EconS 301: Intermediate Microeconomic Theory

Consumer Preferences and Utility

OUTLINE

- BUNDLES
- PREFERENCES FOR BUNDLES
- UTILITY FUNCTIONS
- MARGINAL UTILITY
- INDIFFERENCE CURVES
- MARGINAL RATE OF SUBSTITUTION
- SPECIAL TYPES OF UTILITY FUNCTIONS
- A LOOK AT BEHAVIORAL ECONOMICS–SOCIAL PREFERENCES
- APPENDIX. FINDING MARGINAL RATE OF SUBSTITUTION

BUNDLES

BUNDLES

- A BUNDLE IS A LIST OF GOODS AND SERVICES.
  - *EXAMPLE*: IF AN INDIVIDUAL CONSUMES ONLY 2 GOODS, x AND y (APPLES AND ORANGES), BUNDLE $A = (40,30)$ INDICATES THAT SHE CONSUMES $x = 40$ APPLES AND $y = 30$ ORANGES.

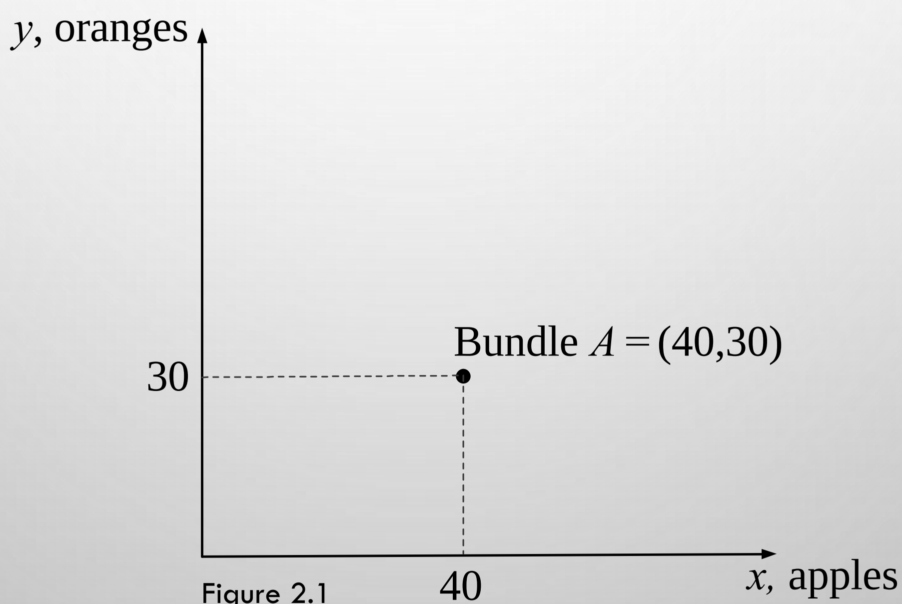

Figure 2.1

PREFERENCES FOR BUNDLES

- LET'S ANALYZE CONSUMER PREFERENCES OVER BUNDLES OR HOW A CONSUMER RANKS DIFFERENT BUNDLES.
- NOTATION FOR COMPARING PREFERENCES FOR BUNDLES:
  - CONSIDER BUNDLES $A = (x_A, y_A)$ AND $B = (x_B, y_B)$.
  - $A \succ B$, THE INDIVIDUAL "STRICTLY PREFERS" BUNDLE A TO B ("STRICTLY" RULES OUT THE POSSIBILITY SHE IS INDIFFERENT BETWEEN THE TWO BUNDLES).
  - $A \sim B$, SHE "INDIFFERENT" BETWEEN BUNDLES A AND B.
  - $A \gtrsim B$, SHE "WEAKLY PREFERS" BUNDLE A TO B (SHE CAN BE INDIFFERENT BETWEEN THE TWO BUNDLES OR TO STRICTLY PREFERS A TO B).

PREFERENCES FOR BUNDLES

- COMPLETENESS:
  - A PREFERENCE RELATION IS *COMPLETE* IF THE CONSUMER HAS THE ABILITY TO COMPARE EVERY TWO BUNDLES A AND B:
    - $A \succ B$ (SHE STRICTLY PREFERS BUNDLE A),
    - $B \succ A$ (SHE STRICTLY PREFERS BUNDLE B), OR
    - $A \sim B$ (SHE IS INDIFFERENT BETWEEN A AND B).
  - COMPLETENESS IMPLIES THAT THE CONSUMER HAS TIME TO BE ABLE TO COMPARE AND RANK TWO BUNDLES.
  - WE DON'T ALLOW THE CONSUMER TO RESPOND "I DON'T KNOW HOW TO COMPARE THESE TWO BUNDLES!"

PREFERENCES FOR BUNDLES

- TRANSITIVITY:
  - FOR EVERY THREE BUNDLES A, B, AND C,
    - IF THE CONSUMER PREFERS A TO B ($A \succ B$),
    - AND B TO C ($B \succ C$),
    - SHE MUST ALSO PREFER A TO C ($A \succ C$).
  - A CONSUMER WITH INTRANSITIVE PREFERENCES WOULD HAVE $A \succ B$ AND $B \succ C$, BUT $C \succ A$. HER PREFERENCES WOULD EXHIBIT A CYCLE:

$$A \succ B \succ C \succ A.$$

  - AN INDIVIDUAL WITH INTRANSITIVE PREFERENCES WOULD BE SUBJECT TO EXPLOITATION.

PREFERENCES FOR BUNDLES

- EXPLOITATION OF INTRANSITIVE INDIVIDUALS:
  - CONSIDER 3 GOODS, AN ORANGE, AND APPLE, AND A BANANA. AND A CONSUMER WITH THE FOLLOWING PREFERENCES:

    $Orange \succ Banana$ AND $Banana \succ Apple$

    BUT $Apple \succ Orange$ (WHICH VIOLATES TRANSITIVITY)
  - ASSUME SHE OWNS 1 ORANGE, AND SHE PLAYS A GAME WITH A FRUIT SELLER. IF THE SELLER GIVES HER PREFERRED FRUIT, SHE PAYS $1.
    - THE SELLER OFFERS AN APPLE, SHE PAYS $1 BECAUSE $Apple \succ Orange$.
    - NEXT, THE SELLER OFFERS A BANANA, SHE PAYS $1 BECAUSE $Banana \succ Apple$.
    - NEXT, THE SELLER OFFERS AN ORANGE, SHE PAYS $1 GIVEN $Orange \succ Banana$.
  - AT THE END, THE CONSUMER HAS 1 ORANGE AS AT THE BEGINNING OF THE EXCHANGE, BUT SHE HAS LOST $3 DUE TO HER INTRANSITIVE PREFERENCES.

PREFERENCES FOR BUNDLES

- STRICT MONOTONICITY:
  - CONSIDER AN INITIAL BUNDLE A, AND A NEW BUNDLE B, WHERE BUNDLE B HAS
    - THE SAME AMOUNT OF GOOD x AS BUNDLE A ($x_A = x_B$),
    - BUT MORE UNITS OF GOOD y ($y_B > y_A$).
  - A CONSUMER'S PREFERENCES SATISFY *STRICT MONOTONICITY* IF
    - SHE STRICTLY PREFERS B TO A ($B \succ A$).
  - INCREASING THE UNITS OF A SINGLE GOOD, AS y IN BUNDLE B, PRODUCES A NEW BUNDLE THAT IS STRICTLY PREFERRED TO A → "MORE OF *ANYTHING* IS STRICTLY PREFERRED."

PREFERENCES FOR BUNDLES

- MONOTONICITY:
  - AGAIN, CONSIDER AN INITIAL BUNDLE A, AND A NEW BUNDLE B, WHERE BUNDLE B HAS THE SAME AMOUNT OF GOOD x AS BUNDLE A ($x_A = x_B$), BUT MORE UNITS OF GOOD y ($y_B > y_A$),
  - WHEREAS A NEW BUNDLE C HAS MORE UNITS OF BOTH GOODS THAN BUNDLE A DOES ($x_c > x_A$ AND $y_c > y_A$).
  - A CONSUMER'S PREFERENCES SATISFY *MONOTONICITY* IF
    - SHE WEAKLY PREFERS PREFERS B TO A ($B \succsim A$),
    - BUT SHE STRICTLY PREFERS C TO A ($C \succ A$)
  - IF THE AMOUNTS OF *ALL* GOODS ARE HIGHER, AS IN BUNDLE C, THE CONSUMER IS BETTER OFF → "MORE OF *EVERYTHING* IS STRICTLY PREFERRED."

PREFERENCES FOR BUNDLES

- *EXAMPLE 2.1: MONOTONIC AND STRICTLY MONOTONIC PREFERENCES.*
  - CONSIDER BUNDLES $A = (2,3)$ AND $B = (2,4)$.
  - ERIC STRICTLY PREFERS BUNDLE B TO A ($B \succ A$).
    - IF THIS RANKING HOLDS FOR ANY TWO BUNDLES WHERE ONLY ONE OF THE GOOD IS INCREASED, THESE PREFERENCES SATISFY *STRICT MONOTONICITY*.
  - CHELSEA IS INDIFFERENT BETWEEN B AND A ($B \sim A$).

    IF WE REPLACE B WITH BUNDLE $C = (3,4)$, SHE STRICTLY PREFERS C TO A ($C \succ A$).
    - IF THIS RANKING HOLDS FOR ANY TWO BUNDLES IN WHICH ONE HAS MORE UNITS OF ALL GOODS, HER PREFERENCES SATISFY *MONOTONICITY.*

PREFERENCES FOR BUNDLES

- STRICT MONOTONICITY IMPLIES MONOTONICITY:
  - IF A CONSUMER BECOMES STRICTLY BETTER OFF IF WE INCREASE ANYONE OF THE GOODS, THEN SHE IS NOT WORSE OFF, WHICH IS THE MINIMAL REQUIREMENT TO SATISFY MONOTONICITY.

$$Strict\ monotonicity \implies Monotonicity$$

  - MONOTONICITY AND STRICT MONOTONICITY REQUIRE THAT THE CONSUMER REGARDS ALL ITEMS IN HER BUNDLE AS GOODS RATHER THAN BADS (E.G., POLLUTION OR GARBAGE).
    - IF SOME GOOD WERE A BAD, INCREASING THE NUMBER OF UNITS IN INITIAL BUNDLE A, WOULD PRODUCE A NEW BUNDLE B THAT WOULD BE *LESS* PREFERRED THAN BUNDLE A, VIOLATING MONOTONICITY AND STRICT MONOTONICITY.

PREFERENCES FOR BUNDLES

- NONSATIATION:
  - PREFERENCES SATISFY NONSATIATION IF, FOR EVERY BUNDLE A, THERE IS ANOTHER BUNDLE B FOR WHICH THE CONSUMER IS BETTER OFF,

$$B \succ A$$

    - NONSATIATION MEANS THERE IS NO “BLISS BUNDLE” → THE CONSUMER CANNOT BE MADE ANY HAPPIER BY CONSUMING AN ALTERNATIVE BUNDLE.
    - NONSATIATION ALLOWS THE CONSUMER TO REGARD SOME GOODS AS “BADS.”
    - NONSATIATION ONLY REQUIRES THE CONSUMER TO ALWAYS FIND MORE PREFERRED BUNDLES.

$$Monotonicity \implies Nonsatiation$$

$$Monotonicity \not\Leftarrow Nonsatiation$$

PREFERENCES FOR BUNDLES

- *EXAMPLE 2.2*: *NONSATIATED PREFERENCES.*
  - CONSIDER BUNDLES $A = (2,3)$ AND $D = (2,1)$.

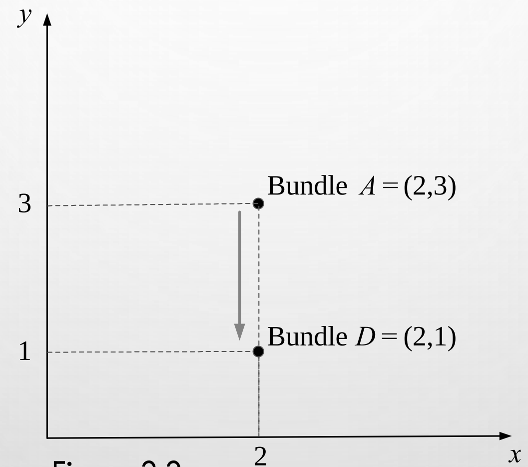

Figure 2.2

  - ERIC SAYS HE STRICTLY PREFERS D TO A, $D \succ A$, AND THAT NO OTHER BUNDLE MAKES HIM AS HAPPY AS D DOES.

DO HIS PREFERENCES SATISFY NONSATIATION?

PREFERENCES FOR BUNDLES

- *EXAMPLE 2.2* (CONTINUED):
  - HIS PREFERENCES, $D \succ A$, CAN SATISFY NONSATIATION, BUT VIOLATE MONOTONICITY.
    - RELATIVE TO BUNDLE A, BUNDLE D DECREASED THE AMOUNT OF GOOD y, KEEPING x UNAFFECTED.
    - If $D \succ A$, it must be that y is a bad.
    - Bundle D is a "more preferred" bundle → nonsatiation is satisfied.
    - Monotonicity would require $A \succ D$.

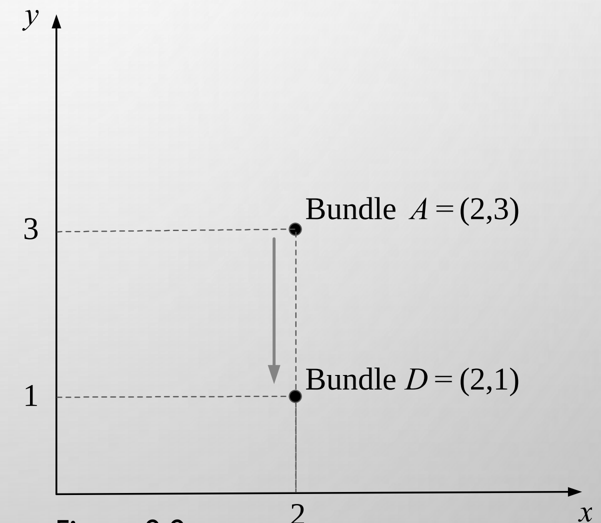

Figure 2.2

UTILITY FUNCTIONS

UTILITY FUNCTIONS

- A UTILITY FUNCTION MATHEMATICALLY REPRESENTS THE LEVEL OF SATISFACTION THAT AN INDIVIDUAL ENJOYS FROM CONSUMING A BUNDLE OF GOODS.
  - *EXAMPLE*: IF SHE CONSUMES BUNDLE $A = (40,30)$ AND HER UTILITY FUNCTION IS $u(x, y) = 3x + 5y$, HER LEVEL OF UTILITY AT BUNDLE A IS

$$u(40,30) = (3 \times 40) + (5 \times 30) = 270$$

  - THE UTILITY LEVEL FROM BUNDLE A IS NOT AS IMPORTANT AS THE *RANKING* OF UTILITIES ACROSS BUNDLES:
    - ONLY THE UTILITY RANKING MATTERS → "ORDINALITY."
    - THE SPECIFIC UTILITY LEVEL THAT THE CONSUMER REACHES WITH EACH BUNDLE DOES NOT MATTER → "CARDINALITY."

UTILITY FUNCTIONS

- *EXAMPLE 2.3: UTILITY RANKING AND INCREASING TRANSFORMATIONS OF THE UTILITY FUNCTION.*
  - CONSIDER UTILITY FUNCTION $u(x, y) = xy$:
    - BUNDLE $A = (40,30)$ PRODUCES $u(40,30) = 1{,}200$.
    - BUNDLE $B = (20,30)$ GENERATES $u(20,30) = 600$.
    - THE CONSUMER PREFERS BUNDLE A TO B ($A \succsim B$).
  - CONSIDER NOW UTILITY FUNCTION $v(x, y) = 3xy + 8$, WHICH IS AN INCREASING TRANSFORMATION OF $u(x, y)$:
    - BUNDLE $A = (40,30)$ YIELDS $v(40,30) = 3{,}608$.
    - BUNDLE $B = (20,30)$ STILL GENERATES $v(20,30) = 1{,}808$.
    - THE CONSUMER STILLS PREFERS BUNDLE A TO B ($A \succsim B$).
  - THE CONSUMER'S PREFERENCE OVER BUNDLE A AND B IS UNAFFECTED (I.E., HER RANKING DOES NOT CHANGE).

UTILITY FUNCTIONS

- *EXAMPLE 2.4: TESTING PROPERTIES OF PREFERENCE RELATIONS.*

  CONSIDER UTILITY FUNCTION $u(x, y) = xy$. WE CHECK:

  a) *COMPLETENESS:*

  - FOR EVERY TWO BUNDLES, $A = (x_A, y_A)$ AND $B = (x_B, y_B)$, COMPLETENESS HOLDS WHEN
    - EITHER $u(x_A, y_A) \geq u(x_B, y_B)$,
    - $u(x_B, y_B) \geq u(x_A, y_A)$, OR
    - BOTH, $u(x_A, y_A) = u(x_B, y_B)$.
  - IF $u(x_A, y_A) = 1{,}200$ AND $u(x_B, y_B) = 600$, WE CHECK THAT $u(x_A, y_A) \geq u(x_B, y_B)$ BECAUSE $1{,}200 > 600$, AND COMPLETENESS IS SATISFIED.

UTILITY FUNCTIONS

- *EXAMPLE 2.4* (CONTINUED):

  b) *TRANSITIVITY:*

  - FOR EVERY THREE BUNDLES, A, B, AND C, WHERE $(x_A, y_A) \geq (x_B, y_B)$ AND $(x_B, y_B) \geq (x_C, y_C)$, TRANSITIVITY HOLDS WHEN
    - $(x_A, y_A) \geq (x_C, y_C)$
  - IF $u(x_A, y_B) = 1{,}200$, $u(x_B, y_B) = 600$ AND $u(x_C, y_C) = 300$, WE KNOW
    - $1{,}200 > 600$,
    - $600 > 300$, AND
    - $1.200 > 300$, IMPLYING THAT TRANSITIVITY IS SATISFIED.

UTILITY FUNCTIONS

- *EXAMPLE 2.4* (CONTINUED):
  c) *STRICT MONOTONICITY:*
    - CONSUMERS WITH STRICTLY MONOTONIC PREFERENCES PREFER BUNDLES WITH MORE UNITS OF *ANY* GOOD.
    - FOR THIS PROPERTY TO HOLD, WE NEED $u(x, y) = xy$ TO BE *STRICTLY* INCREASING IN BOTH GOODS. WE CAN CHECK IT BY CONFIRMING

$$\frac{\partial x(x,y)}{\partial x} = y \geq 0 \text{ AND } \frac{\partial x(x,y)}{\partial y} = x \geq 0$$

      - INCREASING THE UNITS OF x PRODUCES A STRICT INCREASE IN CONSUMER'S UTILITY AS FAR AS $y > 0$.
      - IF SHE DOES NOT CONSUME GOOD y AT ALL, $y = 0$, INCREASING GOOD x DOES NOT ALTER UTILITY LEVEL.
    - THEREFORE, STRICT MONOTONICITY DOES NOT HOLD BECAUSE AN INCREASE IN x DOES NOT NECESSARILY INCREASE CONSUMER'S UTILITY.

UTILITY FUNCTIONS

- *EXAMPLE 2.4* (CONTINUED):

  d) *MONOTONICITY:*

  - WE NEED $u(x, y) = xy$ TO BE *WEAKLY* INCREASING IN x AND y.
  - WE KNOW THAT AN INCREASE IN x
    - PRODUCES A STRICT INCREASE IN CONSUMER'S UTILITY (WHEN $y > 0$),
    - OR DOES NOT AFFECT UTILITY (WHEN $y = 0$),
    - BUT IT NEVER REDUCES UTILITY.

UTILITY FUNCTIONS

- *EXAMPLE 2.4* (CONTINUED):
  d) *MONOTONICITY* (CONT.):
    - A SIMILAR ARGUMENT APPLIES TO y. THEN, AN INCREASE IN BOTH x AND y PRODUCES A NEW BUNDLE THAT GENERATES A STRICTLY GREATER UTILITY.
    - CONSIDER GOOD x IS INCREASED BY $a > 0$ AND GOOD y BY $b > 0$. THIS YIELDS A UTILITY LEVEL OF

$$u(x + a, y + b) = (x + a)(y + b).$$

    - MONOTONICITY IS SATISFIED BECAUSE

$$u(x + a, y + b) > u(x, y).$$

UTILITY FUNCTIONS

- *EXAMPLE 2.4* (CONTINUED):
  e) *NONSATIATION:*
    - THIS PROPERTY HOLDS BY MONOTONICITY.
    - WE FOUND THAT INCREASING AMOUNTS OF BOTH GOODS PRODUCES A NEW BUNDLE $(x+a, y+b)$, THAT IS STRICTLY PREFERRED TO THE ORIGINAL BUNDLE (x, y).
    - STARTING FROM THE ORIGINAL BUNDLE WE CAN ALWAYS FIND ANOTHER BUNDLE FOR WHICH THE CONSUMER IS BETTER OFF.
    - THE CONSUMER IS NEVER SATIATED.

UTILITY FUNCTIONS

- *UTILITY FUNCTIONS AND THEIR PROPERTIES.*

Table 2.1

Utility Function	Completeness	Transitivity	Strict Monotonicity	Monotonicity	Nonsatiation
$u(x,y) = by$	✓	✓	X	✓	✓
$u(x,y) = ax$	✓	✓	X	✓	✓
$u(x,y) = ax - by$	✓	✓	X	X	✓
$u(x,y) = ax + by$	✓	✓	✓	✓	✓
$u(x,y) = Amin\{ax, by)$	✓	✓	X	✓	✓
$u(x,y) = Ax^{\alpha}y^{\beta}$	✓	✓	X	✓	✓

Paramenters a, b, A, α, β are positive.

MARGINAL UTILITY

MARGINAL UTILITY

- MARGINAL UTILITY OF A GOOD IS THE RATE AT WHICH UTILITY CHANGES AS THE CONSUMPTION OF A GOOD INCREASES.
  - INTUITIVELY, *HOW MUCH BETTER OFF DO YOU BECOME BY CONSUMING 1 MORE UNIT OF GOOD x?*
  - MATHEMATICALLY, MARGINAL UTILITY OF GOOD x IS

$$MU_x = \frac{\partial u(x,y)}{\partial x},$$

AND SIMILARLY FOR GOOD y, $MU_y = \frac{\partial u(x,y)}{\partial y}$.

  - GRAPHICALLY, WE MEASURE THE SLOPE (RATE OF CHANGE) OF THE UTILITY FUNCTION AS WE INCREASE THE AMOUNT OF GOOD x, HOLDING THE AMOUNT OF OTHER GOODS CONSTANT.

MARGINAL UTILITY

- *EXAMPLE 2.5: FINDING MARGINAL UTILITY, MU.*
  - CONSIDER UTILITY FUNCTION $u(x,y) = x^{1/2}y^{1/2}$.
  - MARGINAL UTILITY OF GOOD x IS

$$MU_x = \frac{1}{2}x^{\frac{1}{2}-1}y^{\frac{1}{2}} = \frac{1}{2}x^{-\frac{1}{2}}y^{\frac{1}{2}}$$

  - REARRANGING,

$$MU_x = \frac{1}{2}\frac{y^{1/2}}{x^{1/2}}.$$

  - $MU_x > 0$ WHEN THE INDIVIDUAL CONSUMES POSITIVE AMOUNTS OF GOOD x AND y, INDICATING THAT 1 MORE UNIT OF GOOD x RAISES HER UTILITY.

MARGINAL UTILITY

- *EXAMPLE 2.5* (CONTINUED):
  - SIMILARLY, MARGINAL UTILITY OF GOOD y IS

$$MU_y = \frac{1}{2}x^{\frac{1}{2}}y^{\frac{1}{2}-1} = \frac{1}{2}x^{\frac{1}{2}}y^{-\frac{1}{2}}$$

  - REARRANGING,

$$MU_y = \frac{1}{2}\frac{x^{1/2}}{y^{1/2}}$$

  - WHEN THE INDIVIDUAL CONSUMES POSITIVE AMOUNTS OF GOODS x AND y, $MU_y > 0$.

MARGINAL UTILITY

- DIMINISHING MARGINAL UTILITY.
  - MARGINAL UTILITIES OF MOST UTILITY FUNCTIONS ARE *DECREASING* IN THE AMOUNT OF THE GOOD THAT THE INDIVIDUAL CONSUMES,

    MU_x DECREASES IN x, OR $\frac{\partial MU_x}{\partial x} \leq 0$ (SIMILARLY FOR y).
  - WHILE MORE UNITS OF GOOD x INCREASE UTILITY LEVEL, FURTHER INCREMENTS IN x PRODUCE SMALLER UTILITY GAINS.
    - WHEN THE CONSUMER HAS FEW UNITS OF GOOD (E.G., FOOD), GIVING HER WITH 1 MORE UNIT INCREASES HER UTILITY A GREAT DEAL.
    - WHEN SHE ALREADY HAS LARGE AMOUNTS, GIVING HER 1 MORE UNIT OF FOOD PRODUCES A SMALL UTILITY GAIN (OR NO GAIN AT ALL!)

MARGINAL UTILITY

- *EXAMPLE 2.6: DIMINISHING MARGINAL UTILITY.*
  - CONSIDER $u(x,y) = x^{1/2}y^{1/2}$ IN EXAMPLE 2.5.
  - MARGINAL UTILITY OF GOOD x WAS $MU_x = \frac{1}{2}\frac{y^{1/2}}{x^{1/2}}$.
  - MU_x IS DECREASING IN THE AMOUNT THE CONSUMER ENJOYS OF GOOD x,

    $\frac{\partial MU_x}{\partial x} = -\frac{y^{1/2}}{4x^{3/2}} < 0$ FOR ALL VALUES OF x OF y.
  - SIMILARLY, $MU_y = \frac{1}{2}\frac{x^{1/2}}{y^{1/2}}$, IS DECREASING IN GOOD y BECAUSE $\frac{\partial MU_x}{\partial x} = -\frac{x^{1/2}}{4y^{3/2}} < 0$ FOR ALL VALUES OF x OF y.

INDIFFERENCE CURVES

INDIFFERENCE CURVES

- THIS FIGURE DEPICTS $u(x, y) = x^{1/2}y^{1/2}$ IN EXAMPLE 2.4.
  - THE HEIGHT OF THE "MOUNTAIN" IS THE UTILITY THAT THE INDIVIDUAL ACHIEVES BY CONSUMING A SPECIFIC AMOUNT

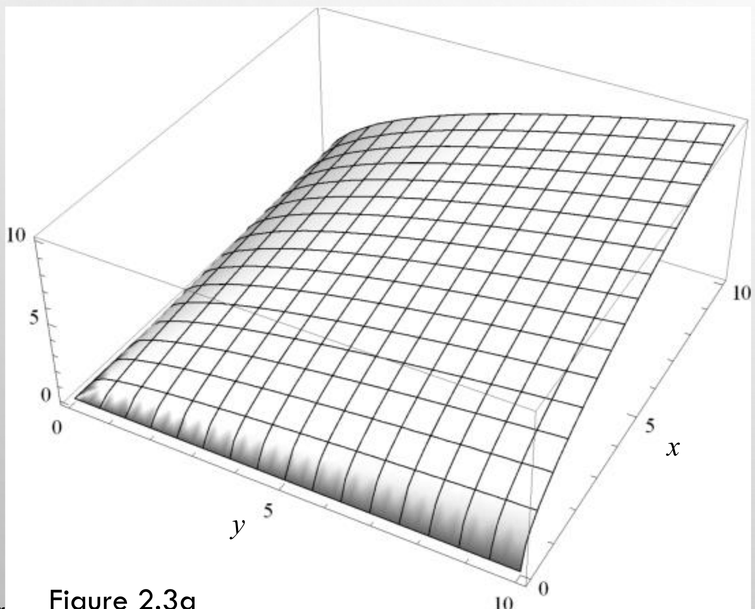

Figure 2.3a

- At bundle $(x, y) = (4{,}9)$, $u(4{,}9) = 4^{1/2}9^{1/2} = 6.$
- This utility level can also be obtained at bundles:
  - $(x, y) = (6{,}6)$, $u(6{,}6) = 6^{1/2}6^{1/2} = 6.$
  - $(x, y) = (9{,}4)$, $u(9{,}4) = 9^{1/2}4^{1/2} = 6.$

INDIFFERENCE CURVES

- THE NEXT FIGURE DEPICTS A "SLICE" OF THE UTILITY MOUNTAIN AT A HEIGHT OF $u = 6$.

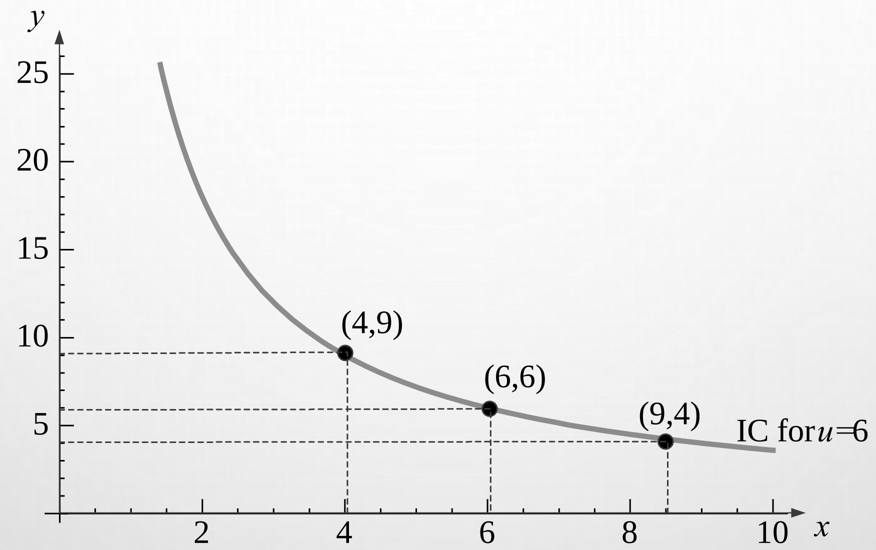

Figure 2.3b

- THIS CURVE CONNECTS BUNDLES AT WHICH THE CONSUMER OBTAINS THE SAME UTILITY $u = 6$. SHE IS INDIFFERENT BETWEEN CONSUMING ANY OF THESE BUNDLES.

INDIFFERENCE CURVES

- INDIFFERENCE CURVE (IC): A CURVE CONNECTING CONSUMPTION BUNDLES THAT YIELD THE SAME UTILITY LEVEL.
  - IC FOR $u(x, y) = x^{1/2}y^{1/2}$ EVALUATED AT $u = 6$. SOLVING FOR y, WE FIND THE EXPRESSION OF THE INDIFFERENCE CURVE:

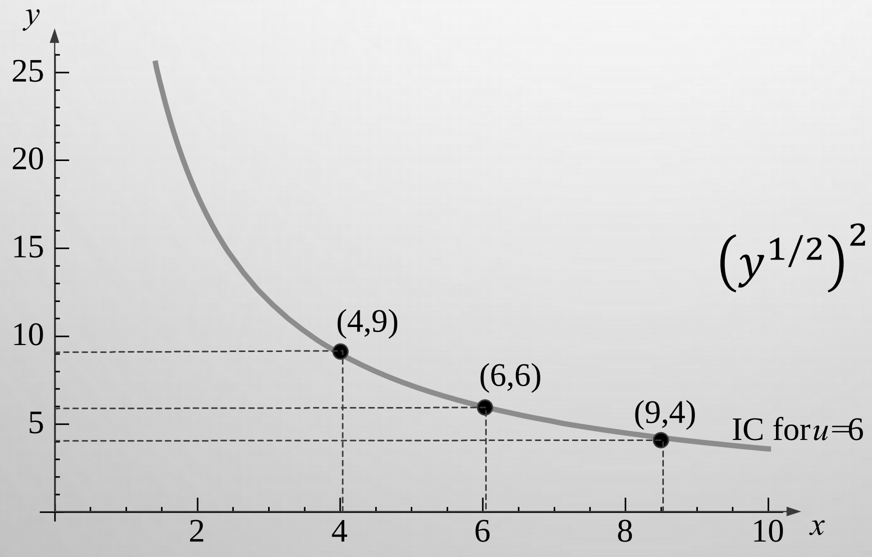

Figure 2.3b

$$x^{1/2}y^{1/2} = 6,$$

$$y^{1/2} = \frac{6}{x^{1/2}},$$

$$\left(y^{1/2}\right)^2 = \left(\frac{6}{x^{1/2}}\right)^2 \Rightarrow y = \frac{36}{x}.$$

INDIFFERENCE CURVES

- *EXAMPLE 2.7*: *FINDING ICS FOR TWO UTILITY FUNCTIONS.*
  - CONSIDER AGAIN UTILITY FUNCTION $u(x, y) = x^{1/2}y^{1/2}$.
  - WE WANT TO OBTAIN THE EXPRESSION FOR THE INDIFFERENCE CURE WHEN THE CONSUMER REACHES UTILITY LEVEL $u = 10$.
  - THIS INDIFFERENCE CURVE ENTAILS

$$x^{1/2}y^{1/2} = 10.$$

  - SOLVING FOR y,

$$y^{1/2} = \frac{10}{x^{1/2}}.$$

  - SQUARING BOTH SIDES WE OBTAIN THE INDIFFERENCE CURVE:

$$\left(y^{1/2}\right)^2 = \left(\frac{10}{x^{1/2}}\right)^2 \quad \Rightarrow y = \frac{100}{x}.$$

INDIFFERENCE CURVES

- *EXAMPLE 2.7* (CONTINUED):
  - PLUGGING IN VALUES FOR GOOD x IN INDIFFERENCE CURVE $y = \frac{100}{x}$,
    - $x = 4$, WHICH PRODUCES $y = \frac{100}{4} = 25$;
    - $x = 8$, WHICH YIELDS $y = \frac{100}{8} = 12.5$;
    - $x = 10$, WHICH ENTAILS $y = \frac{100}{10} = 10$;
  - WE GET BUNDLES $(4,25)$, $(8,12.5)$, AND $(10,10)$.
  - IF WE PLOT THESE BUNDLES AS POINTS ON THE POSITIVE QUADRANT, AND CONNECT THESE POINTS, WE FORM THE INDIFFERENCE CURVE FOR $u = 10$.

INDIFFERENCE CURVES

- *EXAMPLE 2.7* (CONTINUED):
  - CONSIDER NOW $u(x, y) = 5x + 3y$, AND $u = 9$.
  - SOLVING FOR y IN $5x + 3y = 9$,

$$y = 3 - \frac{5}{3}x.$$

  - THIS IC ORIGINATES AT $y = 3$, DECREASES AT A RATE OF $5/3$ AND CROSS THE HORIZONTAL AXIS AT $5/9$.
    - TO FIND THE HORIZONTAL INTERCEPT, SET $3 - \frac{5}{3}x = 0$, REARRANGE $9 = 5x$, AND AND SOLVE FOR x, $x = 9/5$.
  - WE CAN EVALUATE THE IC AT SEVERAL VALUES OF x (WHICH NEED TO BE SMALLER THAN THE HORIZONTAL INTERCEPT, $\frac{9}{5} \cong 1.8$).

PROPERTIES OF INDIFFERENCE CURVES

- ICS ARE NEGATIVELY SLOPED. IT HOLDS FROM MONOTONICITY.
  - CONSIDER BUNDLE $A = (x_A, y_A)$ IN A POSITIVELY SLOPED IC.
    - The IC passing through bundle A cannot go through Regions I and II because the consumer strictly prefers
      - bundles in Region I than A,
      - bundle A than those in Region II.

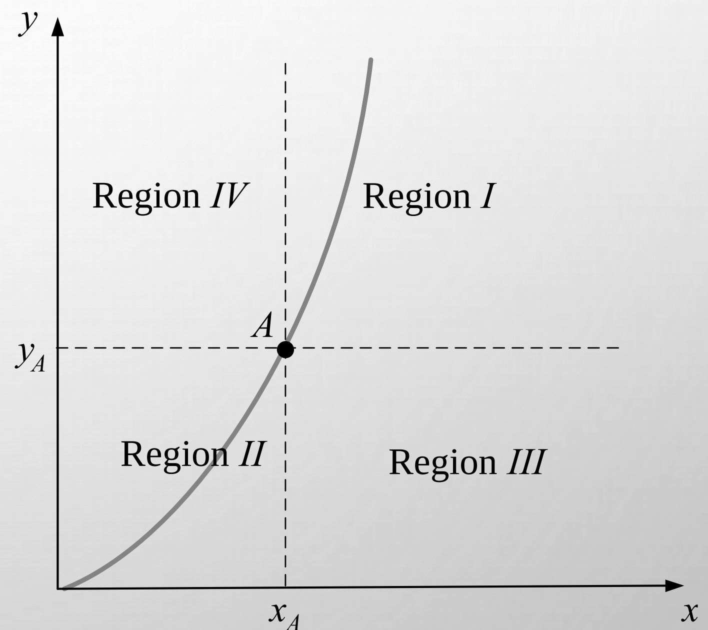

Figure 2.4

PROPERTIES OF INDIFFERENCE CURVES

- ICS ARE NEGATIVELY SLOPED.

  - The IC passing through bundle A can only go through Region III and IV.
  - IC must be negatively sloped.

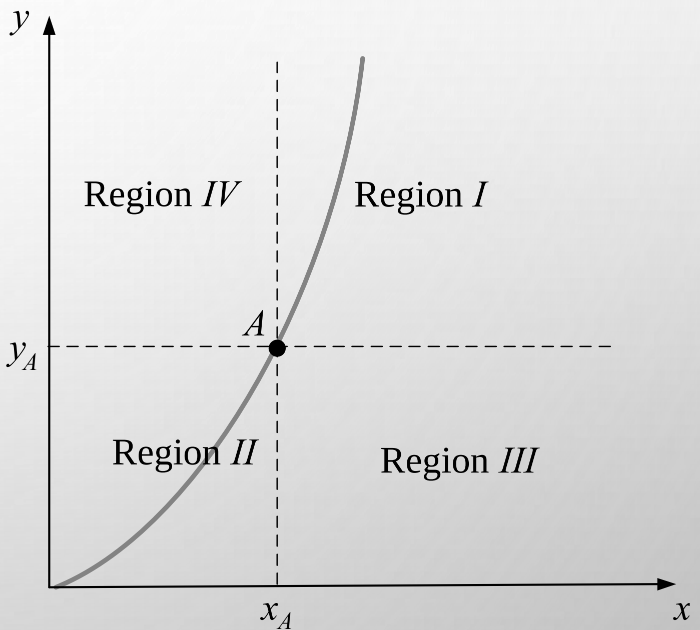

Figure 2.4

PROPERTIES OF INDIFFERENCE CURVES

- ICS ARE NEGATIVELY SLOPED.
  - NEGATIVELY SLOPED ICS ARE REFERRED AS "CONVEX."

  FOR ANY TWO BUNDLES, A STRAIGHT LINE CONNECTING THEM LIES:

  (1) strictly above the curve, yielding a higher utility (when the IC curve is strictly decreasing); or

  (2) on the indifference curve, yielding the same utility level (when the IC is a straight line).

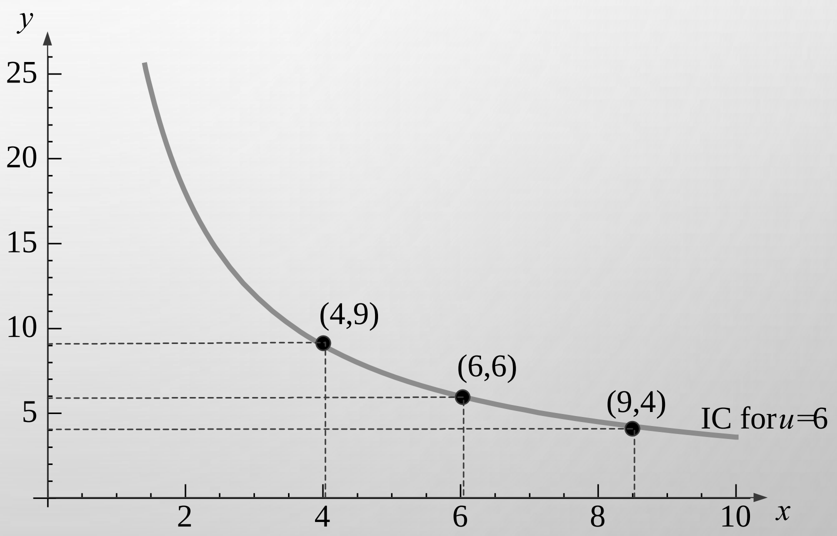

Figure 2.3b

PROPERTIES OF INDIFFERENCE CURVES

- ICS CANNOT INTERSECT. IT HOLDS FROM MONOTONICITY.
  - ICS IN THE FIGURE INTERSECT AT BUNDLE A, VIOLATING MONOTONICITY.
    - Bundle B lies northeast of C. With monotonicity, $u_B > u_C$.
    - Bundle D lies northeast of E. With monotonicity $u_D > u_E$.
    - Bundles C and D lie on the same IC, $u_C = u_D$. Similarly, $u_B = u_E$.

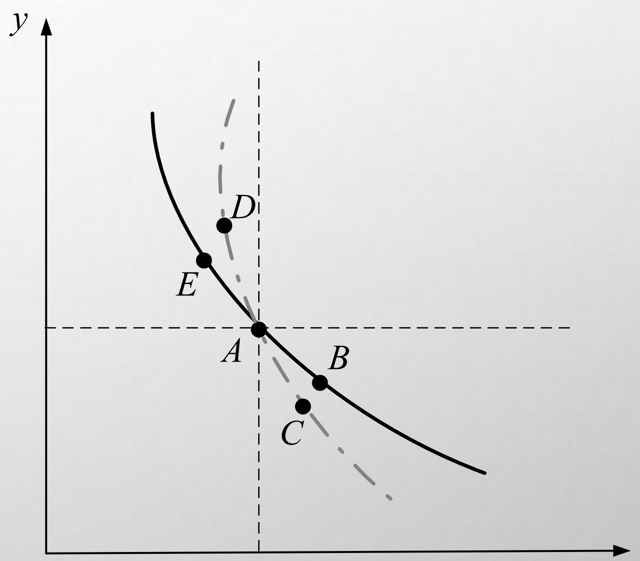

Figure 2.5

PROPERTIES OF INDIFFERENCE CURVES

- ICS CANNOT INTERSECT.

  - Combining with $u_B > u_C$,

    $$u_E = u_B > u_C = u_D,$$
    $$u_E > u_D,$$

    which contradicts the result about bundles E and D ($u_D > u_E$).

  - Monotonicity → ICs cannot intersect.

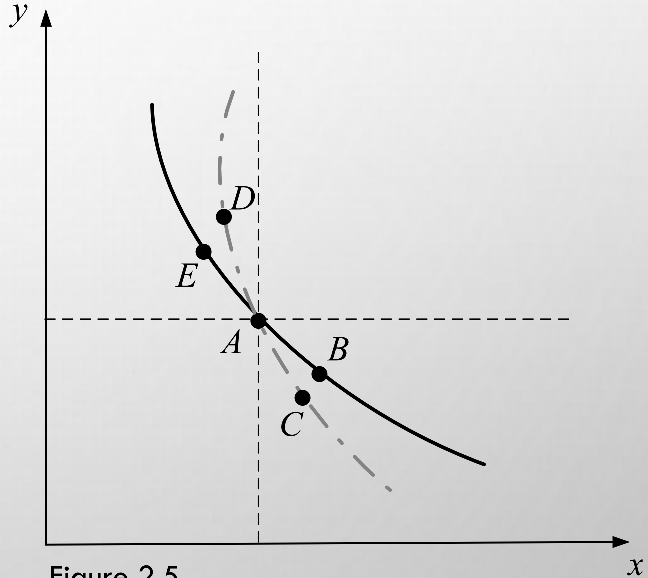

Figure 2.5

PROPERTIES OF INDIFFERENCE CURVES

- ICS ARE NOT THICK. IT HOLDS FROM MONOTONICITY.
  - THE THICK IC DEPICTED IN THE FIGURE VIOLATES MONOTONICITY.

- Bundles A and B lie in the same thick IC.
- But, bundle B contains larger amounts of goods x and y than A. Then,
  - The consumer is not indifferent between A and B.
  - By monotonicity, $u_B > u_A$.
- Monotonicity → ICs cannot be thick.

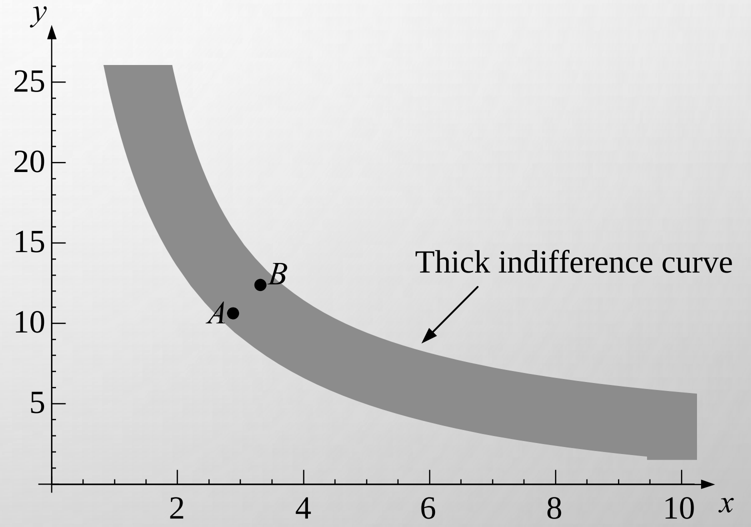

Figure 2.6

MARGINAL RATE OF SUBSTITUTION

MARGINAL RATE OF SUBSTITUTION

- MARGINAL RATE OF SUBSTITUTION (MRS) IS THE RATE AT WHICH A CONSUMER IS WILLING TO GIVE UP UNITS OF GOOD y AS SHE RECEIVES AN ADDITIONAL UNIT OF GOOD x, IN ORDER TO KEEP HER UTILITY LEVEL CONSTANT.

FORMALLY,

$$MRS_{x,y} = \frac{MU_x}{MU_y}.$$

- When $MU_x > 0$ and $MU_y < 0$,

$$MRS_{x,y} = \frac{(+)}{(-)} = (-).$$

- MRS represents the slope of the IC.

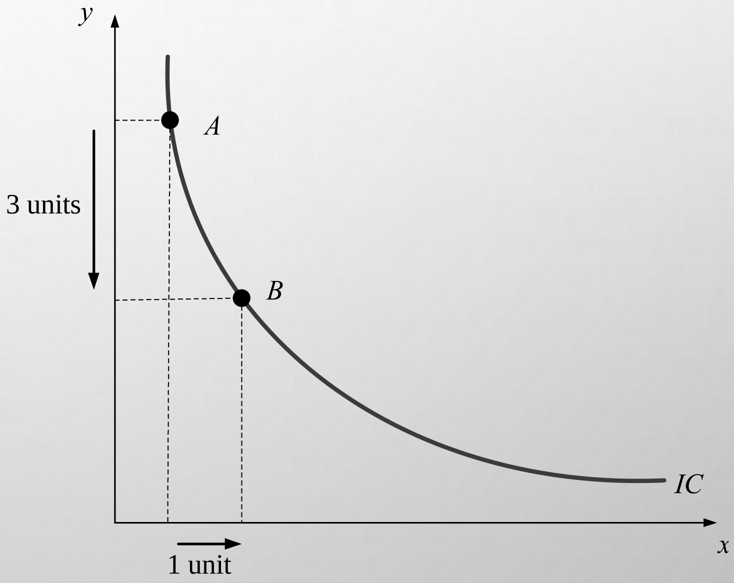

Figure 2.7

MARGINAL RATE OF SUBSTITUTION

- DIMINISHING MRS. THE IC IS RELATIVELY STEEP FOR SMALL AMOUNTS OF GOOD x, BUT BECOMES FLATTER AS WE MOVE RIGHTWARD TOWARD GREATER AMOUNTS OF GOOD x.

  1. *PREFERENCE FOR VARIETY*. ICS ARE BOWED IN TOWARD THE ORIGIN.

     - The consumer is indifferent between extreme bundles, such as A and C, which yield utility level of u_1.
     - She prefers more balanced bundles, such C, yielding a higher utility of u_2.

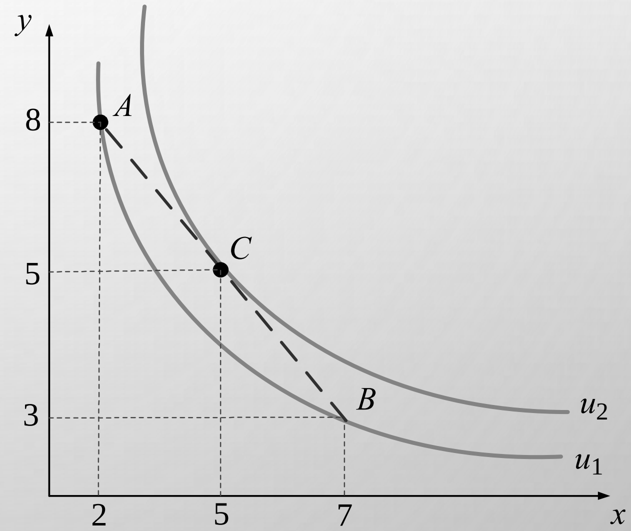

Figure 2.8

MARGINAL RATE OF SUBSTITUTION

- DIMINISHING MRS.

  2. *DECREASING WILLINGNESS TO SUBSTITUTE.*

- At A, MU_x is high while MU_y is low.
  - The consumer is willing to give up several units of y to obtain more units of x.
- At C, MU_x is low and MU_y becomes high.
  - Willingness to give up units of y decreases once she has more units of x.

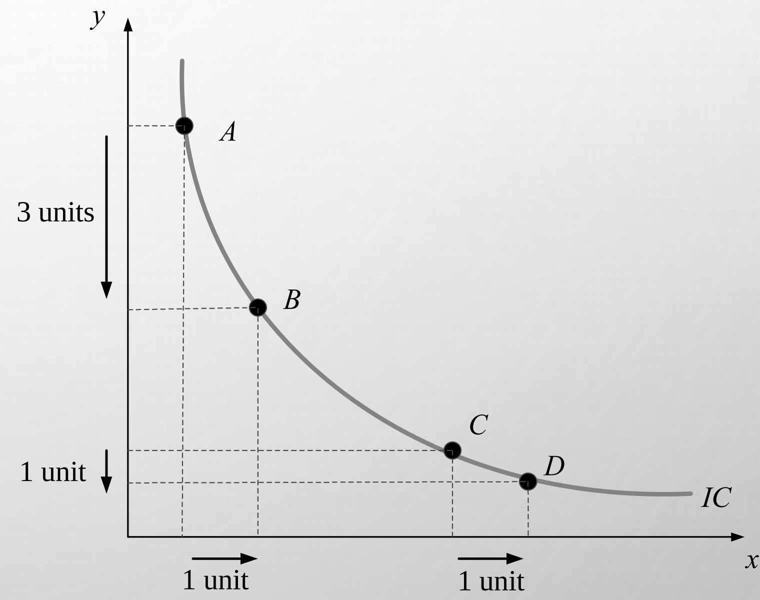

Figure 2.9

MARGINAL RATE OF SUBSTITUTION

- *EXAMPLE 2.8: FINDING MRS.*

  1. CONSIDER UTILITY FUNCTION $u(x, y) = x^{1/2}y^{1/2}$ FROM EXAMPLE 2.5,

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{\frac{1}{2}x^{-\frac{1}{2}}y^{\frac{1}{2}}}{\frac{1}{2}x^{\frac{1}{2}}y^{-\frac{1}{2}}} = \frac{y^{\frac{1}{2}-\left(-\frac{1}{2}\right)}}{x^{\frac{1}{2}-\left(-\frac{1}{2}\right)}} = \frac{y}{x},$$

WHERE WE CANCEL $1/2$ ON NUMERATOR AND DENOMINATOR; AND WE USE THE PROPERTY $\frac{x^a}{x^b} = x^{a-b}$ FOR EXPONENTS a AND b.

$MRS_{x,y}$ IS <u>DECREASING</u> IN x, YIELDING ICS THAT ARE BOWED IN TOWARD THE ORIGIN.

MARGINAL RATE OF SUBSTITUTION

- *EXAMPLE 2.8* (CONTINUED):

  2. CONSIDER THE LINEAR UTILITY FUNCTION $u(x, y) = ax + by$ WHERE $a, b > 0$,

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{a}{b}.$$

$MRS_{x,y}$ IS CONSTANT IN x.

FOR INSTANCE, IF $a = 10$ AND $b = 4$, $MRS_{x,y} = 2.5$, INDICATING THAT THE SLOPE OF THE IC IS -2.5 ALONG ALL ITS POINTS (I.E., A STRAIGHT LINE).

MARGINAL RATE OF SUBSTITUTION

- *EXAMPLE 2.8* (CONTINUED):

3. CONSIDER UTILITY FUNCTION $u(x, y) = ax^2 + by^3$.

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{2ax}{3by^2}.$$

$MRS_{x,y}$ IS INCREASING IN x, YIELDING ICS BOWED AWAY FROM THE ORIGIN. THE IC IS RELATIVELY FLAT FOR LOW VALUES OF x, BUT BECOMES STEEPER AS WE MOVE RIGHTWARD ALONG THE x-AXIS.

SPECIAL TYPES OF UTILITY FUNCTIONS

SPECIAL TYPES OF UTILITY FUNCTIONS

- PERFECT SUBSTITUTES:
  - CONSIDER GOODS x AND y. THE CONSUMER CAN USE EITHER GOOD WITHOUT SIGNIFICANTLY AFFECTING HER UTILITY.
    - *EXAMPLES*: TWO BRANDS OF MINERAL WATER, BUTTER AND MARGARINE.
  - THE CONSUMER'S UTILITY FUNCTION TAKES THE FORM

$$u(x, y) = ax + by, \text{ WHERE } a, b > 0.$$

  - THIS UTILITY IS LINEAR IN BOTH GOODS BECAUSE MARGINAL UTILITIES ARE CONSTANT, $MU_x = a$ AND $MU_y = b$.
  - MRS IS ALSO CONSTANT,

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{a}{b}.$$

SPECIAL TYPES OF UTILITY FUNCTIONS

- PERFECT SUBSTITUTES (CONT.):
  - SOLVING FOR y IN $u(x,y) = ax + by$,
  $$y = \frac{u}{b} - \frac{a}{b}x.$$
  - ICS ARE STRAIGHT LINES:
    - Originating at $\frac{u}{b}$.
    - Decreasing at rate $\frac{a}{b}$.
    - Crossing the x-axis at $\frac{u}{a}$.
  - Figure 2.10 illustrates ICs evaluated at $u = 1$, and at $u = 2$.

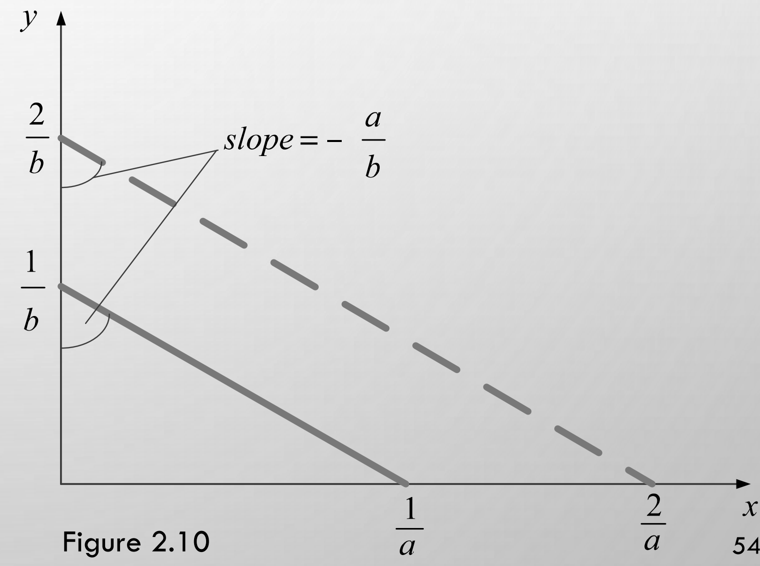

Figure 2.10

SPECIAL TYPES OF UTILITY FUNCTIONS

- PERFECT SUBSTITUTES (CONT.):
  - RECALL THAT MRS MEASURES THE CONSUMER'S WILLINGNESS TO GIVE UP UNITS OF GOOD y TO OBTAIN 1 MORE UNIT OF x, KEEPING HER UTILITY LEVEL UNAFFECTED.
    - A CONSTANT MRS (I.E., A NUMBER) → THE CONSUMER'S WILLINGNESS TO SUBSTITUTE y FOR ADDITIONAL UNITS OF x IS "ALWAYS THE SAME."
    - A DECREASING MRS → THE CONSUMER IS WILLING TO GIVE UP MORE UNITS OF GOOD y WHEN x BECOMES RELATIVELY SCARCE.

SPECIAL TYPES OF UTILITY FUNCTIONS

- PERFECT COMPLEMENTS:
  - THE CONSUMER MUST CONSUME GOODS IN FIXED PROPORTIONS.
    - *EXAMPLES*: CARS AND GASOLINE, LEFT AND RIGHT SHOES.
  - THE UTILITY FUNCTION (REFERRED AS "LEONTIEF") TAKES THE FORM

$$u(x, y) = A\ \mathrm{MIN}\{ax, by\}, \text{ WHERE } \mathrm{A}, a, b > 0.$$

    - IF $A = 1$ AND $a = b = 2$, THE UTILITY FUNCTION REDUCES TO

$$u(x, y) = \mathrm{MIN}\{2x, 2y\} = 2\,\mathrm{MIN}\{x, y\}.$$

SPECIAL TYPES OF UTILITY FUNCTIONS

- PERFECT COMPLEMENTS (CONT.):
  - IF THE CONSUMER INCREASES THE AMOUNT OF x BY 1 UNIT WITHOUT INCREASING THE AMOUNT OF y, HER UTILITY DOES NOT NECESSARILY INCREASE.
    - IF $x \geq y$, AN INCREASE IN x DOES NOT INCREASE HER UTILITY.
    - IF $y > x$, AN INCREASE IN x DOES INCREASE HER UTILITY.

SPECIAL TYPES OF UTILITY FUNCTIONS

- PERFECT COMPLEMENTS (CONT.):
  - CONSIDER THE CONSUMER HAS 10 UNITS OF EACH GOOD, YIELDING

$$u(10,10) = \text{MIN}\{2 \times 10, 2 \times 10\} = \text{MIN}\{20,20\} = 20$$

  - IF GOOD x IS INCREASED FROM 10 TO 11 UNITS, BUT GOOD y IS UNAFFECTED, HER UTILITY REMAINS THE SAME

$$u(11,10) = \text{MIN}\{2 \times 11, 2 \times 10\} = \text{MIN}\{22,20\} = 20$$

  - INCREASING THE AMOUNT OF ONE OF THE GOODS ALONE DOES NOT YIELD UTILITY GAINS, AS THE CONSUMER NEEDS TO ENJOY BOTH GOODS IN FIXED PROPORTIONS.
  - FORMALLY, PREFERENCES FOR COMPLEMENTARY GOODS VIOLATE THE MONOTONICITY PROPERTY.

SPECIAL TYPES OF UTILITY FUNCTIONS

- PERFECT COMPLEMENTS (CONT.):
  - ICS HAVE AN L-SHAPE:
    - THE KING OCCURS AT POINTS WHERE $ax = by$.
    - THE SLOPE IS ZERO IN THE FLAT SEGMENT.
    - THE SLOPE IS $-\infty$ IN THE VERTICAL SEGMENT.

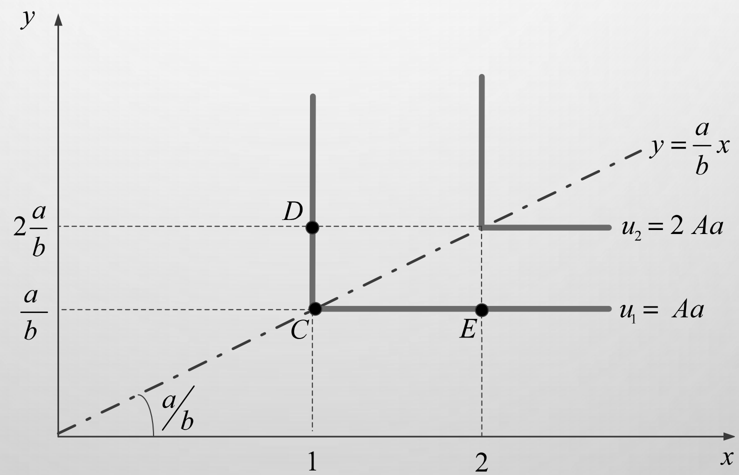

Figure 2.11

SPECIAL TYPES OF UTILITY FUNCTIONS

- COBB-DOUGLAS:
  - THE CONSUMER REGARDS GOODS x AND y AS NEITHER PERFECTLY SUBSTITUTABLE NOR COMPLEMENTARY.
  - THE UTILITY FUNCTION TAKES THE FORM

$$u(x,y) = Ax^{\alpha}y^{\beta}, \text{ WHERE } A, \alpha, \beta > 0.$$

  - MARGINAL UTILITIES ARE

$$MU_x = A\alpha x^{\alpha-1}y^{\beta} \text{ AND } MU_y = A\beta x^{\alpha}y^{\beta-1}.$$

WHICH YIELD

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{A\alpha x^{\alpha-1}y^{\beta}}{A\beta x^{\alpha}y^{\beta-1}} = \frac{\alpha y^{\beta-(\beta-1)}}{\beta x^{\alpha-(\alpha-1)}} = \frac{\alpha y}{\beta x}.$$

SPECIAL TYPES OF UTILITY FUNCTIONS

- COBB-DOUGLAS (CONT.):
  - $MRS_{x,y} = \frac{\alpha y}{\beta x}$ IS DECREASING IN x.
  - ICS ARE BOWED IN THE ORIGIN, THEY BECOME FLATTER AS x INCREASES.

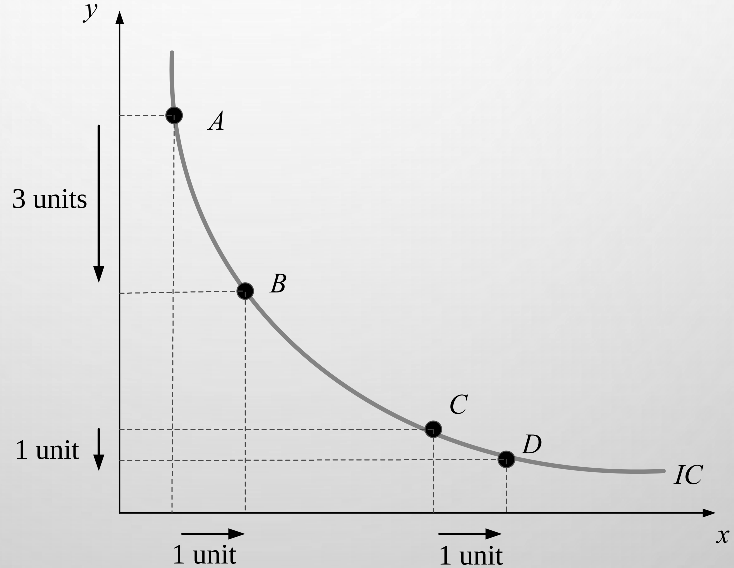

Figure 2.9

SPECIAL TYPES OF UTILITY FUNCTIONS

- COBB-DOUGLAS (CONT.):
  - SPECIAL CASES:

1. $A = \alpha = \beta = 1,$

$$u(x, y) = xy \quad \Rightarrow MRS_{x,y} = \frac{y}{x}.$$

2. $A = 1, \alpha = \beta,$

$$u(x, y) = x^{\alpha} y^{\alpha} = (xy)^{\alpha} \quad \Rightarrow MRS_{x,y} = \frac{y}{x}.$$

3. $A = 1, \beta = 1 - \alpha,$

$$u(x, y) = x^{\alpha} y^{1-\alpha} \quad \Rightarrow MRS_{x,y} = \frac{\alpha}{1-\alpha} \frac{y}{x}.$$

UTILITY ELASTICITY OF GOOD

- EXPONENTS IN THE COBB-DOUGLAS UTILITY FUNCTION CAN BE INTERPRETED AS ELASTICITIES.
- "UTILITY ELASTICITY" OF GOOD x, $\varepsilon_{u,x}$, IS THE % INCREASE IN UTILITY (IF $\varepsilon_{u,x} > 0$) OR % DECREASE IN UTILITY (IF $\varepsilon_{u,x} < 0$) THAT THE CONSUMER EXPERIENCES AFTER INCREASING THE AMOUNT OF GOOD x BY 1%. FORMALLY,

$$\varepsilon_{u,x} = \frac{\%\Delta u(x,y)}{\%\Delta x}.$$

REARRANGING,

$$\varepsilon_{u,x} = \frac{\%\Delta u(x,y)}{\%\Delta x} = \frac{\frac{\Delta u(x,y)}{u(x,y)}}{\frac{\Delta x}{x}} = \frac{\Delta u(x,y)}{\Delta x}\frac{x}{u(x,y)}.$$

UTILITY ELASTICITY OF A GOOD

- WHEN THE INCREASE IN THE AMOUNT OF GOOD x IS MARGINALLY SMALL,

$$\varepsilon_{u,x} = \underbrace{\frac{\partial u(x,y)}{\partial x}}_{MU_x} \underbrace{\frac{\overbrace{x}^{\text{Amount of } x \text{ consumed}}}{u(x,y)}}_{\text{Utility function}}.$$

- APPLYING THE DEFINITION OF $\varepsilon_{u,x}$ TO THE COBB-DOUGLAS UTILITY FUNCTION,

$$\varepsilon_{u,x} = \frac{\partial u(x,y)}{\partial x} \frac{x}{u(x,y)} = \underbrace{A\alpha x^{\alpha-1} y^{\beta}}_{\frac{\partial u(x,y)}{\partial x}} \frac{x}{\underbrace{Ax^{\alpha} y^{\beta}}_{u(x,y)}}.$$

UTILITY ELASTICITY OF A GOOD

SIMPLIFYING,

$$\varepsilon_{u,x} = \frac{A\alpha x^{\alpha-1+1}y^{\beta}}{Ax^{\alpha}y^{\beta}} = \frac{A\alpha x^{\alpha}y^{\beta}}{Ax^{\alpha}y^{\beta}} = \alpha.$$

- HENCE, WHEN FACING A UTILITY FUNCTION LIKE $u(x, y) = Ax^{\alpha}y^{\beta}$, WE CAN CLAIM THE EXPONENT IN GOOD x, α, REPRESENTS THE UTILITY ELASTICITY OF A MARGINAL INCREASE IN x.
  - A 1% INCREASE IN THE AMOUNT OF GOOD x INCREASES UTILITY BY $\alpha\%$.
- AND β IS THE UTILITY ELASTICITY OF GOOD y.

SPECIAL TYPES OF UTILITY FUNCTIONS

- QUASILINEAR:
  - CONSUMERS WHO USE ALL THEIR ADDITIONAL INCOME ON ONE GOOD ALONE, y (E.G., VIDEO GAMES).
  - ADDITIONAL INCOME IS NEVER SPENT ON GOOD x (E.G., TOOTHPASTE).
  - THIS UTILITY FUNCTION TAKES THE FORM

$$u(xy) = v(x) + by.$$

WHERE $b > 0$, AND $v(x)$ IS A NONLINEAR FUNCTION IN x.

SPECIAL TYPES OF UTILITY FUNCTIONS

- QUASILINEAR (CONT.):
  - *EXAMPLES*:
    - $v(x) = x^{1/2}$
    - $v(x) = lnx.$
    - ANY $v(x)$ WHICH $v'(x)$ IS NOT A CONSTANT, BUT INSTEAD DEPENDS ON THE UNITS OF GOOD x, GOOD y, OR BOTH.
      - E.G., $v(x) = axy$, WHICH $v'(x) = ay$ (NOT CONSTANT).

SPECIAL TYPES OF UTILITY FUNCTIONS

- QUASILINEAR (CONT.):
  - FOR $u(x, y) = v(x) + by$, THE MARGINAL UTILITIES ARE $MU_x = v'(x)$ AND $MU_y = b$, WHICH YIELD

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{v'(x)}{b}.$$

  - FOR A GIVEN VALUE OF x, THE MRS IS CONSTANT BECAUSE IT DOES NOT DEPEND ON THE AMOUNT OF GOOD y.
  - *EXAMPLE*: $u(x, y) = x^{1/2} + 3y$, WHERE $v(x) = x^{1/3}$, $b = 3$.

$$MRS_{x,y} = \frac{\frac{1}{2}x^{-1/2}}{3} = \frac{1}{6\sqrt{x}}.$$

FOR $x = 16$, $MRS_{x,y} = \frac{1}{6\sqrt{16}} = \frac{1}{24}$, WHICH IS CONSTANT IN y.

SPECIAL TYPES OF UTILITY FUNCTIONS

- QUASILINEAR (CONT.):
  - ICS ARE PARALLEL SHIFTS OF EACH OTHER.
  - IF WE FIX CONSTANT THE VALUE OF GOOD x (E.G., $x = 16$), THE SLOPE OF THE IC ($MRS_{x,y}$) IS UNAFFECTED BY THE AMOUNT OF GOOD y.

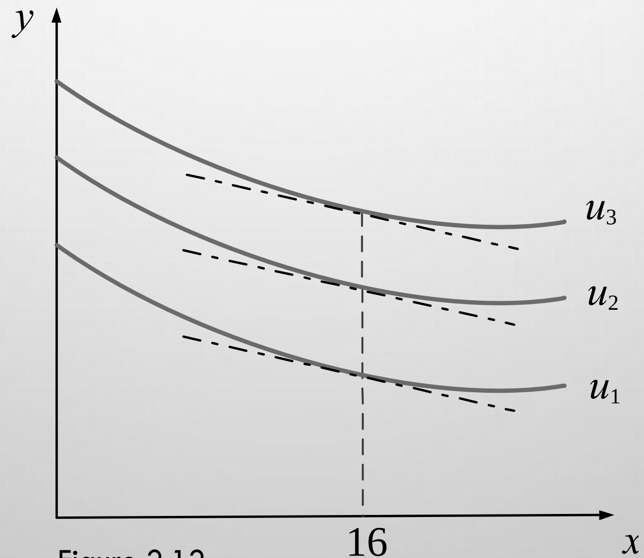

Figure 2.12

SPECIAL TYPES OF UTILITY FUNCTIONS

- STONE-GEARY:
  - IT TAKES A COBB-DOUGLAS SHAPE, BUT REQUIRES THE INDIVIDUAL HAVE A MINIMUM AMOUNT OF EACH GOOD (E.G., HALF A GALLON OF WATER), REPRESENTED AS $\bar{x}$ AND $\bar{y}$.
  - THIS UTILITY FUNCTION TAKES THE FORM

    $u(x, y) = A(x - \bar{x})^{\alpha}(y - \bar{y})^{\beta}$, WHERE $A, \mathrm{A}, \beta > 0$.

    - THE CONSUMER OBTAINS A POSITIVE UTILITY FROM GOOD x ONLY AFTER EXCEEDING HER MINIMAL CONSUMPTION $\bar{x}$, WHEN $x > \bar{x}$. AND SIMILARLY, FOR GOOD y, $y > \bar{y}$.
    - WHEN $\bar{x} = \bar{y} = 0$, THE UTILITY REDUCES TO $u(x, y) = Ax^{\alpha}y^{\beta}$, WHICH COINCIDES WITH COBB-DOUGLAS UTILITY FUNCTION.

SPECIAL TYPES OF UTILITY FUNCTIONS

- STONE-GEARY (CONT.):
  - FOR $u(x, y) = A(x - \bar{x})^{\alpha}(y - \bar{y})^{\beta}$, MARGINAL UTILITIES ARE

$$MU_x = A\alpha(x - \bar{x})^{\alpha-1}(y - \bar{y})^{\beta},$$
$$MU_y = A\beta(x - \bar{x})^{\alpha}(y - \bar{y})^{\beta-1}.$$

  WHICH IMPLY

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{A\alpha(x - \bar{x})^{\alpha-1}(y - \bar{y})^{\beta}}{A\beta(x - \bar{x})^{\alpha}(y - \bar{y})^{\beta-1}} = \frac{\alpha(y - \bar{y})^{\beta-(\beta-1)}}{\beta(x - \bar{x})^{\alpha-(\alpha-1)}} = \frac{\alpha(y - \bar{y})}{\beta(x - \bar{x})}.$$

  - WHEN $\bar{x} = \bar{y} = 0$, MRS COLLAPSES TO MRS WITH COB-DOUGLAS FUNCTION,

$$MRS_{x,y} = \frac{\alpha(y-\bar{0})}{\beta(x-\bar{0})} = \frac{\alpha y}{\beta x}.$$

A LOOK AT BEHAVIORAL ECONOMICS–SOCIAL PREFERENCES

SOCIAL PREFERENCES

- PREVIOUS UTILITY FUNCTIONS ASSUME THE CONSUMER CARES ABOUT THE BUNDLE SHE RECEIVES BUT IGNORE THE BUNDLE (OR MONEY) THAT OTHER INDIVIDUALS ENJOY.
- HOWEVER, THERE ARE SCENARIOS WHERE WE CARE ABOUT THE WELL-BEING OF FAMILY MEMBERS OR FRIENDS.
- WE NEXT EXPLORE UTILITY FUNCTIONS WHERE INDIVIDUALS EXHIBIT SOCIAL, RATHER THAN SELFISH, PREFERENCES.
  - FEHR-SCHMIDT SOCIAL PREFERENCES (1999).
  - BOLTON AND OCKENFELS SOCIAL PREFERENCES (2000).

APPENDIX. FINDING THE MARGINAL RATE OF SUBSTITUTION

FINDING MRS

- WE INCREASE GOOD x BY 1 UNIT AND SEEK TO MEASURE HOW MANY UNITS OF GOOD y THE CONSUMER MUST GIVE UP TO PRESERVE HER UTILITY LEVEL.
- BECAUSE WE SIMULTANEOUSLY ALTER THE AMOUNTS OF X AND Y, WE TOTALLY DIFFERENTIATE $u(x, y)$,

$$du = \frac{\partial u(x,y)}{\partial x}dx + \frac{\partial u(x,y)}{\partial y}dy.$$

- BECAUSE THE CONSUMER IS MOVING ALONG AN IC, HER UTILITY DOES NOT VARY, IMPLYING $du = 0$.
- PLUGGING THIS RESULT AND USING $MU_x = \frac{\partial u(x,y)}{\partial x}$ AND $MU_y = \frac{\partial u(x,y)}{\partial y}$,

$$\underbrace{0}_{du=0} = MU_x dx + MU_y dy.$$

FINDING MRS

- AFTER REARRANGING,

$$-MU_y dy = MU_x dx.$$

- BECAUSE WE ARE INTERESTED IN THE RATE AT WHICH y CHANGES FOR A 1-UNIT INCREASE IN x,

$$-\frac{dy}{dx} = \frac{MU_x}{MU_y}.$$

- THEREFORE, THE SLOPE OF THE INDIFFERENCE CURVE, COINCIDES WITH THE RATIO OF MARGINAL UTILITIES.
- THIS RATIO IS REFERRED TO AS THE MARGINAL RATE OF SUBSTITUTION BETWEEN GOODS x AND y, OR $MRS_{x,y}$.