Theory of Consumer Choice: Cardinal Approach

What will you learn from this topic?

- How consumers choose to spend their income on goods and services
- Why consumers make choices by maximizing **utility,** a measure of satisfaction from consumption
- Why the **principle of diminishing marginal utility** applies to the consumption of most goods and services
- How to use marginal analysis to find the **optimal consumption bundle**
- What **income** and **substitution effects** are

- CARDINAL APPROACH (ASSUMED THAT UTILITY IS MEASURABLE)
- ORDINAL APPROACH

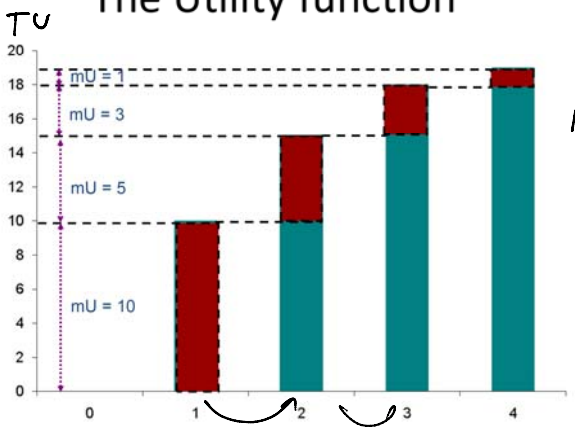
The Utility function

(UTILS)

- *Cardinal* utility assigns a value to the level of satisfaction associated with the consumption of a basket of goods.
- TU — *Total* utility is the sum of the satisfactions derived from the consumption of several goods.
- MU — *Marginal* utility is the increase in utility following the consumption of an extra unit of a good.

Beers consumed	Total Utility	Marginal Utility
0	0	0
1	10	10
2	15	5
3	18	3
4	19	1

The Utility function



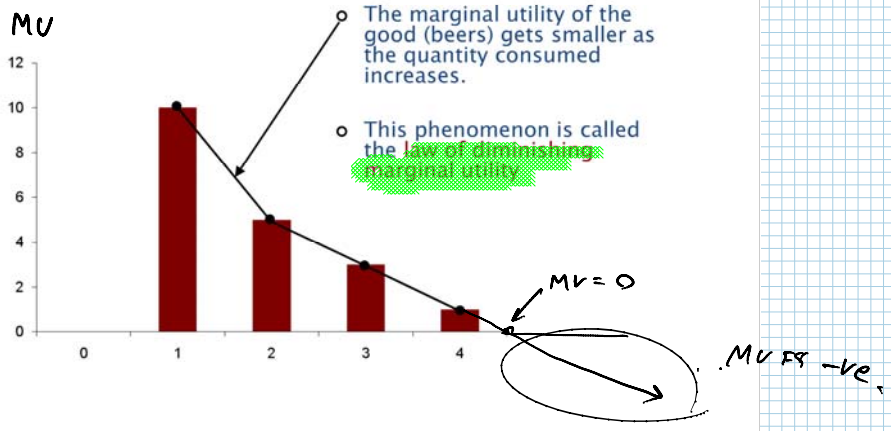
$MU = \frac{\Delta TU}{\Delta Q}$

Ex: $Q = 2 \rightarrow Q = 3$

$TU = 15 \rightarrow TU = 18$

$\frac{\Delta TU}{\Delta Q} = \frac{18 - 15}{3 - 2} = 3$

The Utility function



Is Marginal Utility Really Diminishing?

Income = 9 baht

MAX $U(X, Y)$

S.T. $P_X \cdot X + P_Y Y = M$

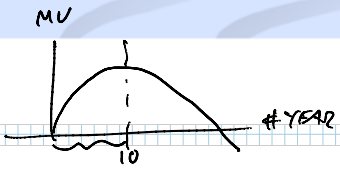
$X^* = ?$

$Y^* = ?$

DECISION MAKING PROCESS

Income = 9 baht

P_X = 2 Baht/Unit				P_Y = 1 Baht/Unit			
Units of X	TU_X	MU_X	MU_X/P_X	Units of Y	TU_Y	MU_Y	MU_Y/P_Y
1	10	10	5	1	8	8	8
2	18	8	4	2	15	7	7
3	24	6	3	3	21	6	6
4	28	4	2	4	26	5	5
5	31	3	1.5	5	30	4	4
6	33	2	1	6	33	3	3



Compare the Value of MU of 1st Unit of X & 1st Unit of Y

P_X = 2 P_Y = 1

Units of X	MU_X	MU_X/P_X	Units of Y	MU_Y	MU_Y/P_Y
1	10	5	1	8	8
2	8	4	2	7	7
3	6	3	3	6	6
4	4	2	4	5	5
5	3	1.5	5	4	4
6	2	1	6	3	3

Since 8 ....Utils/Baht > 5 ..... Utils/Baht The consumer buys 1ST UNIT OF Y

Total Quantity: 1 UNIT OF Y

TU: 8 UTILS

Paid: 1 BAHT

Money Left: 9 - 1 = 8 BAHT

$\frac{MU_Y}{P_Y} > \frac{MU_X}{P_X}$

$(8) \quad (5)$

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Compare the Value of MU of 1st unit of X & 2nd unit of Y

P_X = 2 P_Y = 1

Units of X	MU_X	MU_X/P_X	Units of Y	MU_Y	MU_Y/P_Y
1	10	5	1	8	8
2	8	4	2	7	7
3	6	3	3	6	6
4	4	2	4	5	5
5	3	1.5	5	4	4
6	2	1	6	3	3

Since 7 Utils/Baht > 5 Utils/Baht, The consumer buys THE 2ND UNIT OF Y

Total Quantity: 2 UNITS OF Y

TU: 8 + 7 = 15 UTILS

Paid: 1 + 1 = 2 BAHTS

Money Left: 9 - 2 = 7 BAHT

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Compare the Value of MU of 1st unit of X & 3rd unit of Y

$P_x = 2$ $P_y = 1$

Units of X	MUx	MUx/Px	Units of Y	MUy	MUy/Py
1	10	5	1	8	8
2	8	4	2	7	7
3	6	3	3	6	6
4	4	2	4	5	5
5	3	1.5	5	4	4
6	2	1	6	3	3

Since 6 Utils/Baht > 5 Utils/Baht, The consumer buys 3RD UNIT OF Y

Total Quantity: 3 UNITS OF Y

TU: 8+7+6 = 21 UTILS

Paid: 1+1+1 = 3 BAHT

Money Left: 9 − 3 = 6 BAHT

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Compare the Value of MU of 1st Unit of X & 4th Unit of Y

$P_x = 2$ $P_y = 1$

Units of X	MUx	MUx/Px	Units of Y	MUy	MUy/Py
1	10	5	1	8	8
2	8	4	2	7	7
3	6	3	3	6	6
4	4	2	4	5	5
5	3	1.5	5	4	4
6	2	1	6	3	3

Since 5 Utils/Baht = 5 Utils/Baht, The consumer buys 1ST UNIT OF X + 4TH UNIT OF Y

Total Quantity: 4 UNITS OF Y + 1 UNIT OF X

TU: 8+7+6+5 + 10 = 36 UTILS

Paid: 1+1+1+1+2 = 6 BAHT

Money Left: 9 − 6 = 3 BAHT

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Compare the Value of MU of 2nd Unit of X & 5th Unit of Y

$P_x = 2$ $P_y = 1$

Units of X	MUx	MUx/Px	Units of Y	MUy	MUy/Py
1	10	5	1	8	8
2	8	4	2	7	7
3	6	3	3	6	6
4	4	2	4	5	5
5	3	1.5	5	4	4
6	2	1	6	3	3

Since 4 Utils/Baht = 4 Utils/Baht, The consumer buys THE 5TH UNIT OF Y + THE 2ND UNIT OF X

Total Quantity: 5Y + 2X

TU: 8+7+6+5+4 + 10+8 = 48 UTILS

Paid: 9 BAHT

Money Left: 0 BAHT

(2, 5) → 48 UTILS

X* X** HIGHEST POSSIBLE TOTAL UTILITY

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INFERIOR OPTIONS

Will the Consumer have The Maximum Utility by Consuming 3 Units of X (6 Baht) and 3 Units of Y (3 Baht) That Cost 9 Baht?

$P_x = 2$ $P_y = 1$

Units of X	MU_X	MU_X/P_X	Units of Y	MU_Y	MU_Y/P_Y
1	10	5	1	8	8
2	8	4	2	7	7
3	6	3	3	6	6
4	4	2	4	5	5
5	3	1.5	5	4	4
6	2	1	6	3	3

-6 UTILS
+9 UTILS
+3 UTILS

Total U Obtained by Consuming 3 Units of X: 10 + 8 + 6 = 24 UTILS

Total U Obtained by Consuming 3 Units of Y: 8 + 7 + 6 = 21 UTILS

Total U Obtained by Consuming 3 Units of X and 3 Units of Y: 24 + 21 = 45 UTILS

45 UTILS < 48 UTILS

(3,3) +2Y +3 UTILS (2,5)

-1X → -6 UTILS

NOTICE THAT ONCE HE FINISHES HIS PURCHASE, $\frac{MU_X}{P_X} < \frac{MU_Y}{P_Y}$ ($=3$ vs $=6$)

- THE KID BOUGHT TOO MANY OF X OR TOO LITTLE OF Y.
- HE SHOULD REALLOCATE HIS BUDGET AGAIN. BY BUYING MORE OF Y & LESS OF X

Could the Consumer Consumes 3 Units of X & 6 Units of Y?

$P_x = 2$ $P_y = 1$

Units of X	MUx	MUx/Px	Units of Y	MUy	MUy/Py
1	10	5	1	8	8
2	8	4	2	7	7
3	6	3	3	6	6
4	4	2	4	5	5
5	3	1.5	5	4	4
6	2	1	6	3	3

The cost of 3 Units of X = ... Baht

The Cost of 6 Units of Y = ... Baht

Total Cost = ...

Rational Spending Rule

OBJECTIVE : MAX $U(X, Y)$

CONSTRAINT : $P_X X + P_Y Y = M$

CONSUMER'S OPTIMIZATION PROBLEM

($P_X = 2$, $P_Y = 1$, $M = 9$)

(X^*, Y^*) → MAXIMUM OF UTILITY ?

ANSWER : $(X^* = 2, Y^* = 5)$ → 48 UTILS.

IF A RATIONAL CONSUMER WOULD LIKE TO MAXIMIZE HIS UTILITY GIVEN BUDGET CONSTRAINT, HE MUST SPEND SUCH THAT ONCE HE FINISHES HIS SPENDING,

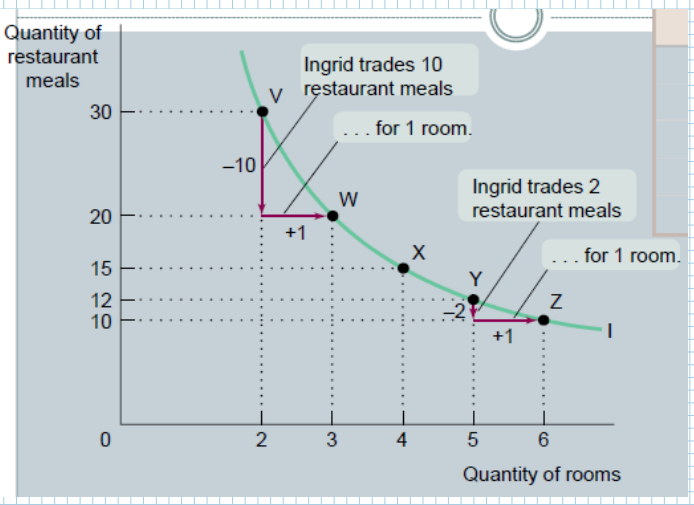
MARGINAL UTILITY PER BAHT SPENT ON BUYING GOOD X $\left(\frac{MU_X}{P_X}\right)$ =

MARGINAL UTILITY PER BAHT SPENT ON BUYING GOOD Y $\left(\frac{MU_Y}{P_Y}\right)$

MARGINAL UTILITY PER BAHT SPENT ON BUYING GOOD Y ($\frac{MU_Y}{P_Y}$)

IF $\frac{MU_X}{P_X} < \frac{MU_Y}{P_Y}$, HE SHOULD BUY MORE OF Y AND LESS OF X.

IF $\frac{MU_X}{P_X} > \frac{MU_Y}{P_Y}$, HE SHOULD BUY MORE OF ---- AND LESS OF ---- .



THEORY OF CONSUMER CHOICE : ORDINAL APPROACH

- WHILE CARDINAL APPROACH NEEDS TO ASSUME THAT UTILITY IS MEASURABLE, ORDINAL APPROACH DOES NOT NEED THIS ASSUMPTION.
- WHAT ORDINAL APPROACH REQUIRES IS THAT A CONSUMER IS ABLE TO "RANK" HIS PREFERENCE. (OR ORDER)
- THIS APPROACH CONSISTS OF 3 MAIN BLOCKS

(1) WHAT A CONSUMER WANTS (CONSUMER'S PREFERENCES/ TASTES)

(2) WHAT THE CONSUMER CAN AFFORD, (BUDGET CONSTRAINT)

(3) "HOW" THE CONSUMER "OPTIMALLY" CHOOSE.
↓ CHOOSE THE BEST AFFORDABLE CHOICE.

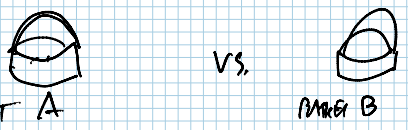
- BEFORE WE VISIT ALL 3 ROOMS ABOVE, WE MUST MAKE SOME ASSUMPTIONS ABOUT CONSUMER'S PREFERENCES.

(1) THIS CONSUMER IS A RATIONAL MAN : HE

KNOWS WHAT HE WANTS, NAMELY "MAXIMIZE HIS SATISFACTION"

② HE IS ABLE TO "RANK" HIS PREFERENCES.

CONSIDER TWO BASKETS OF GOODS.



HE MUST BE ABLE TO GIVE ONE OF THREE POSSIBLE ANSWERS:

① A IS PREFERRED TO B: $A \succ B$

$A \succ B \iff U(A) > U(B)$ (IFF)

② B IS PREFERRED TO A: $B \succ A$

$B \succ A \iff U(B) > U(A)$

③ A IS INDIFFERENT TO B: $A \sim B$

$A \sim B \iff U(A) = U(B)$.

③ MORE IS PREFERRED TO LESS

OR

MORE IS BETTER

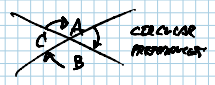
i.e., MORE OF THE GOODS LEADS TO HIGHER SATISFACTION (AT LEAST, THIS IS TRUE OVER A CERTAIN AMOUNT OF GOOD)

④ HE LOVES VARIETY OF GOODS IN HIS BASKET, i.e., MIXTURES OF GOODS ARE PREFERRED TO EXTREMES

⑤ HIS PREFERENCE IS CONSISTENT:

IF $A \succ B$ AND $B \succ C$, THEN $A \succ C$

(TRANSITIVITY)



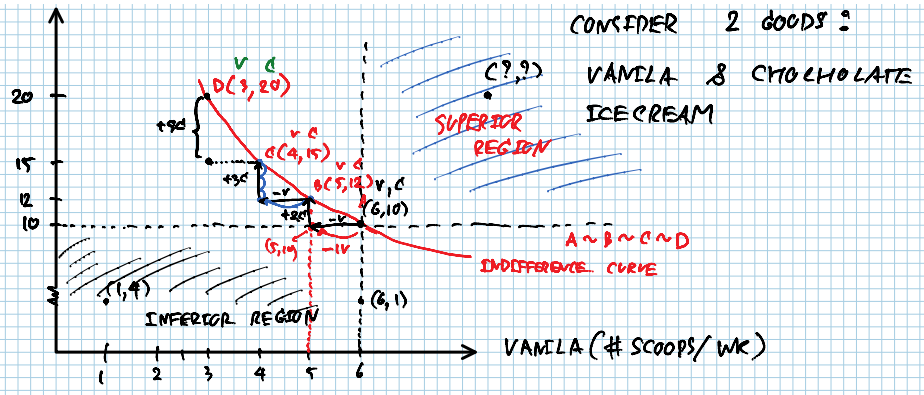
NOW, SUPPOSE THIS GUY PASSES OUR CHECK LIST OF CONSUMER'S PREFERENCES, SO NOW WE ARE READY TO INVESTIGATE HIS CONSUMPTION CHOICE.

Ⓘ WHAT A CONSUMER WANTS (EXPLAINED BY A TOOL CALLED "INDIFFERENCE CURVES")

CHOC C # SCOOP/WK)

CONSIDER 2 GOODS:

VANILLA & CHOCHOLATE ICECREAM



AN INDIFFERENCE CURVE: A COLLECTION OF ALL BASKETS (BUNDLES) THAT GIVES THE SAME UTILITY OR SATISFACTION TO A CONSUMER.

FROM A → B: SLOPE = $\frac{+2C}{-1V} = -2$

FROM B → C: (5,12) (4,15) SLOPE = $\frac{+3C}{-1V} = -3$

FROM C → D: (4,15) (3,20) SLOPE = $\frac{+5C}{-1V} = -5$

SLOPE = MARGINAL RATE OF SUBSTITUTION (MRS_{VC})

THE RATE AT WHICH A CONSUMER IS WILLING TO TRADE ONE GOOD FOR ANOTHER

NOTICE THAT FROM D → C → B → A, MRS (IGNORE THE NEGATIVE SIGN) IS DIMINISHING !!! (i.e., 5 → 3 → 2)

LAW OF DIMINISHING MRS:

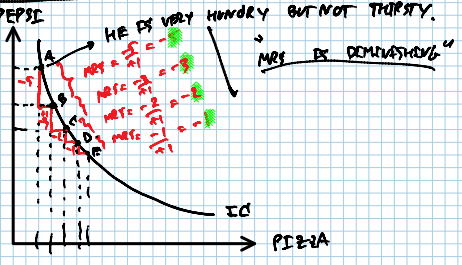
WHEN THIS KID HAS RELATIVELY HIGHER AMOUNT OF CHOCHOLATE (i.e., HAS MORE OF C BUT LITTLE OF V) (LIKE BASKET D (3,20))

HE IS WILLING TO GIVE UP MORE SCOOPS OF C TO OBTAIN ONE EXTRA SCOOP OF V.

LATER ON, WHEN AMOUNT OF C IS GETTING SMALLER AND AMOUNT OF V IS GETTING BIGGER,

HE WILL BE WILLING TO GIVE UP LESS AMOUNT OF C FOR ONE EXTRA SCOOP OF V.

ANOTHER EXAMPLE: PIZZA & PEPSI



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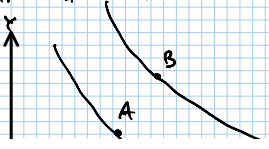
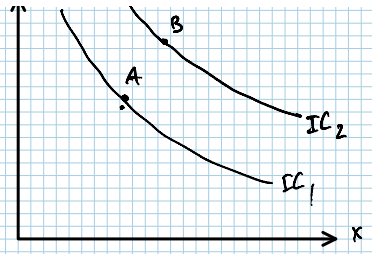
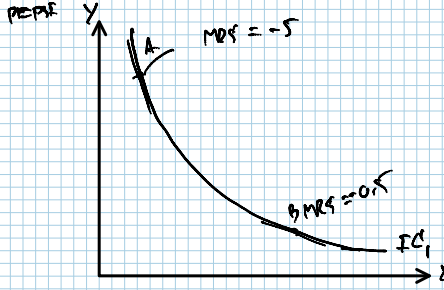
PROPERTIES OF INDIFFERENCE CURVES

① EVERY BASKET OF THE GOODS MUST HAVE AN INDIFFERENCE CURVE PASSING THROUGH IT.





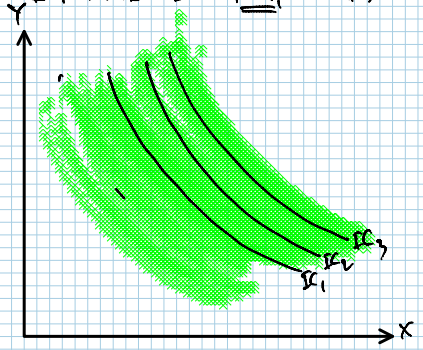
② ICs ARE DOWNWARD SLOPING (WHEN LOOKING FROM THE LEFT TO THE RIGHT. (WHY?)



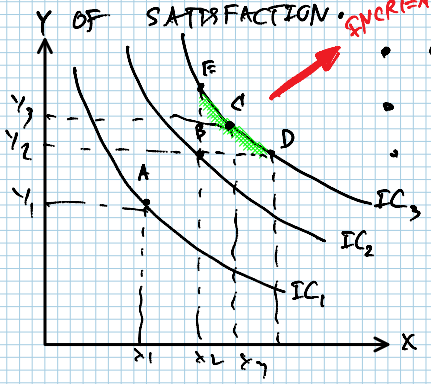
$$MRS_{XY} = \left.\frac{\Delta Y}{\Delta X}\right|_{\bar{U}}$$

∴ MRS IS DIMINISHING

③ INDIFFERENCE MAP IS A COLLECTION OF MILLIONS OF ICs.



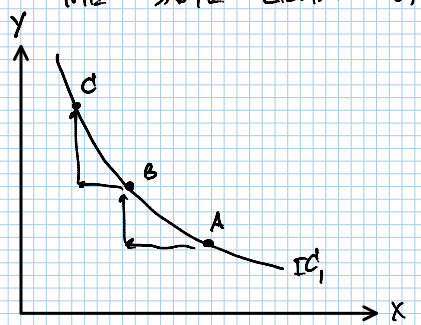
④ THE FARTHER FROM THE ORIGIN, THE HIGHER LEVEL OF SATISFACTION. INCREASING SATISFACTION



- C ≻ B ≻ A
- D ≻ B
- E ≻ B

$$U_{IC_3} > U_{IC_2} > U_{IC_1}$$

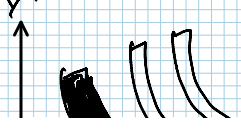
⑤ EVERY BASKET ON THE SAME IC GIVE THE SAME LEVEL OF SATISFACTION.



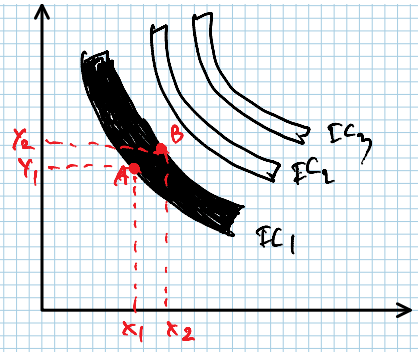
$$A \sim B \sim C \iff U(A) = U(B) = U(C) \quad \text{IFF}$$

(ALL BASKETS GENERATE THE SAME HAPPINESS LEVEL)

⑥ INDIFFERENCE CURVES ARE NOT THICK.



PROOF BY CONTRADICTION



PROOF BY CONTRADICTION

JUST DRAW A THICK IC, AND SEE WHAT WOULD HAPPEN.

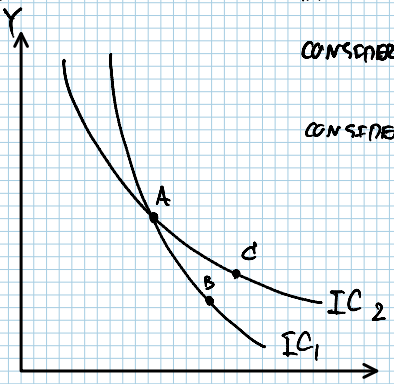
SINCE A AND B ARE ON THE SAME IC, NAMELY IC_1, THEN $A \sim B$

SINCE B HAS MORE OF X AND Y, THEN $B \succ A$

HOWEVER, THE TWO STATEMENTS ABOVE CANNOT BE TRUE AT THE SAME TIME. (THIS IS A CONTRADICTION)

SO, WE CONCLUDE THAT IC'S CANNOT BE THICK. # END OF THE PROOF.

(2) ICs (FROM THE SAME MAP) CANNOT CROSS.



CONSIDER IC_1 : SINCE A AND B ARE ON THE SAME IC, $A \sim B$

CONSIDER IC_2 : SINCE A AND C ARE ON THE SAME IC (IC_2), $A \sim C$.

BY TRANSITIVITY, IF $A \sim B$ AND $A \sim C$, THEN $B \sim C$.

BUT!, BY MORE IS PREFERRED TO LESS, $C \succ B$. (∵ C HAS MORE OF K AND MORE OF Y)

NONETHELESS, THE TWO STATEMENT CANNOT BE CORRECT/TRUE AT THE SAME TIME!

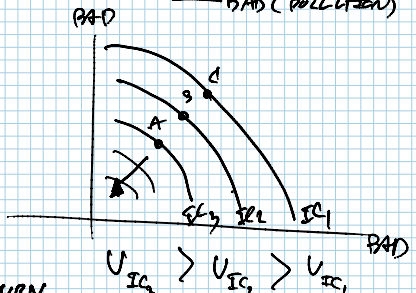
(THIS IS A CONTRADICTION IF YOU ALLOW FOR CROSSING ICs.)

SO, ICs CANNOT CROSS. # END OF THE PROOF

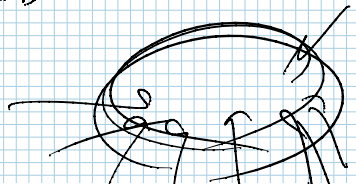
GOOD : MORE IS PREFERRED TO LESS → BAD (GARBAGE)

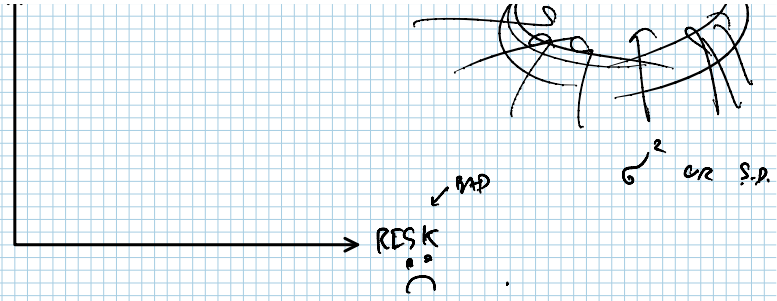
BAD : LESS IS PREFERRED TO MORE → BAD (POLLUTION)

NEUTER : —



GOOD → ☺ RETURN




MP
RESK
2
OR
S.D.