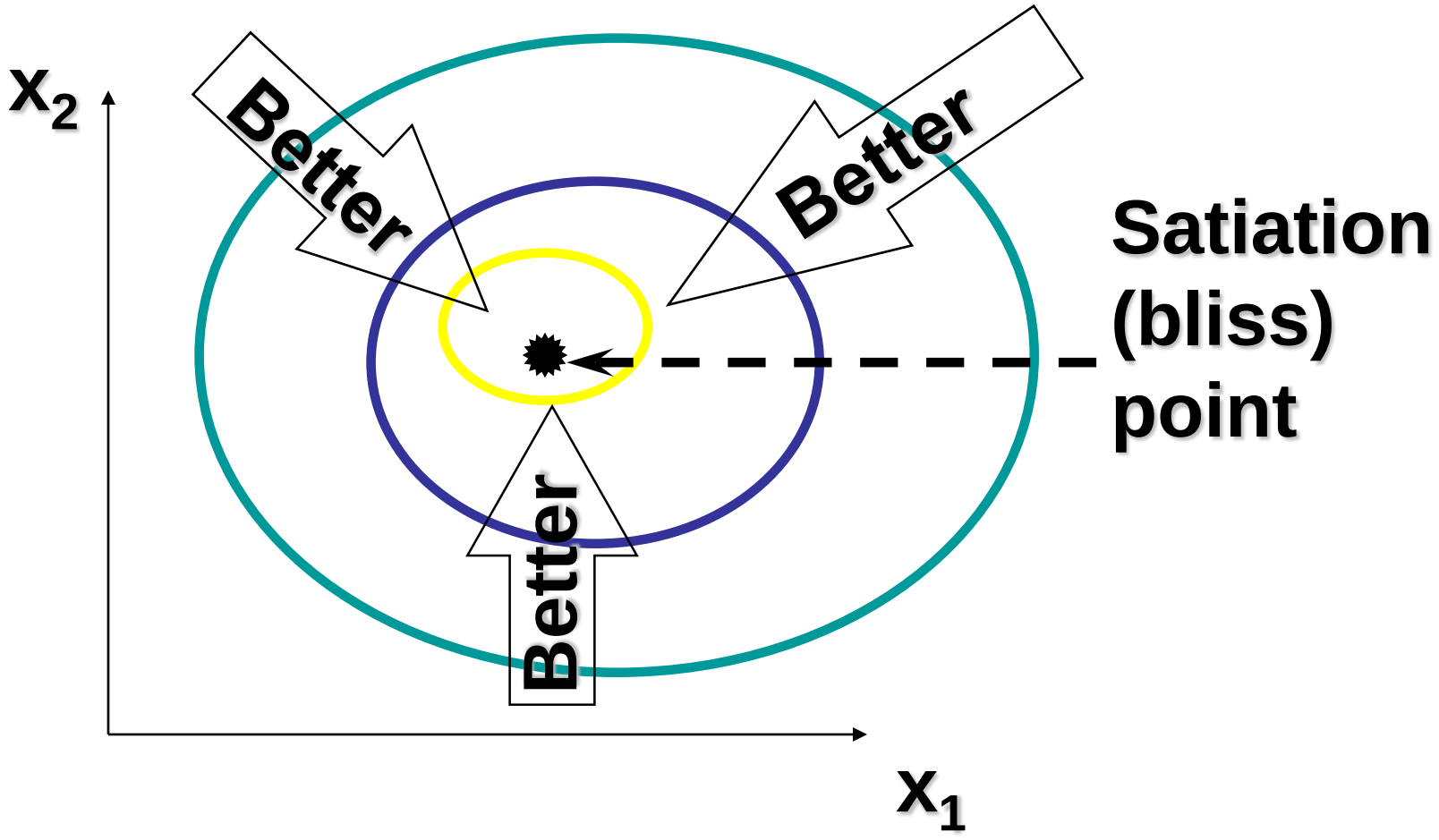
- If less of a commodity is always preferred then the commodity is a bad.



One good and one bad ➡ a positively sloped indifference curve.

Examples of preferences; Satiation

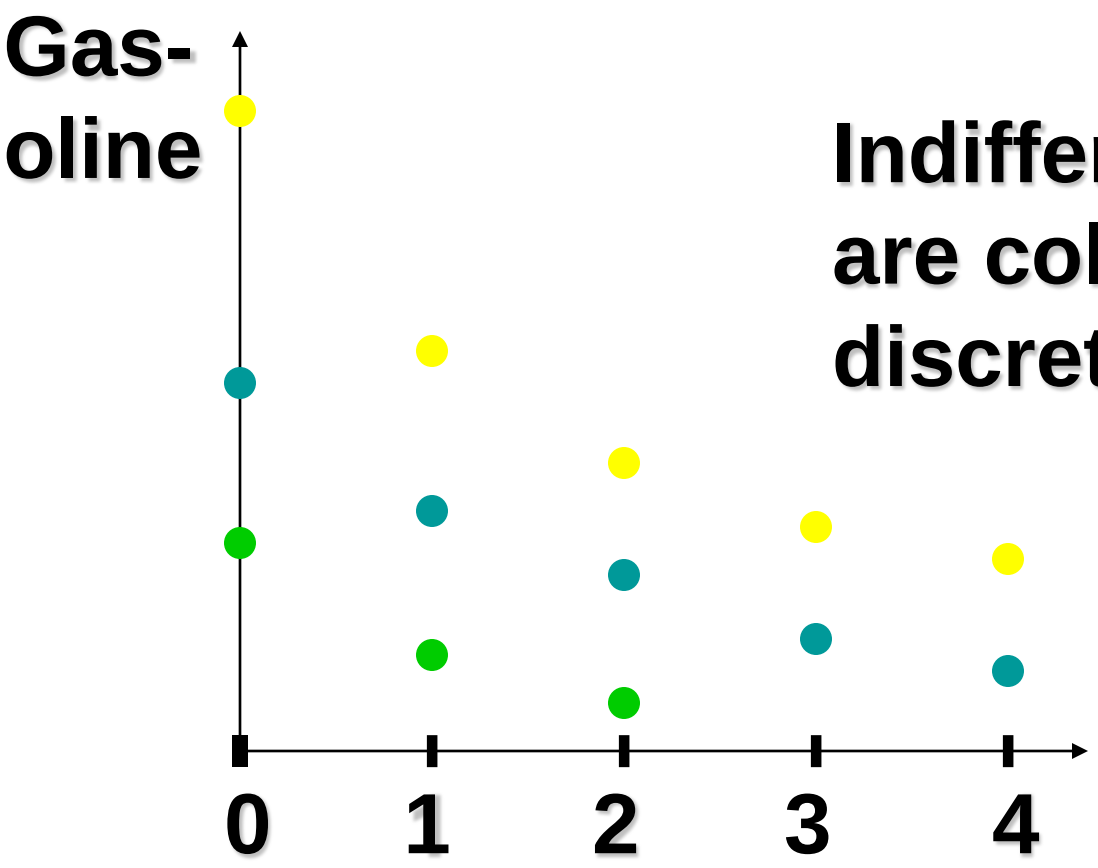
- A bundle strictly preferred to any other is a satiation point or a bliss point.



Examples of preferences; Discrete Commodities

- A commodity is infinitely divisible if it can be acquired in any quantity; *e.g.* water or cheese.
- A commodity is discrete if it comes in unit lumps of 1, 2, 3, … and so on; *e.g.* aircraft, ships and refrigerators.
- Suppose commodity 2 is an infinitely divisible good (gasoline) while commodity 1 is a discrete good (aircraft). What do indifference "curves" look like?

Examples of preferences; Discrete Commodities



Indifference "curves" are collections of discrete points.

Well-Behaved Preferences

- Monotonicity: More of any commodity is always preferred (*i.e.* no satiation and every commodity is a good).
  - I.C. is negative-sloped

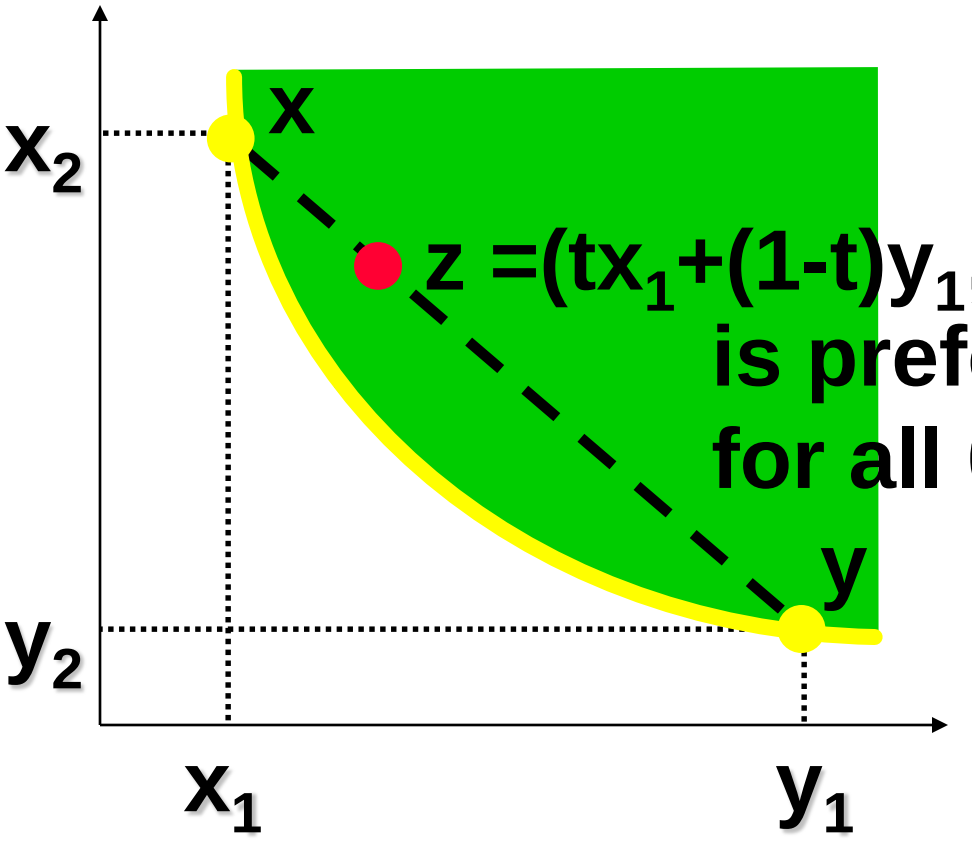
- Convexity: Averages are preferred to extremes.

$$If \quad (x_1, x_2) \sim (y_1, y_2)$$

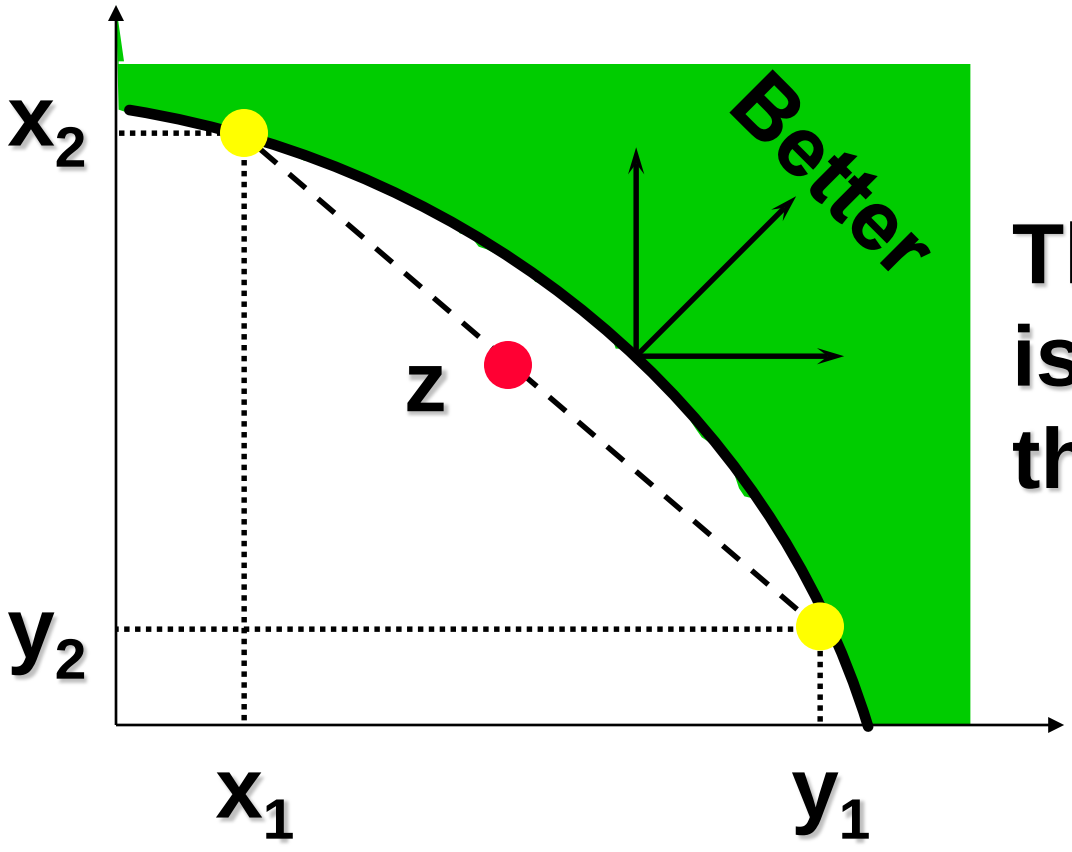
$$(tx_1 + (1-t)y_1, tx_2 + (1-t)y_2) \succeq (x_1, x_2)$$

$$for\ any\ 0 \leq t \leq 0$$

Well-Behaved Preferences -- Convexity.

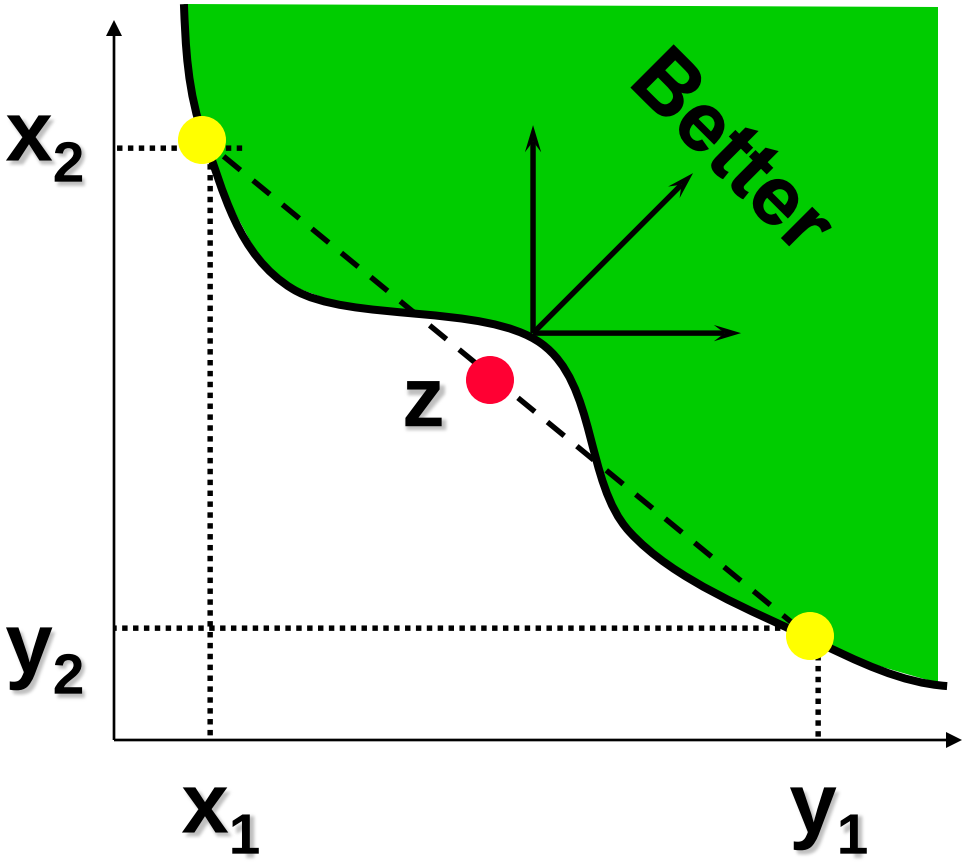


Non-Convex Preferences



The mixture z is less preferred than x or y.

Non-Convex Preferences

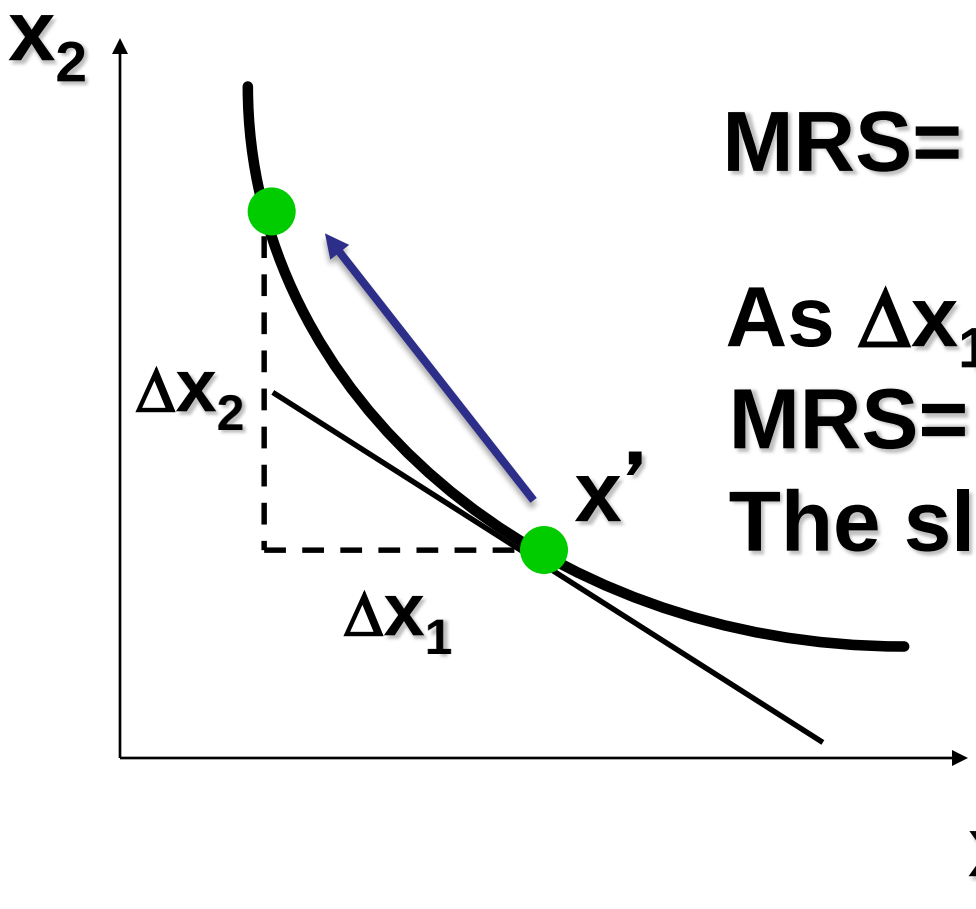


The mixture z is less preferred than x or y.

Marginal Rate of Substitution

- Marginal rate of substitution (MRS): the rate at which the consumer is just willing to substitute one good for the other
- ‘just willing to substitute’ implies no changes in the consumer’s preference
- On the same indifference curve
- The slope of an indifference curve is its MRS.

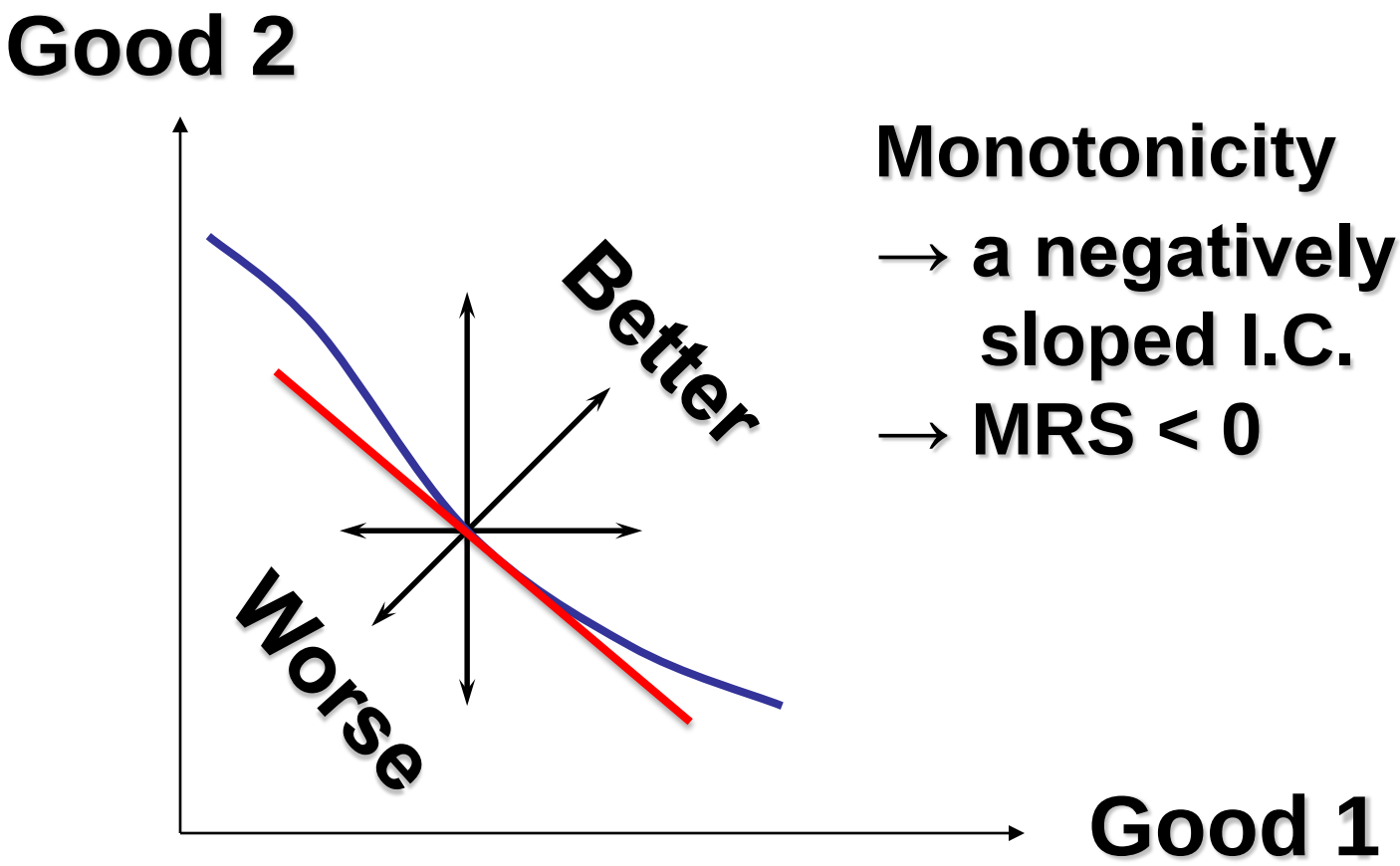
Marginal Rate of Substitution



MRS= $\Delta x_2 / \Delta x_1$

As $\Delta x_1 \rightarrow 0$
MRS= dx_2/dx_1
The slope of I.C.

MRS & Preference Properties

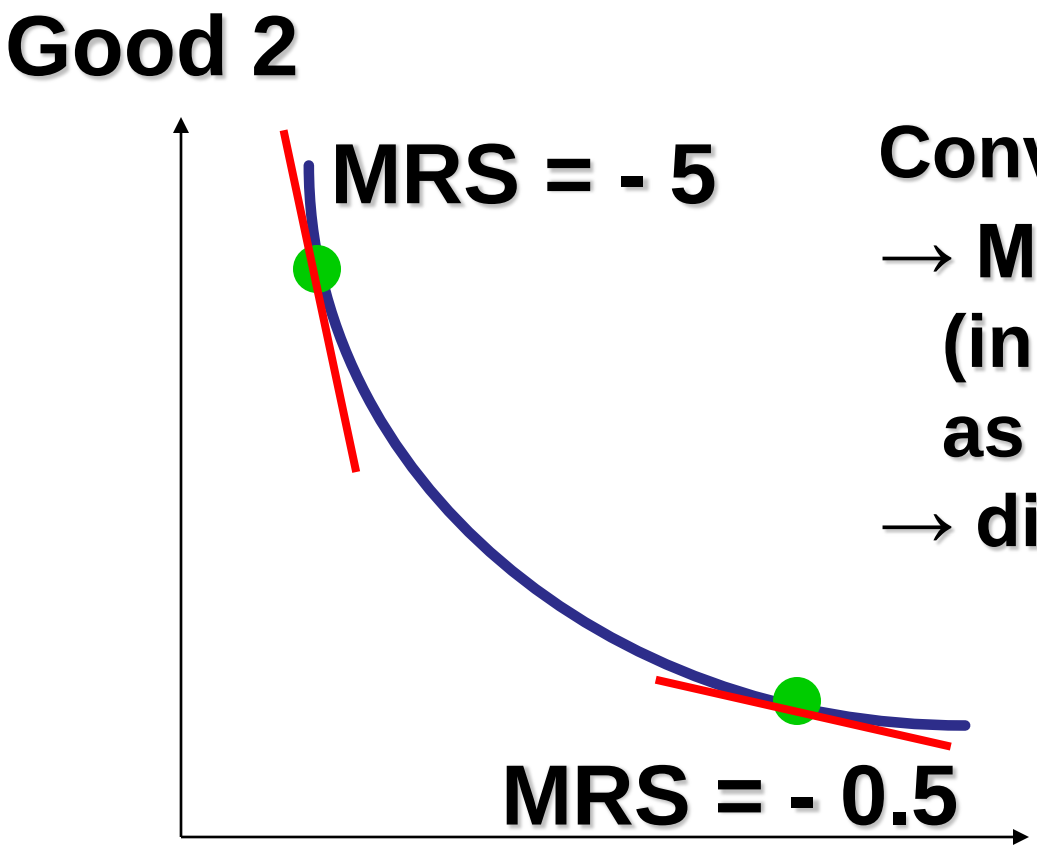


Monotonicity

→ a negatively sloped I.C.

→ MRS < 0

MRS & Preference Properties



Convexity

→ MRS decreases (in absolute value) as x_1 increases

→ diminishing MRS