Lecture 5:
Consumer Choice

September 23, 2025

Course Administration

1. Use Numbers 2 of 2 should be in
   - will return next week
2. Problem set 3 is graded and in your returned work folder
3. Be sure to check Piazza or forward to your email
4. Happy to see you in office hours – use scheduler
5. Any questions or outstanding issues?

How What You're Learning is Policy-Relevant

Ripped from Headlines presentation(s)

As a reminder, next week

Afternoon

Finder	Presenter
Natalia	Mia

Evening

Finder	Presenter
Bhanu	Cara
Aiyana	Bhanu

This Week's Ripped From the Headlines

Afternoon

Finder	Presenters
Jacob	George

Evening

Finder	Presenters
Cara	Eric

Quantity Regulations

Two Types of Quantity Regulations

We just looked at regulations on price. Now we consider regulations on quantity.

1. Quota $\equiv$ a regulated (almost always limited) "quantity of a good or service provided"
2. Government provision of a good or service (skip for time reasons)

Policy Aside: Quotas in the World

- Number of US doctors per year
  - limited by the number of Medicare-funded medical residency slots
- US used to have "tariff rate quotas"
  - higher tariff after a certain amount of imports
  - import limit may vary by country
  - dairy, stainless steel, ...
- Quota on immigration of highly skilled workers
  - via H1-B immigration visas

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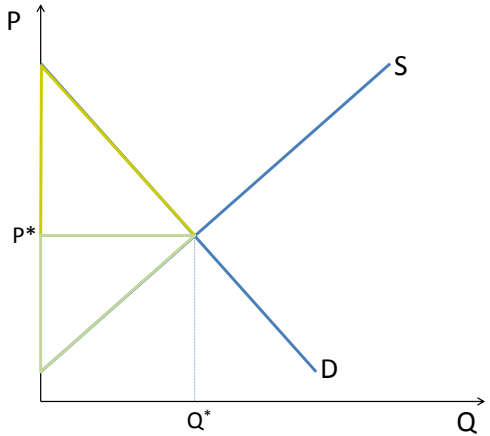
Next: Ask how quotas impact prices and total surplus

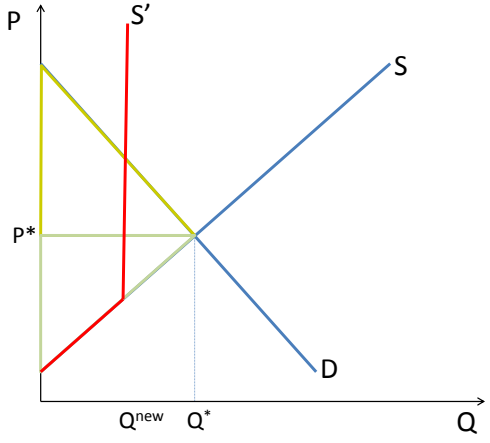
Quotas in Pictures

Market Equilibrium: How Does Supply Change with a Quota?



Quotas in Pictures

Supply with a Quota: What Happens to Price?



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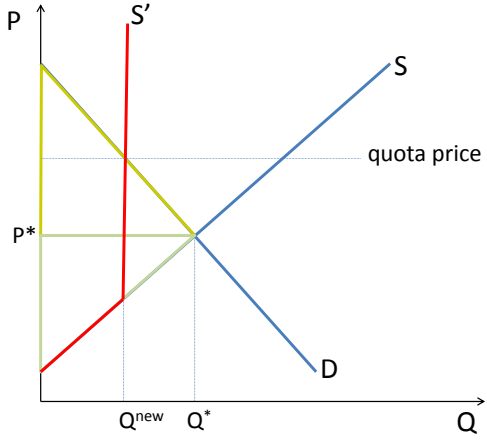

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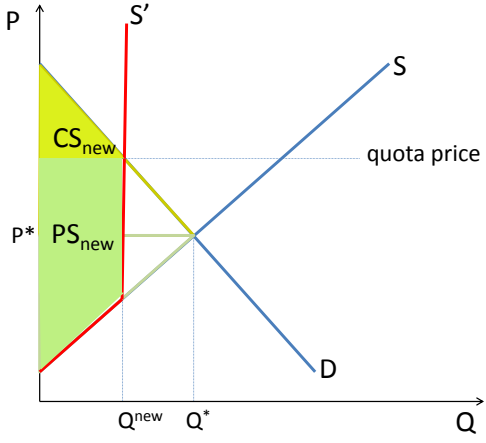
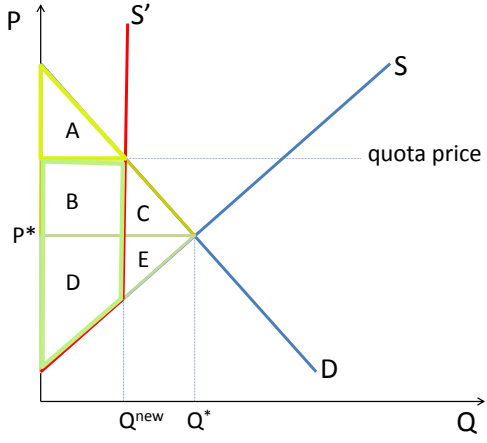


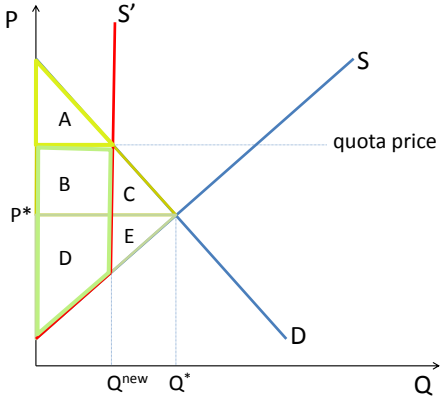
Quotas in Pictures

Figuring Out the Differences



Figuring Out the Difference, Details

- Before
  - $CS =$



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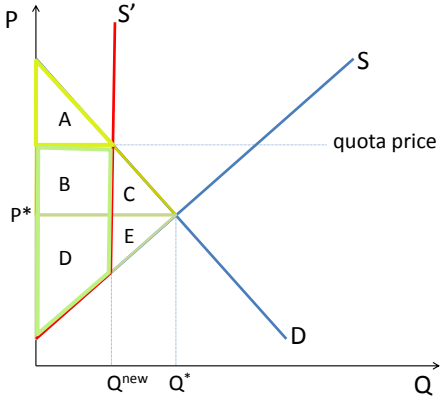

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  - $CS = A + B + C$
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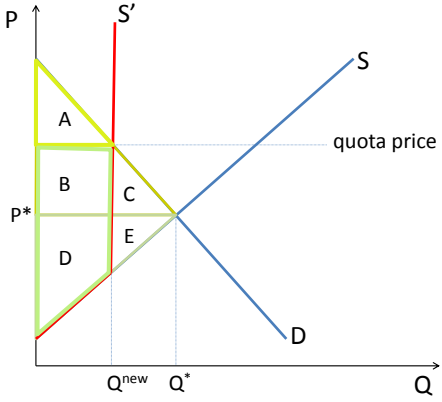

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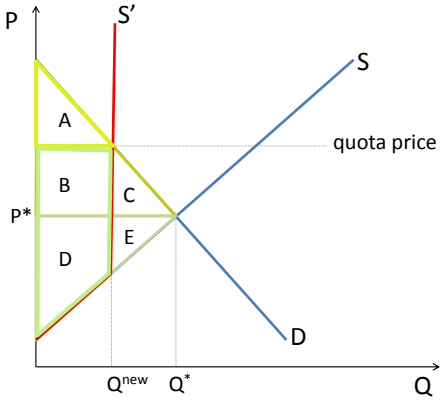

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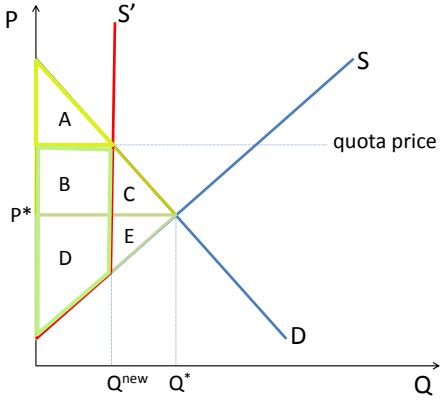

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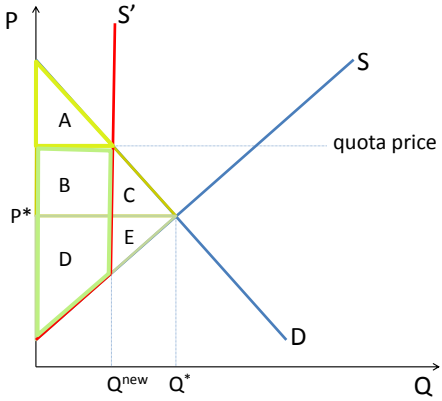

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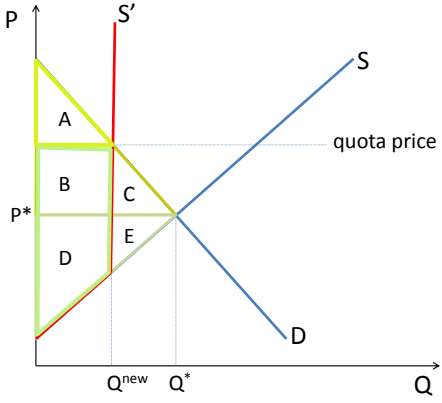

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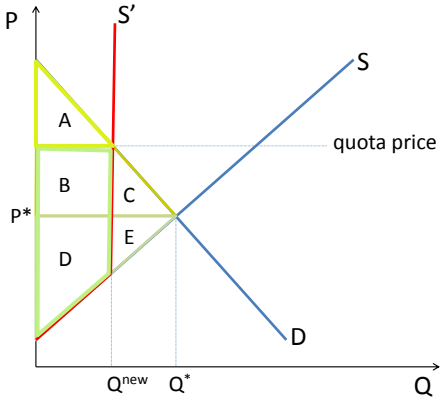

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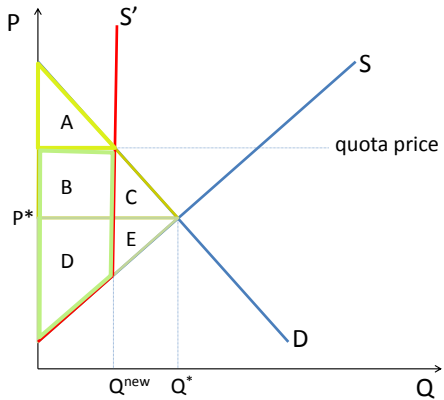

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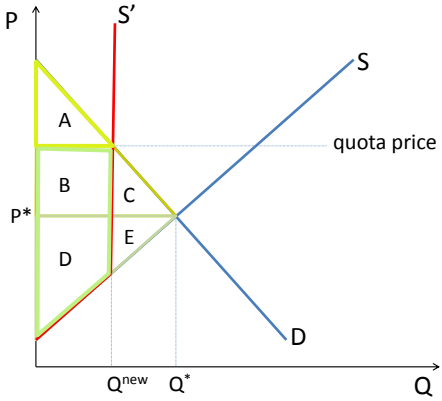

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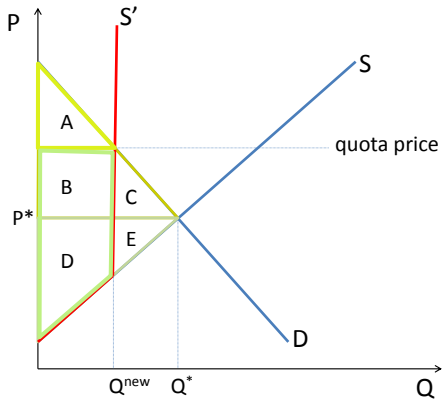

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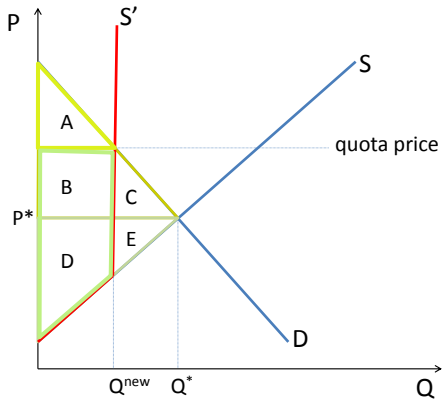

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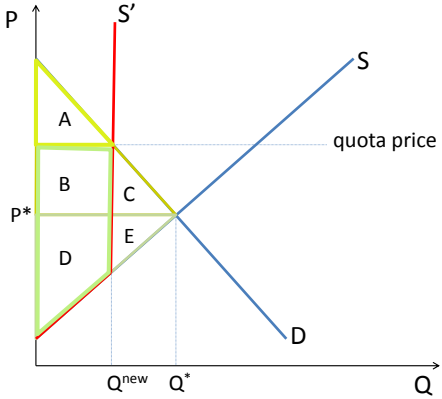
  - Note that nobody gets C or E after $\rightarrow$ trades that don't take place $\rightarrow$ DWL $= C + E$

Figuring Out the Difference, Details



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- Equilibrium $P*$ and $Q*$
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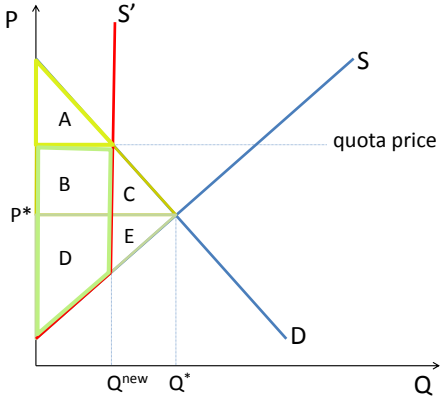

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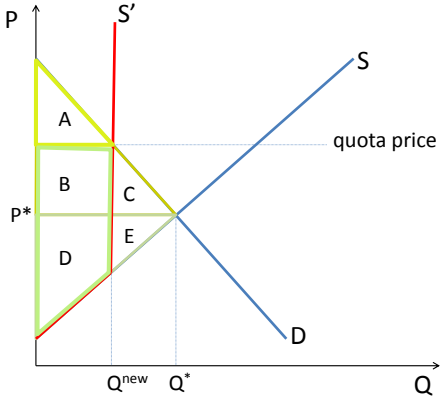

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- Price suppliers would choose at Q^{new}
  - P where $Q_S = Q^{\text{new}}$ from supply curve

Today: Consumer's Problem

Today: Shift to Consumers' Problem

- Until now
  - Supply and demand equilibria
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  - And policy choices that impact equilibrium outcomes
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- Next two classes focus on how economists think about consumer choices
- Today
  - Lay out consumer decision
  - Graphs with good X and good Y axes
- Lecture 6
  - Use consumer framework to understand responses to price changes and income changes
  - Review Use Numbers # 2

Why Do We Study the Consumer's Problem?

- Build up to the demand curve from first principles
- Understand consumer choices
- Clearly illuminate areas where policy can act
- Illustrate welfare consequences of policy choices
- Understand intuition of constrained maximization

Also Learn How Economists Think

- All decisions involve trade-offs
- Problems where agents try to do the best they can subject to constraints
- Called constrained minimization or maximization problems

Where We Are Going

1. Consumer preferences and utility
2. Indifference curves
3. Budget constraints
4. Optimization

Utility

Assumptions about Consumer Preferences

1. Completeness and Rankability
   - You can rank all your consumption choices
   - For two bundles A and B, you always either
     - prefer A to B
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4. The more you have of a particular good, the less of something else you are willing to give up to get more of that good

What is Utility?

Overall satisfaction or happiness

What is Utility?

Overall satisfaction or happiness

- Measured in utils!
- This framework allows us to describe what consumption or habits make you happier than other consumptions or habits
- It's not a tool for comparing across people

Some Example Utility Functions

Most general $U = U(X, Y)$

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They can take many forms, such as

- $U = U(X, Y) = XY$
- $U = U(X, Y) = X + Y$
- $U = U(X, Y) = X^{0.7} Y^{0.3}$

Marginal Utility

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Following our assumptions, what is generally true about marginal utility of X as consumption of X increases?

Basics of Marginal Utility

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- Your first cup of coffee: 3 utils
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- What is the marginal utility of the second cup?

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- 10 additional utils

Utility and Comparisons

- Ordinal: we can rank bundles from best to worst
- Not cardinal: we cannot say how much one bundle is preferred to another in fixed units
- We cannot make interpersonal comparisons

No other assumptions on utility apart from the four preference assumptions.

Indifference Curves

Indifference Curves, or What You Like

Indifference Curve Plan

1. What they are
2. Why they have the shape they do
3. Math for describing the trade-offs indifference curves describe
4. Substitutes and complements

Describing Your Utility

- Let i denote a bundle of goods, so $i \in \{1, 2, 3, ...\}$
- An indifference curve is a set of bundles (X_i, Y_i) where $U(X_i, Y_i)$ is the same for any i

Describing Your Utility

- Let i denote a bundle of goods, so $i \in \{1, 2, 3, ...\}$
- An indifference curve is a set of bundles (X_i, Y_i) where $U(X_i, Y_i)$ is the same for any i
- Suppose a consumer has two bundles, (X_1, Y_1) and (X_2, Y_2)
- Consumer is indifferent when $U(X_1, Y_1) = U(X_2, Y_2)$

Working Up to an Indifference Curve

- Give me two items

Working Up to an Indifference Curve

- Give me two items
- Each axis is a **quantity** of those items
- Give me some points where you are equally happy

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Why Can We Draw Indifference Curves?

- Because of the assumptions we made at the beginning about preferences: completeness and rankability
- All bundles have a utility level and we can rank them

Indifference Curves Level and Slope

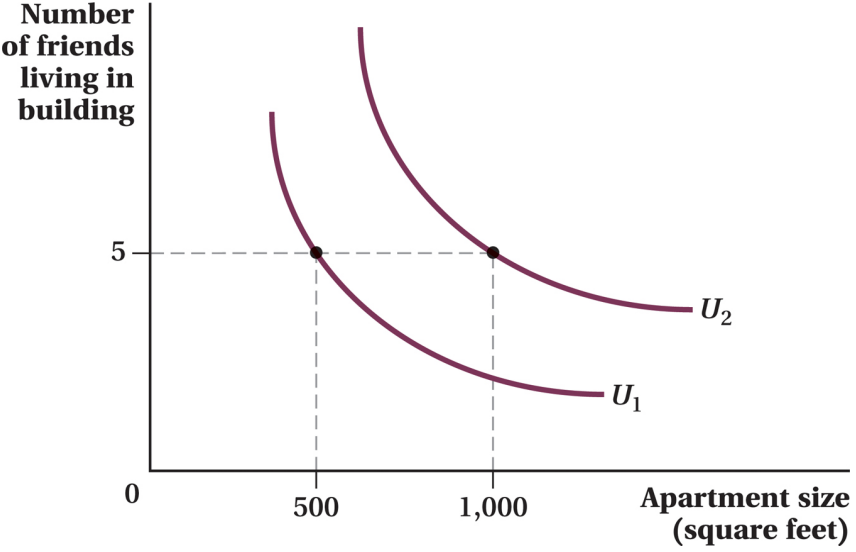
What does “more is better” tell us?

Indifference Curves Level and Slope

What does "more is better" tell us?

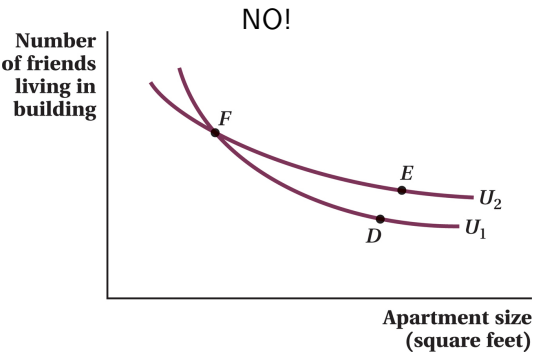
- That higher indifference curves give more utility
- Curve must have a negative slope
  - Suppose that you increase your consumption of X
  - "More is better" $\rightarrow$ you are happier
  - To be equally happy as before, you should give up some Y

More Utility on Curves Farther From Origin



Indifference Curve Shape

- Curves never cross
  - it would violate transitivity
- Curves are U-like (convex) with respect to the origin
  - Comes from assumption about diminishing marginal utility
  - Your willingness to trade off differs along the curve



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- So what changes as you move along the curve?

Steepness of the Indifference Curve

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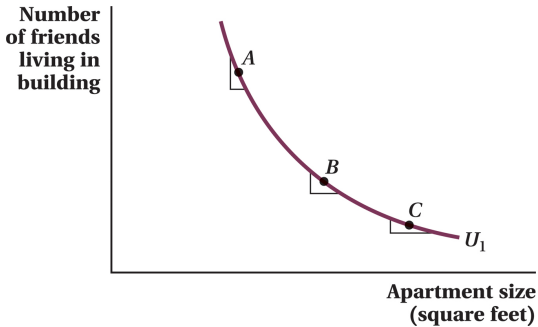
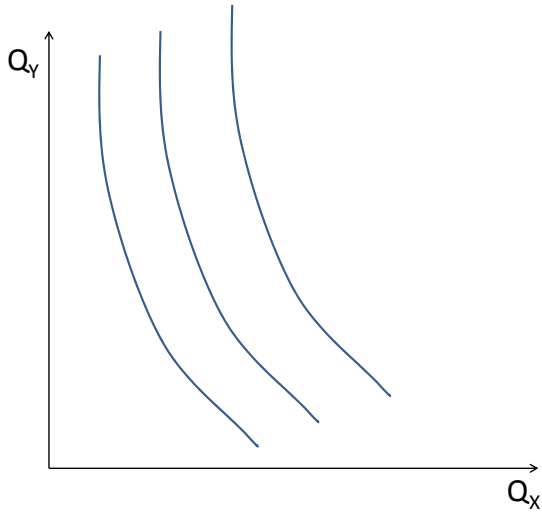
- So what changes as you move along the curve?
  - you are trading off X and Y
  - the rate at which you trade them off tells us how much you value them



When the curve is steep, what are you willing to give up more of?



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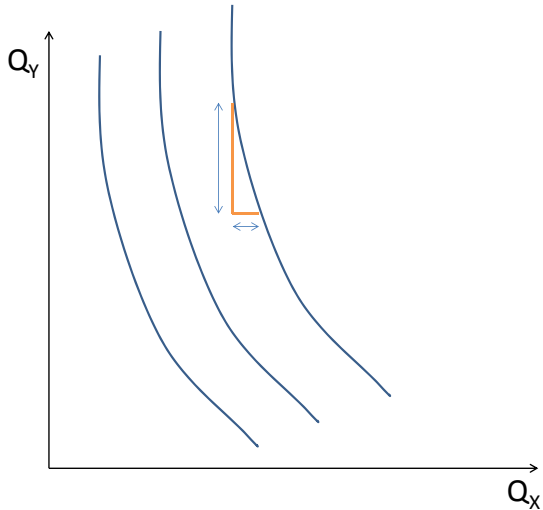

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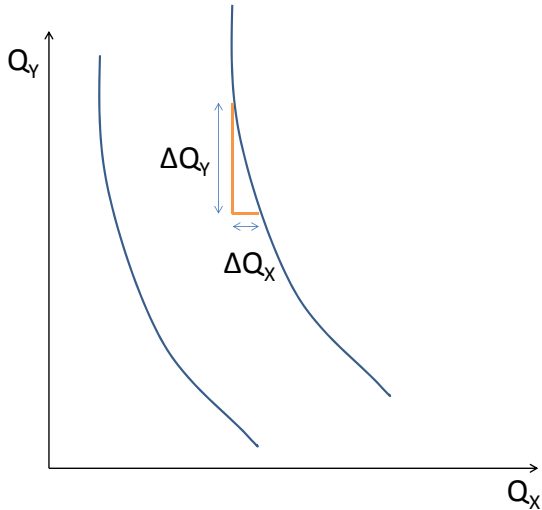

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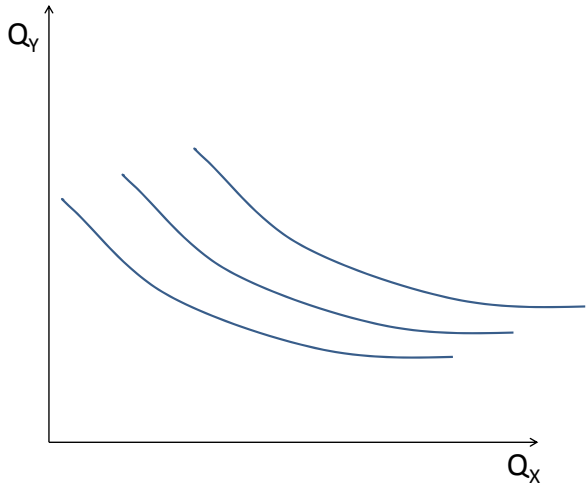

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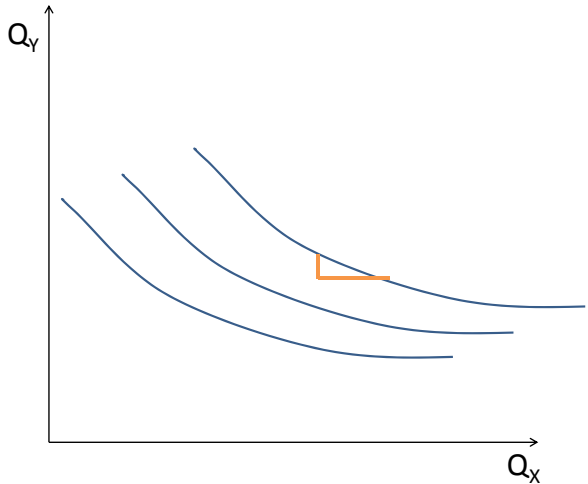

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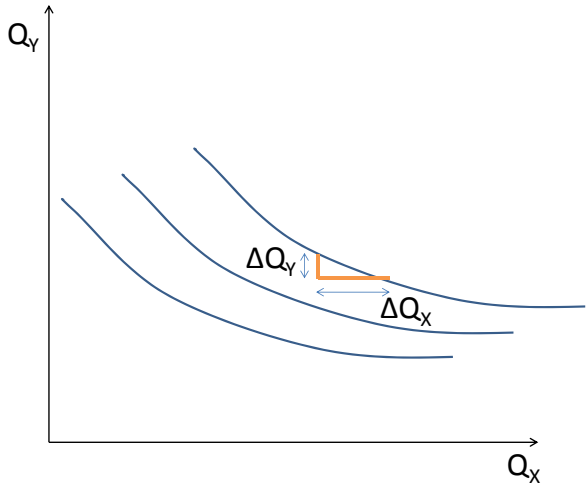

Quantifying the Trade-off in the Indifference Curve

- How much of X are you willing to give up for Y?
- **Marginal Rate of Substitution** is the trade-off
- Define

$$MRS_{XY} = (-1) * \frac{MU_X}{MU_Y}$$

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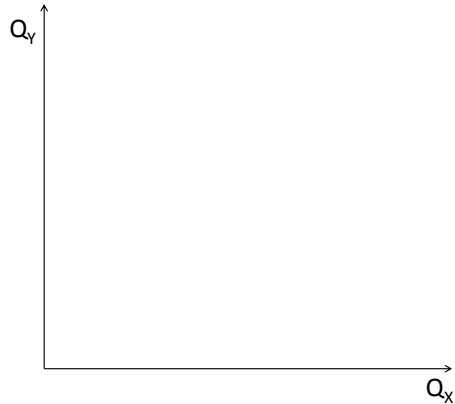
- Is it the same everywhere on the curve? Not necessarily.
- If you want a derivation, see the textbook!

Indifference Curves for Perfect Complements

Work with your neighbor!

- Suppose we have two goods that are perfect complements
- X and Y being perfect complements means each is useless without the other
- What do the indifference curves look like?
- We write this utility as $U = \min\{aX, bY\}$



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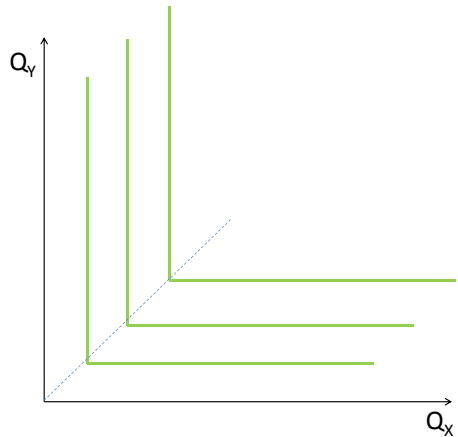

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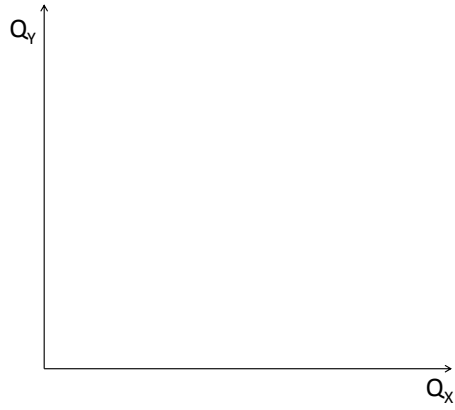

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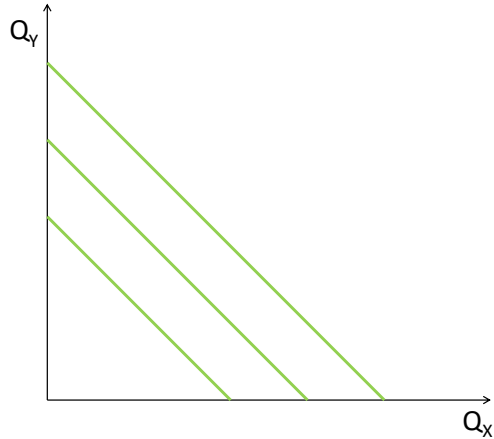
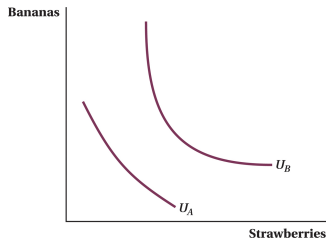


Curves May Change Shape as Consumption Increases



- the same person can have differently shaped indifference curves
- at different levels of happiness
- U_A: low happiness – willing to make any trade-offs
- U_B: high happiness – less willing to trade off

How Algebra Tells Us About Substitutes and Complements

In which equation(s) are X and Y substitutable? in which are they complementary?

- $U = U(X, Y) = XY$
- $U = U(X, Y) = X + Y$
- $U = U(X, Y) = X^{0.7}Y^{0.3}$

Budget Constraint

Budget Constraint, or What You Can Afford

Budget Constraint Plan

1. Define
2. Draw
3. Find slope

Budget Constraint Assumptions

1. Each good has a fixed price and infinite supply
2. Each consumer has a fixed amount of income to spend
3. The consumer cannot save or borrow

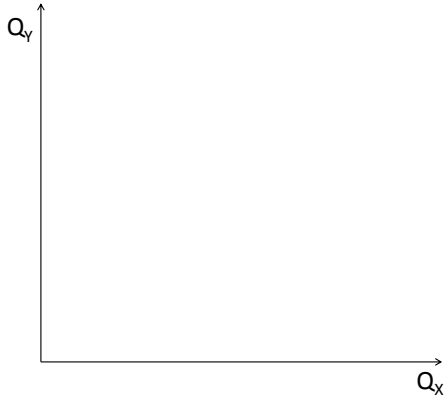
Defining the Budget Constraint

Budget constraint:

$$I = P_X Q_X + P_Y Q_Y$$

- **feasible bundle** $\equiv$ combinations of X and Y that the consumer can purchase with his income
- **infeasible bundle** $\equiv$ all the combinations the consumer is just too poor to get

Drawing the Budget Constraint



What if you spend all your money on X or all your money on Y?

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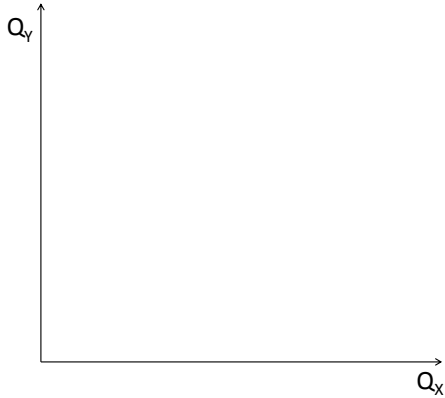

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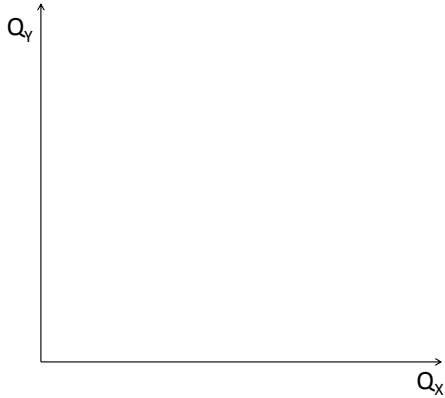

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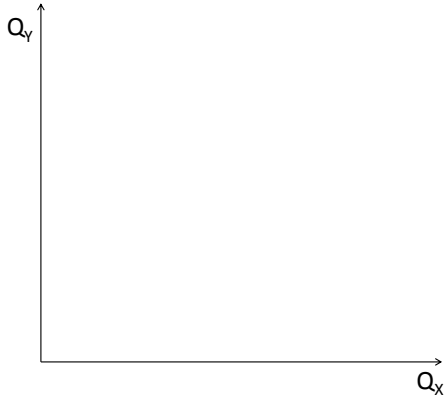

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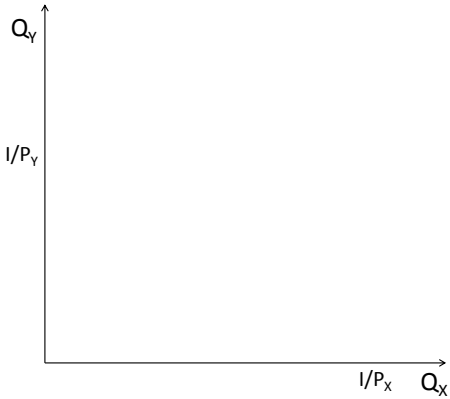

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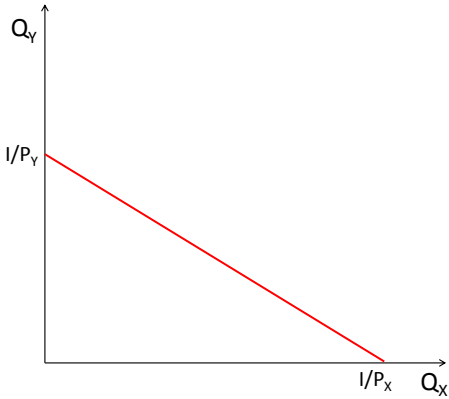

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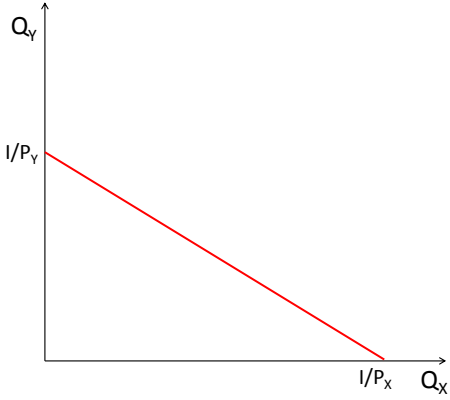

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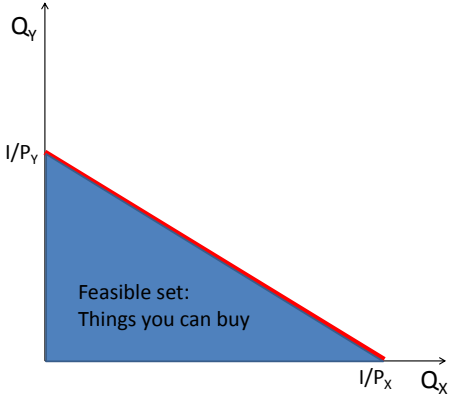
What points are feasible to purchase?

Drawing the Budget Constraint



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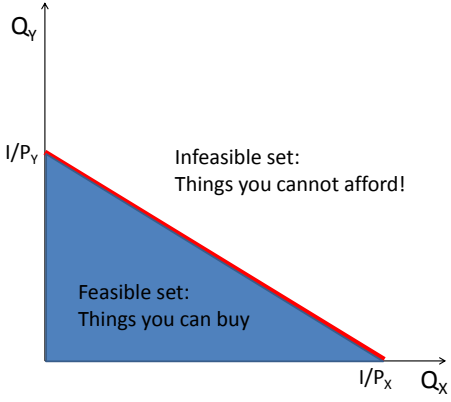

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Slope of the Budget Constraint

Algebra of the slope: Write $Q_Y = f(Q_X)$

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So an additional unit of Q_X requires you to give up $\frac{P_X}{P_Y}$ of Q_Y

What Two Things Affect the Position of the Budget Constraint?

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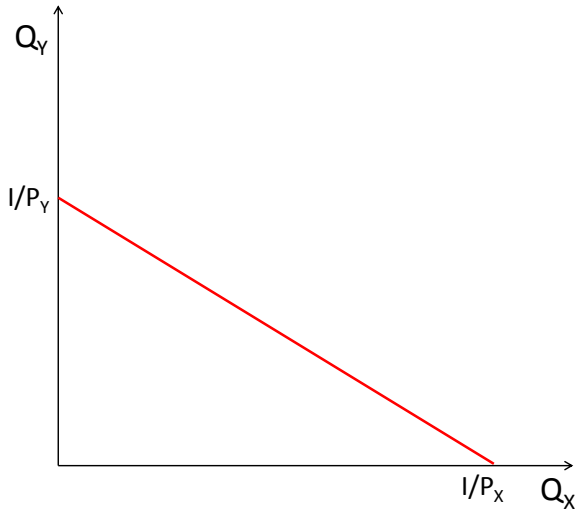
Prices and Income

What Happens if the Price of Y Decreases?



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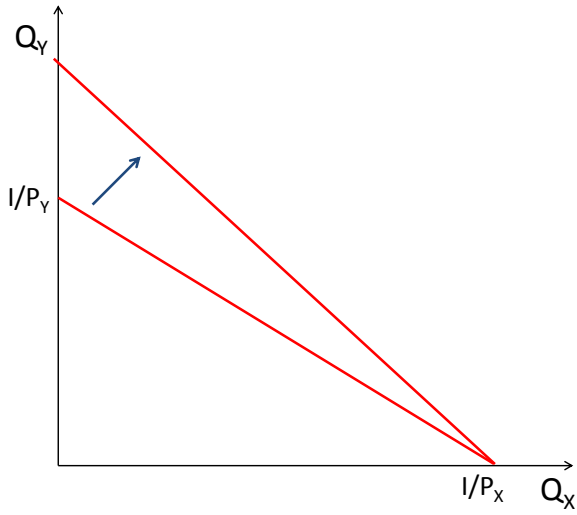

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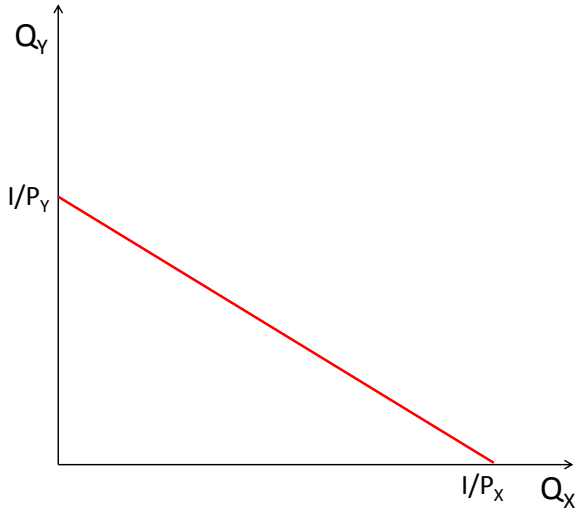

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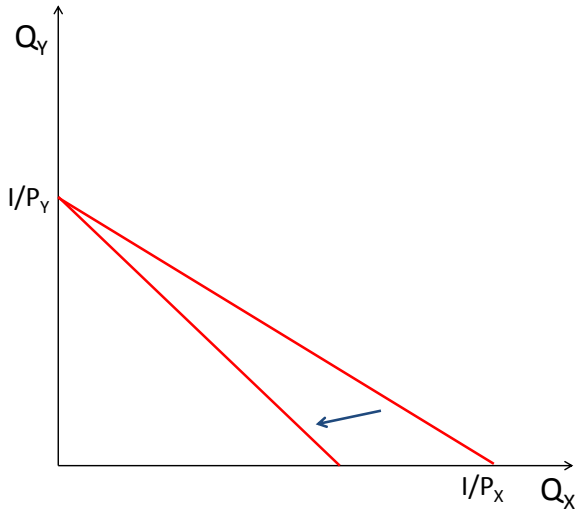

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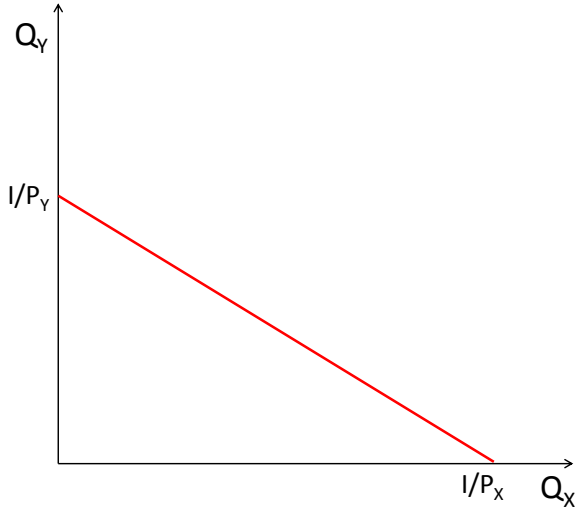

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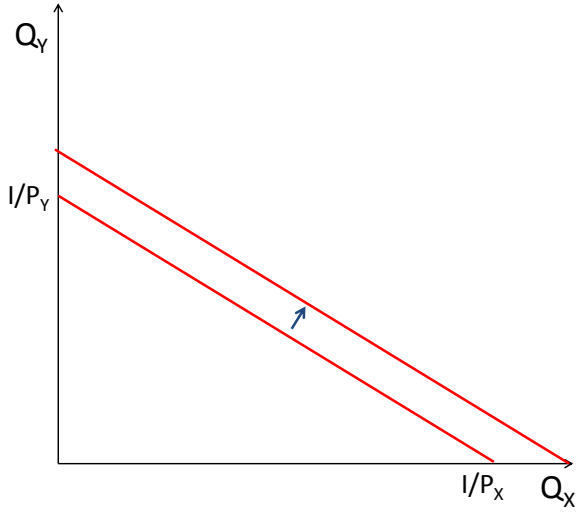

Budget Constraint Changes, In Sum

- Things that change the slope
  - Change in prices, P_X or P_Y
- Things that don't change the slope, but move the line in and out
  - Change in income

Optimizing

Optimizing, or
The Best You Can Do, Given What You Like and What You Can Afford

How to Be As Happy as Possible

- Maximize your utility given your budget constraint
- Can this person get the level of utility drawn on the indifference curve given his budget constraint?

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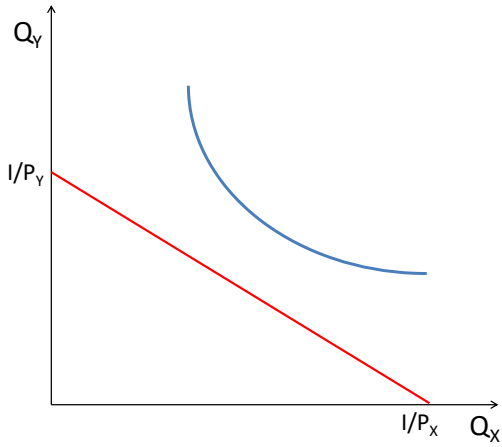

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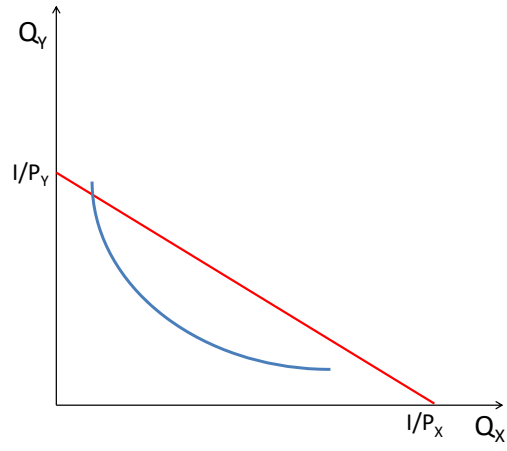

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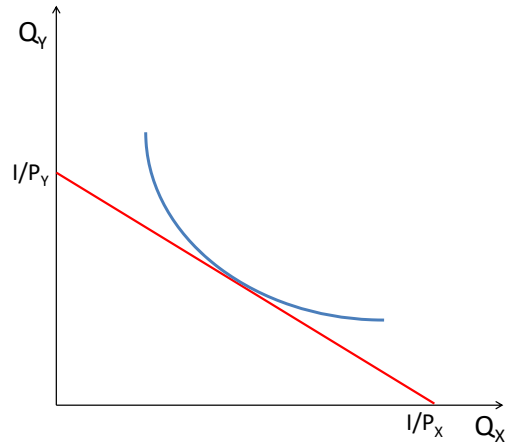

Algebra of Utility Maximization

- Utility is maximized, given the budget constraint, when the slope of the indifference curve is tangent to the budget constraint
- tangency $\rightarrow$ equality

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- One of the few formulae you need to memorize

When Are You Optimizing?

By definition

- if $MRS_{XY} = P_X/P_Y$ you are optimizing
- if $MRS_{XY} \neq P_X/P_Y$ you are **not** optimizing*

* unless you are at a corner solution, where you consume only one good

How to Find Optimal Consumption?

Start with two equations and two unknowns

- Budget constraint
  $I = P_X X + P_Y Y$
- Optimality condition
  $\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$
  MU_X and MU_Y are in terms of X and Y

This is enough to find optimal consumption of X and Y.

In-Class Problem

Set-up

- Sarah gets utility from soda (S) and hotdogs (H)
- Her utility function is $U = S^{0.5}H^{0.5}$
- Therefore
  - $MU_S = 0.5\frac{H^{0.5}}{S^{0.5}}$
  - $MU_H = 0.5\frac{S^{0.5}}{H^{0.5}}$
- Sarah's income is \$12
- Price of soda is \$2
- Price of hotdogs is \$3

Questions

1. Write the equation for Sarah's budget constraint
2. Draw Sarah's budget constraint
3. Write the marginal rate of substitution in terms of H and S
4. What amount of sodas and hotdogs makes Sarah happiest, given her budget constraint?
   - Recall that you have two equations and two unknowns
     - budget constraint
     - MRS = ratio of prices

Answer to In-Class Problem, 1 of 2

- We have two unknowns (optimal H and S), so we need two equations to solve for them
- Equation 1: From the information about income and prices, we can write a budget constraint

$$\begin{aligned} I &= P_S S + P_H H \\ 12 &= 2S + 3H \end{aligned}$$

- Equation 2: We know that at equilibrium $-MRS_{H,S} = -\frac{P_H}{P_S}$, or $-MRS$ is equal to the slope of the budget constraint.

$$\begin{aligned} -MRS_{S,H} &= -\frac{P_S}{P_H} \\ \frac{MU_S}{MU_H} = \frac{0.5H^{0.5}S^{-0.5}}{0.5S^{0.5}H^{-0.5}} &= \frac{2}{3} \\ \frac{H}{S} &= \frac{2}{3} \end{aligned}$$

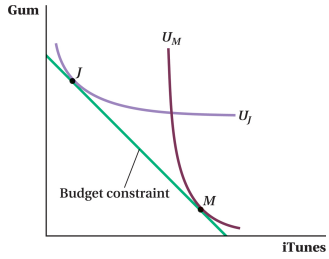
Answer to In-Class Problem, 2 of 2

Now we have two equations and two unknowns. From Equation 2, we know that $H = \frac{2}{3}S$. We can therefore plus this into the budget constraint:

$$\begin{aligned} 12 &= 2S + 3H \\ 12 &= 2S + 3\frac{2}{3}S \\ 12 &= 2S + 2S = 4S \\ S &= 3 \end{aligned}$$

If $S = 3$, then $12 = 2 * 3 + 3H$, which means that $6 = 3H$, or $H = 2$. And Sarah has spent all her money.

A Usual Maximization of Utility s.t. Budget Constraint



- People with different preferences
- But consume at the same *MRS*

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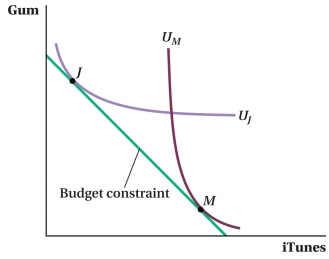

- People with different preferences
- But consume at the same *MRS*
- Because they face the same prices!
- But don't consume the same thing

What We Did This Class

1. Preferences and utility
2. Indifference curves – what you like
3. Budget constraint – what you can afford
4. Optimization – the best you can do given what you like and can afford

The Big Ideas

- Utility
- What you like: indifference curves
- What you can afford: budget constraint
- The best you can do given these two: optimization

Next Class

- Read Chapter 5
  - Omit income Engel curves from 5.1
  - Skip 5.3 entirely