

Lecture 9(i)

Announcements

- Work on “Consumer Theory” worksheet (at week 9 on Canvas) before recitation.
- Midterm 2 coming up. Can start looking at practice midterms (at week 10 on Canvas).

Lecture

1. Substitution and Income Effects

2. Robinson and Crusoe with indifference curves and budget constraints. (We finish the masterpiece.) Our version of



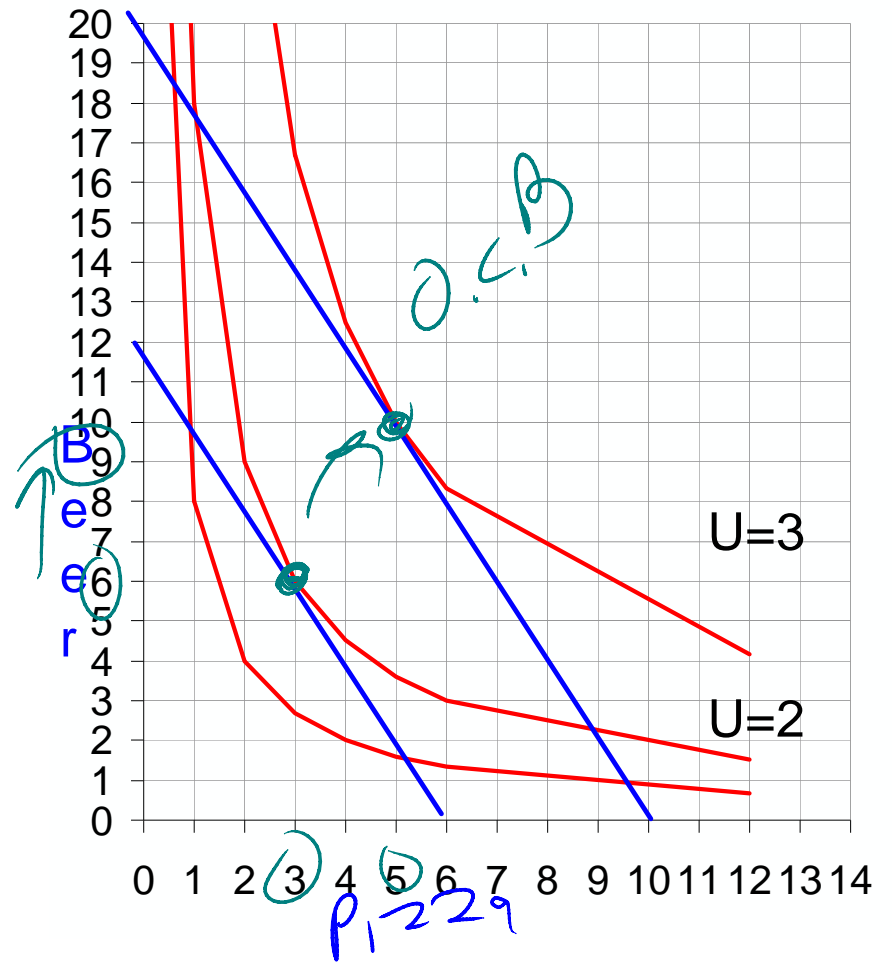
3. Costs
U-shaped Average Cost

On Friday, figured out income effect:

Initially at Income = 24
(price of beer = \$2, price of pizza \$4)

Then Goldy buys:

If income is \$40, then



Next: what happens when price changes?

1. Income and Substitution Effects

At optimum two conditions:

(1) $MRS = \frac{P_{\text{pizza}}}{P_{\text{beer}}}$

(2) On budget constraint

If initially at optimum and price of pizza falls, then **both conditions are messed up.**

Breaking things down into **income** and **substitution** effects, we fix things one at a time.

(1) Fix $MRS = \text{price ratio}$ condition

(2) Shift to fix budget constraint.

Definitions:

1. **Substitution effect.** Effect of change in opportunity cost (by spending power held fixed so stay on same indifference curve)

- buy more if price falls

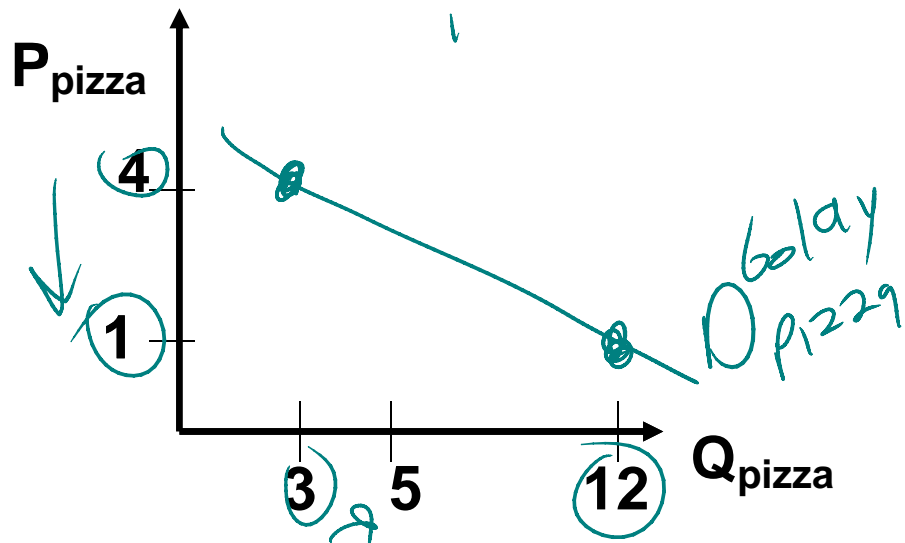
2. **Income effect**

The effect of change in income holding opportunity cost fixed at the new level.

- direction of effect depends upon whether normal or inferior

Let's start with the **total effect**. That should be easy

Our old graph of demand curve from the beginning of the semester

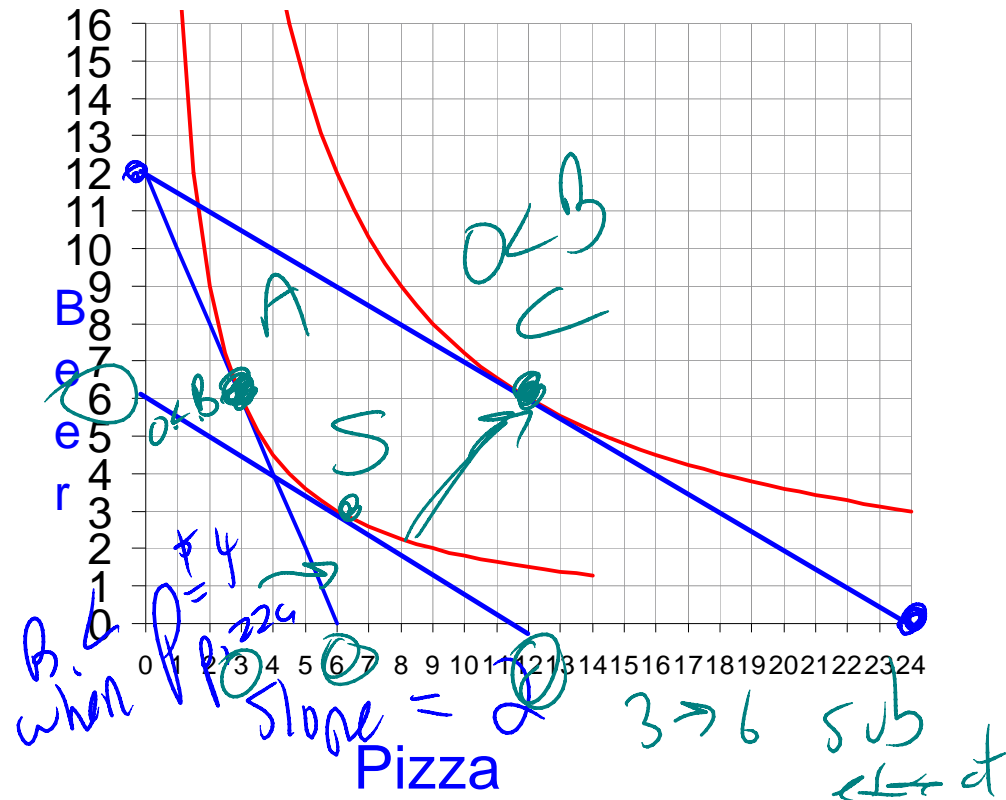


Start at price equal \$4, lower price to \$1, is a **movement along demand**

$I = \$24$ and $P_{\text{Beer}} = \$2$ fixed

$P_{\text{Pizza}} = \$4$: Label **OCB A**

$P_{\text{Pizza}} = \$1$: Label **OCB C**



(OCB is Optimal Consumption Bundle)

Movement **A** to **C** is **total effect** of price decrease

Breakdown into **substitution effect**:
New **opportunity cost**, but original **indifference curve**.

Label this **S**

Substitution Effect is movement from **A** to **S** 3 pizza to 6 pizza

Income Effect is movement from **S** to **C** 6 pizza increase to 12 pizza increase
6 pizza increase

When price falls:

Substitution effect:

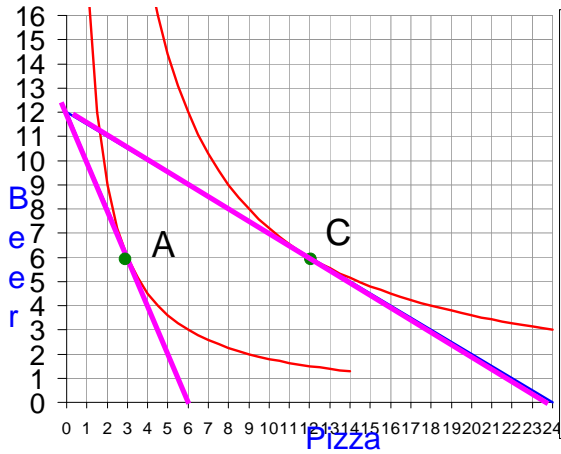
buy more (because opportunity cost is lower)

Income effect (since original bundle is cheaper than before so have income left over)

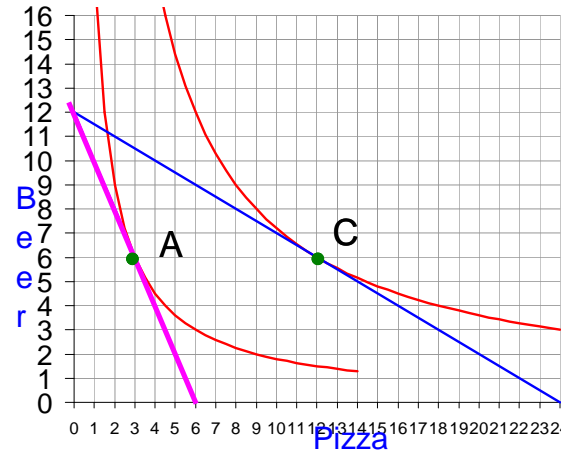
normal good: buy more
inferior good: buy less

So if normal, **Sub** and **Inc** work same way

If inferior, **Sub** and **Inc** go different ways.



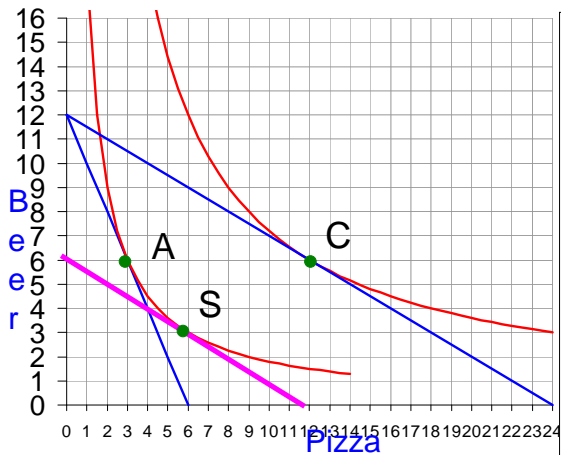
Example 1
 P_{pizza} falls from \$4 to \$1
 $P_{\text{beer}} = \$2$, Income = \$24



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 P_{pizza} falls from \$4 to \$1
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Optimum goes from A to C
 (3 pizza to 12 pizza)

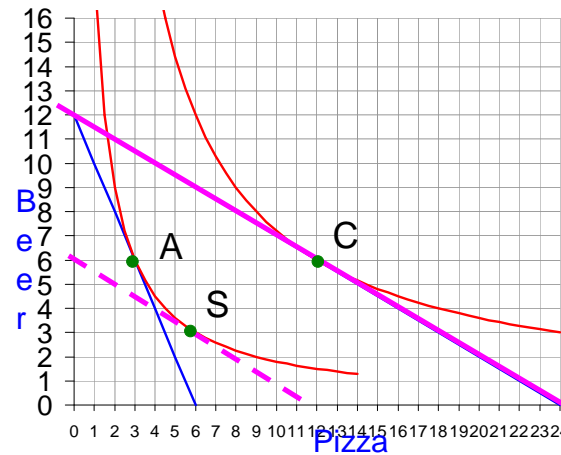
To get Sub Effect we rotate on original indifference condition to get MRS condition fixed.



Example 1
 P_{pizza} falls from \$4 to \$1
 $P_{\text{beer}} = \$2$, Income = \$24

Optimum goes from A to C
 (3 pizza to 12 pizza)

Sub effect is A to S



Example 1
 P_{pizza} falls from \$4 to \$1
 $P_{\text{beer}} = \$2$, Income = \$24

Optimum goes from A to C
 (3 pizza to 12 pizza)

Sub effect is A to S
 Inc is S to C

Normal good, both work in same direction.

Let's redo this maneuver, so you can get the hang of it....

More on income effect. At \$4 a slice, (and income=\$24 and price of beer equal to \$2), Goldy buys 3 slices of pizza. If the price fell to \$1 and Goldy bought her original consumption bundle, she would have \$9 left over. (3 slices times \$3 savings (\$4 to \$1) on each slice).

The \$9 adds to her purchasing power. Since pizza is a normal good for Goldy, that additional purchasing power leads her to buy more pizza.

One of the most important applications of theory of income and substitution effects is **Labor supply**

For consumer goods, price goes up, result in a **decrease** in income. So for normal goods, **Sub** and **Inc** go the same way.

For labor, price goes up, individual gets an **increase** in income.

Income Effect

- Leisure a normal good
- So income effect: **work less**
- Evidence that leisure a normal good: What do lottery winners do? Quit working?

Leisure: a good. Has an opportunity cost: wage.

Wage goes up:

Substitution effect

- Opportunity cost of leisure increases
- consume less leisure or..... **work more**

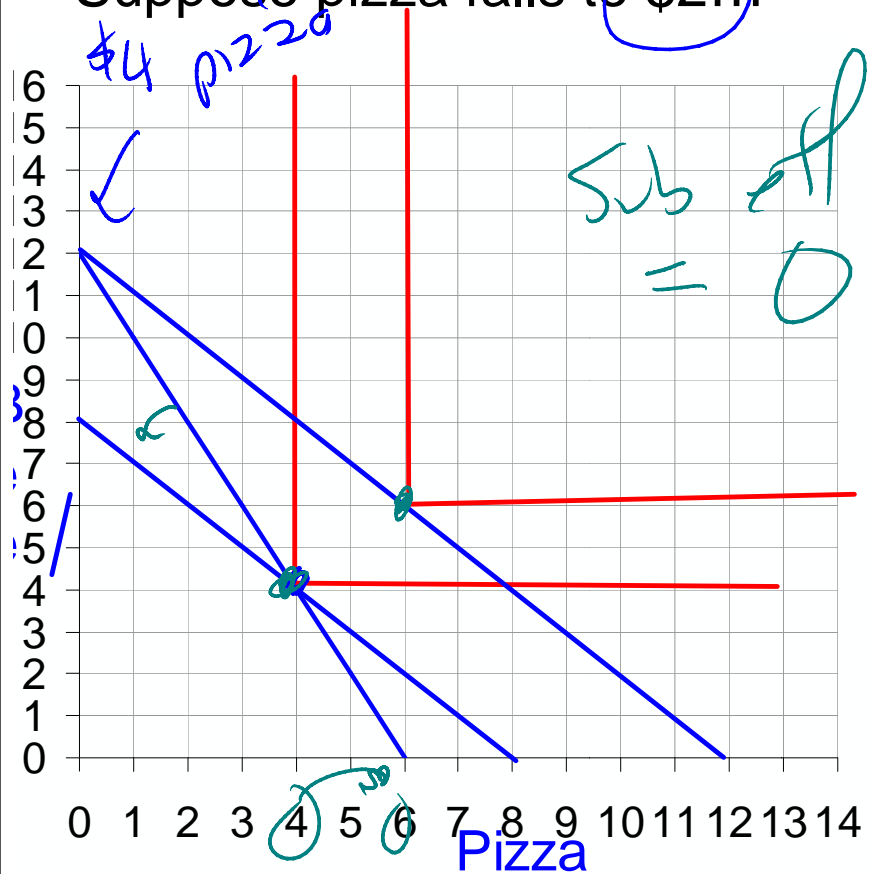
What is **net** effect?

Over time, as income has increased, time spent working has gone down (but income has increased dramatically) So for trend **over time**, income effect has predominated

Finally let's test your knowledge of the substitution effect, by figuring out what it will be for **Bucky** who consumes in fixed proportions.

Suppose pizza falls to \$2...

$\$4$ to $\$2$



For Bucky, the total effect on demand of the price decline from \$4 to \$2 is 2 more slices of pizza.

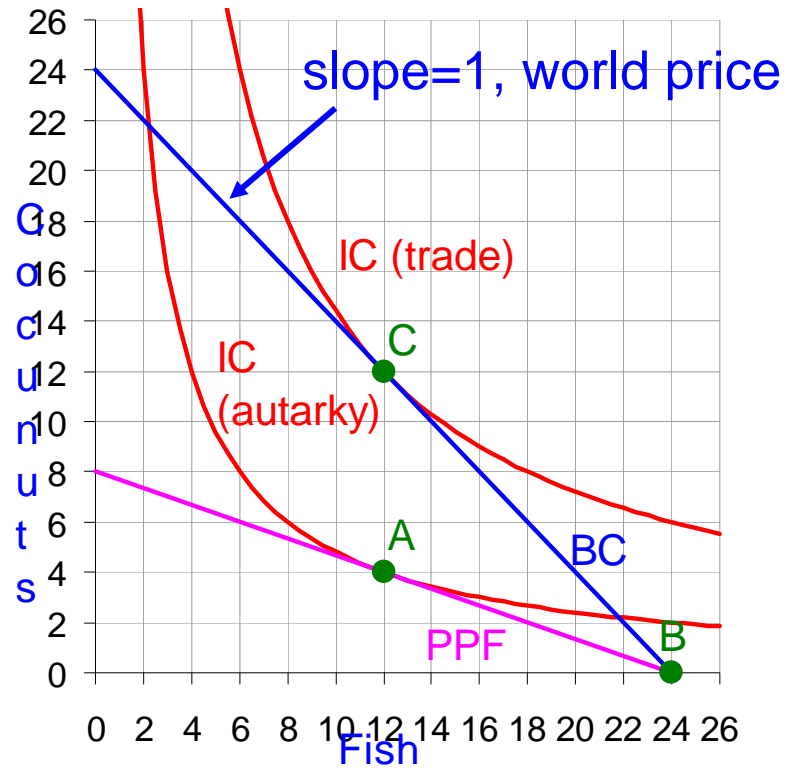
We can divide the total effect into the substitution effect and the income effect.

We see from the previous page that the substitution effect is zero.

Therefore income effect is everything and equals an increase of 2 pizzas.

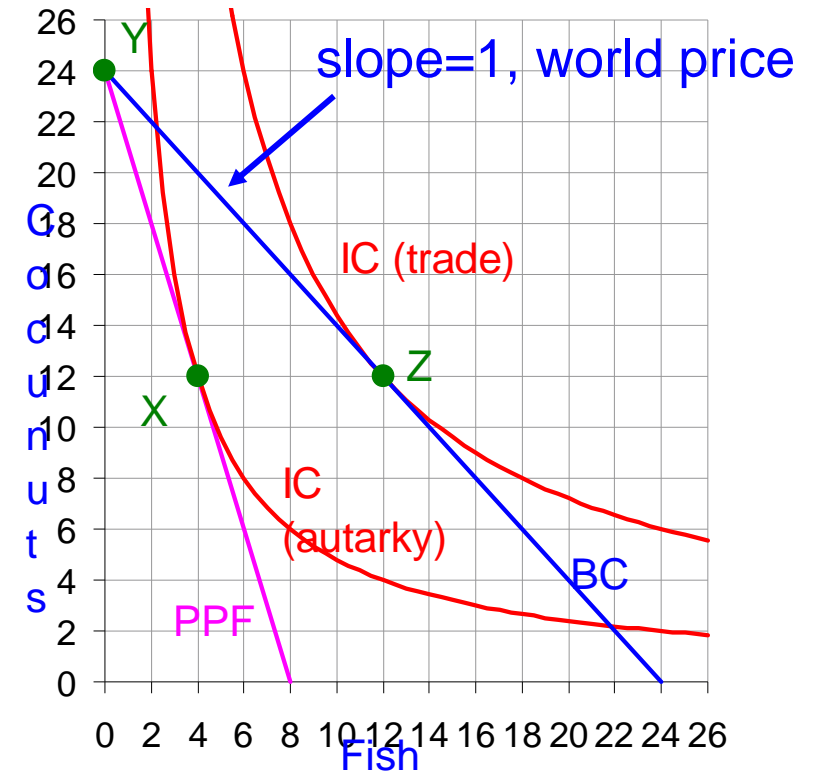
Next we use our new knowledge about preferences and indifference curves to finish our diagram of **comparative advantage** as a basis for trade.

Comparative Advantage as a Basis Robinson PPF



	Produce	Consume
Autarky	A(12F,4C)	A (12F,4C)
Trade	B(24F,0C)	C(12F,12C)

for Trade (Complete Picture!) Friday PPF



	Produce	Consume
Autarky	X(4F,12C)	X(4F,12C)
Trade	Y(0F,24C)	Z(12F,12C)

Lots of great stuff on graph!!!!

1. Production Possibility Frontier
2. Choice under autarky (pink PPF is budget constraint, choice A where MRS equals opportunity cost)
3. With trade specializing in terms of comparative advantage. Picks production B to maximize income.
4. With trade and new budget constraint in blue. Picks C to maximize utility.
5. Supply=Demand (Robinson supplies 12 fish and Friday demands 12 fish)

3. Costs

Costs pretty simple so far in Econland

S1: can make 0 or 1 widget.

Cost to make 0 widget: \$0

Cost to make 1 widget: \$1

In real world, things are usually more complicated.

Meet S11

Details of her widget operation.

Fixed Cost of \$4 to be in business
These are costs that are the same regardless of quantity produced.

Examples:

- Salary of the CEO
- Electric bill for lights
- rent on factory

Variable Input:

Labor (\$2 an hour)

Widget Juice (\$1 quart, need one quart per widget)

(Cost in \$)

Q	L hours	Labor Cost (wage=\$2 hr)	Materials Cost	Variable Cost
0	0.0	0	0	0
1	.5	1	1	2
2	2.0	4	2	6
3	4.5	9	3	12
4	8.0	16	4	20

The cost structure for S11 exhibits

Diminishing Marginal Returns

To get first widget, need half hour of labor

To get second widget, need 1.5 hours of labor more.

So return on additional units of labor added is diminishing.

This is what happens when pick the **low hanging fruit** first.

(Note, here we don't have diminishing returns in materials)

One big table

Q	FC Fixed Cost	VC Variable Cost	TC Total Cost
0	4	0	4
1	4	2	6
2	4	6	10
3	4	12	16
4	4	20	24

$$TC = FC + VC$$

$$AFC = \text{Average Fixed Cost} = FC/Q$$

$$AVC = \text{Average Variable Cost} \\ = VC/Q$$

Marginal Cost: change in cost from increasing output one unit.

AFC	AVC	ATC	MC Marginal Cost
4	2	6	2
2	3	5	4
1.33	4	5.33	6
1	5	6	8

$$\text{MC between } 0 \text{ and } 1 \text{ is } 2 = 6 - 4$$

$$\text{MC between } 1 \text{ and } 2 \text{ is } 4 = 10 - 6$$

$$\text{MC between } 2 \text{ and } 3 \text{ is } 6 = 16 - 10$$

$$ATC = AFC + AVC$$

Put this all together:

Q	FC	VC	TC	MC	AFC	AVC	ATC
0	4	0	4	2			
1	4	2	6	4	4	2	6
2	4	6	10	6	2	3	5
3	4	12	16	8	1.33	4	5.33
4	4	20	24		1	5	6

C for "cost," F for "fixed,"
V for "variable," T for "total,"
A for "average," M for "marginal."

Let's Graph S11's Cost Structure

