

Perfect Competition

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Introduction

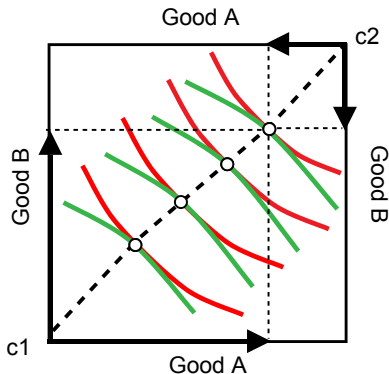
Today is (anti-)climax: put it all together

- 1 Refresh and extend pure trade equilibrium
 - Reminder about the Edgeworth box
 - Equilibrium existence and large economies
- 2 Production and comparative advantage
 - How trade aids production, as well as consumption
 - Effects of international trade: who wins and loses
- 3 Comparative statics and stability
 - Basic comparative statics follow from stability
- 4 Welfare theorems and their implications
 - Why the First Welfare Theorem doesn't favor market
 - Second Welfare Theorem and optimal redistribution
- 5 Why this is only the beginning
 - Hayek, information and prices

The benefits of trade and the Edgeworth Box

Recall: why did trade bring benefits?

- 1 I have things that you value more and vice-verse
- 2 Trade allows us to each have what we value most
- 3 Simple representation was Edgeworth Box



Exchange efficiency and the Welfare Theorems

Not only do we know that there are gains from trade?

- 1 We know any equilibrium is Pareto efficient
 - At equilibrium, everyone must be tangent to prices
 - But this makes them tangent to one another!

$$\frac{MU_x^i}{MU_y^i} = MRS_{xy}^i = \frac{p_x}{p_y} = MRS_{xy}^j = \frac{MU_x^j}{MU_y^j}, \forall i, j$$

- ⇒ Each individual's optimization leads to social optimization
- This is the invisible hand of the market

- 2 In fact, *any Pareto efficient allocation is an equilibrium*
 - Just transfer endowment from one to another
 - Anything efficient happens at *some* point of tangency

Much of today just reiterates, in terms of production

- I won't go over formalism of Robinson Crusoe, read in book

Non-convexities: example of equilibrium non-existence

But this all assumes very smooth preferences

- What if discontinuities, non-convexities?
 - May seem technical problem but indivisibility common
 - Houses, cars, spectrum...what isn't indivisible?
 - Simple example useful
 - Two people, two goods
 - Charlie views goods as perfect complements, values at \$1
 - Sonia views as either-or, values at \$.75
 - No equilibrium; why?
 - 1 If either price below \$.75, Sonia will buy one, but not other
 - 2 Charlie will only buy together, and only if total below \$1
- ⇒ Only efficient for Charlie to have both, but not equilibrium
- But there's a problem here: only two people!
 - If Charlie had both, he wouldn't sell below \$1
 - If Sonia had one, she'd offer to Charlie for \$1
 - But this is monopoly...we'll get to this soon

Large markets and the solution

The point is that, if competitive, should be more than two people

- Suppose mass .5 of Charlie's, Sonia's and each good
- Then can you see the equilibrium?
 - ① Half of Sonia's satisfied with each good
 - ② Half of Charlie's get bundle
 - Optimal: on average Charlie's value at .5, Sonia's at .75
 - ③ Prices are .5 for both goods: everyone indifferent
- What happens at $(.5, .5)$ prices in finite economy?
 - Aggregate demand could be $(1, 0)$, $(0, 1)$, $(2, 1)$, or $(1, 2)$
 - So aggregate supply in *convex hull*, but not in demand
 - Having more people *convexifies*
- Basic idea works even in (large) finite economy
 - If even number, everything works perfectly
 - If odd (say 3) then only one problematic good pair
- $(.5, .5)$ and efficient allocation *approximately equilibrium*

Broader lessons about equilibrium existence

Very simple example but teaches some broader lessons:

- 1 Large numbers and uncertainty/heterogeneity convexify
 - Thus in most realistic settings, equilibrium exists
 - True in game theory as well as general equilibrium
- 2 Message particularly true in general equilibrium
 - If small numbers, people will not take prices
 - If real issue, look to monopoly or oligopoly
- 3 If equilibrium fails to exist, you've written model wrong
 - Non-existence is not a "real" problem to worry about
- 4 In worst case, change notion of equilibrium
 - Approximate equilibrium serves motivation almost as well
 - Always ask whether this is right idea of equilibrium
 - *Don't be a slave to definitions and formalism!*

The idea of comparative advantage

What does production add to benefits of trade?

- Brazil is great at growing sugar; costs 1 computer for a ton
- China is great at building computers; costs $\frac{1}{10}$ ton
- We say China has *comparative advantage* in computers
 - Brazil in sugar, even if China can produce both cheaper
 - If so China has *absolute advantage* in both
- Regardless, both do better if focus on CA
- If China can produce 100 computers and Brazil 8 tons...
- Then together then can produce 80 computers and 10 tons
- Alone, for nearly same ratio, China would produce 50 and 5
- Brazil would produce 7 computers and 1 ton
- Together only 57 and 6: much worse!
 - ⇒ Very analogous to trade: everyone consumes what they like
 - Everyone produces what they are best at

Graphical depiction of comparative advantage

Who loses? The Stolper-Samuelson Theorem

Now suppose two different groups own farms and factories

- Overall we can produce more but...
- Now prices will be in middle: say 5 computers per ton
- Thus Chinese farm owners' price cut in half!
- And Brazilian factory owners' price falls five times!
- Brazilian famers, Chinese producers benefit more
 - ⇒ Overall social gain, but loss to *scarce factor*
 - This is called the Stolper-Samuelson Theorem
 - We could compensate (economists advocate) but problems:
 - If too much, could lead to strategic protectionism
 - ⇒ Imperfect compensation, lobbying by scarce factor
- In US, labor scarce compared to most developing countries
 - ⇒ Labor unions are usually the supporters of protectionism
- Some politics explained this way (UK and German history)

Other sources of gains from trade

Classic comparative advantage based on “natural endowments”

- Clearly crucial in many areas
 - 1 China-Latin America/Africa natural resource boom
 - 2 Latin America-US trade in agricultural goods
- But missing many important sources of gains from trade
 - 1 Endogenous specialization and the Krugman model
 - Japanese do hardware, US does software
 - Any particular “comparative advantage”?
 - Mostly chose to specialize just to be different
 - Everyone gains from various regions “focusing”
 - Spillovers, increasing returns lead to focus, cities
 - 2 Talented individuals reach bigger audience (Melitz model)
 - A bit like comparative advantage, but not “focus”
 - Just exploit natural differences in ability
 - 3 Many others, but all have connected logic

The comparative statics of equilibrium

What happens if supply rises?

- You'd expect quantity to rise, consumer price to fall
 - Comes from normal supply and demand
- This is still true, but a bit more subtle
- Let's look at it mathematically
- In single market, equilibrium is $s + S(p) = D(p)$ so

$$\frac{dp}{ds} = ? \frac{1}{D'(p^*) - S'(p^*)}$$

- Classic elasticity formula; must be negative because
 - 1 Demand slopes down and supply up, but more importantly...
 - 2 If at equilibrium demand cut from below, unstable
 - If price rose a little, excess demand would drive higher, etc.
 - Price would rise (or fall) out of control
- $D(p) - S(p)$ excess demand $E(p)$; stability $E' < 0$

Graph of the Correspondence Principle

The Correspondence Principle

This reasoning has an analog for general equilibrium

- Consider two dimensions: $\mathbf{E}(\mathbf{p}) = \begin{bmatrix} E^1(\mathbf{p}) \\ E^2(\mathbf{p}) \end{bmatrix}$, $\mathbf{s} = \begin{bmatrix} s^1 \\ s^2 \end{bmatrix}$

- Equilibrium is $\mathbf{E}(\mathbf{p}) = \mathbf{s}$; implicit function theorem here?

$$\frac{d\mathbf{p}}{d\mathbf{s}} = \left[\frac{\partial \mathbf{E}}{\partial \mathbf{p}}(\mathbf{p}) \right]^{-1}, \text{ where } \frac{\partial \mathbf{E}}{\partial \mathbf{p}}(\mathbf{p}) = \begin{bmatrix} E_1^1(\mathbf{p}) & E_2^1(\mathbf{p}) \\ E_1^2(\mathbf{p}) & E_2^2(\mathbf{p}) \end{bmatrix}$$

- By the 2x2 matrix inverse formula:

$$\left[\frac{\partial \mathbf{E}}{\partial \mathbf{p}} \right]^{-1} = \frac{1}{E_1^1 E_2^2 - E_2^1 E_1^2} \begin{bmatrix} E_2^2 & -E_2^1 \\ -E_1^2 & E_1^1 \end{bmatrix}$$

- So equivalent is that $E_1^1, E_2^2 < 0$ and $E_1^1 E_2^2 > E_2^1 E_1^2$
- Similar to negative definite, but not symmetric
- Stability = right CS's: Correspondence Principle

⇒ *Always check stability conditions (just like 2nd order)*

Productive efficiency and the First Welfare Theorem

Just as with trade, with production all equilibria are efficient

- Now production possibilities also tangent:

$$\frac{MC_x^i}{MC_y^i} = MRT_{xy}^i = \frac{p_x}{p_y} = MRT_{xy}^j = MRS_{xy}^k$$

- Everything made tangent by prices, exactly efficiency
- Production really no different from consumption....
- Utility is just money, but otherwise same

First Fundamental Theorem of Welfare Economics

All market allocations are Pareto optimal.

- Invisible hand again
 - Markets can be useful if just to compute optimum
- ⇒ Used in situations typically considered “non-market”

Other applications of market mechanisms

Some unusual applications of markets include?

1 Marriage and matching

- Gale-Shapley (62) and Becker (73): marriage like market
- People do the best they can, given who will take them
- Gale-Shapley proposed centralized market mechanism
- Al Roth and others applied to create kidney, medical match

2 Course allocation

- You are probably pretty aggravated with course sign-ups
- Budish (2010) proposes solution: use a market
- Everyone gets fake money, spends on courses
- If everyone same money, fair, and efficient

3 Perhaps in future: delegated financial investing

- Good investing complicated for humans, easy for computers
- You could give your information to computer, internal market
- Fast, easy for people, no need for physical currency, etc.

Redistribution and the Second Welfare Theorem

Second Welfare Theorem also still holds

- ⇒ Any Pareto optimal allocation can be achieved by market
- Right amount of money just needs to be redistributed
 - This leads economists to avoid price interventions:
 - 1 Money should be directly distributed
 - 2 Then market should be allowed to operate

Why direct redistribution is difficult

In practice this is impossible; why?

- 1 Money must be redistributed independent of actions
- 2 But most people have most wealth in human capital
- 3 But how much? Hard to know
 - Wage rate and other measures not great
 - Don't really capture the potential job person might get
- 4 If you require fixed amount, and they don't pay, what to do?
- 5 What if someone has talent, but wants to live like bum?
 - Or do public service, or something like that...
 - Do you really want to throw them in jail?

Exceptions do exist though: Henry George's land tax

- Henry George famously argued land value fixed
- So advocated *land value tax* (not property tax)
- Efficient, but distributive effect never popular (why?)

Real-world message of Second Welfare Theorem

In practice, interpretation is a bit different

- 1 Redistribution should be as direct as possible
 - Taxes should fall on income, total consumption, etc.
 - Many economists even oppose capital gains taxes
 - Biases inter-temporal consumption trade-off
- 2 Redistribution should usually not affect goods prices
 - Many programs aim to subsidize goods consumed by poor
 - Many developing countries have fuel, corn subsidies
 - These are almost always misguided:
 - Not even distributively effective: just give money to poorest!
 - Cause vast over-consumption of relevant product
- 3 When it does affect goods prices, logic more subtle
 - Taxes penalize work, tax leisure complements (vacations)
 - Or: if people better off given income consume more, tax

Socialist interpretation of Welfare Theorems

You learned pro-market interpretation of Welfare Theorems

- Market does everything efficiently, so leave it alone
- But this is not how they have always been seen
- Many famous socialists argued what?
 - 1 Planner can just implement the relevant conditions
 - 2 Markets, in practice, suffer from many imperfections
 - Market power, externalities, public goods, mistakes
 - We'll study these throughout the rest of the course
 - 3 Socialism would be more efficient, true “market” allocation
 - 4 Welfare theorems warn against stupid local deviations...
 - Don't subsidize things as a way of redistribution
 - But they may even favor highly centralized system
 - Think of the non-market applications I gave earlier...

⇒ Welfare theorems do not favor “capitalism” or “market”

Parsimony of information in prices

If not this, then what is good about markets?

- Famous answer given by von Mises (and Hayek)
- For planner to make these decisions, needs information
- How would she get this without prices?
 - Imagine trying to build a railroad
 - Go around mountain or tunnel through?
 - You have weigh off labor, time saved, materials etc.
 - Without prices, how do you judge?
 - You'd need to do a huge calculation!
- In price system, all you need to know is a few prices
 - Only need to learn a few things
 - At the same time incorporates your “local knowledge”
 - Market fundamentally *information aggregator*
 - Nobody knows how to make a pencil

Value of delegation by markets

Thus, if market failures are main cost, *delegation* main benefit

- If individuals have information government doesn't...
- Value in allowing the market to function, despite problems
 - 1 How much to redistribute?
 - If we knew everyone's potential income, lots
 - But difficult for reasons above
 - So each according to his ability requires paying
 - 2 When does regulation make sense?
 - Keep prices down, hard when company knows costs
 - 3 Prizes v. patents
 - Prizes avoid elevated prices, but which deserve?
 - 4 How much information to give consumers?
 - Could give very blunt labels based on expertise
 - Or lot of detailed information
 - Depends on what is useful to consumer

Distortions v. delegation and information technology

Market distortions \implies centralization better absent information

\implies Capitalism justified by lack of computation, information

- What happens as information becomes more public?
 - In Internet Age, local knowledge is gradually retreating
 - Most knowledge consumers use is on internet
 - We are not there, but that is the direction

\implies Erodes case for capitalist institutions

- 1 Decision engines increasingly making choices for us
 - 2 Case for prizes, free Apps, etc. gets much stronger
 - 3 Easier to monitor income, ability \implies more redistribution
 - 4 Consumer decisions in financial markets bad, centralize
- Many of these changes managed by market
 - But also erode its value
 - Will capitalism be its own undoing?

Optimal paternalism and Mill's perspective on liberty

We are used to taking as self-evident value of liberty

- But J. S. Mill, great economists, took different perspective
- Why do parents gradually give children more freedom?
 - Parent and children have different preferences, goals
 - Child gradually comes to know self, more similar goals
 - Conflict decreases and private information increases...
 - Value of delegation rises, control diminishes
- Similar why we let parents basically take care of children
 - Goals of society for child usually quite different from parents
 - But parents know more about child than government does
 - Thus unless they are horrible to child, we let them decide
- Liberty broadly: valuable to extent of special knowledge
 - Thus welfare we use valid only when individual knows best
 - Economic evaluation of welfare will change as this does

Market failures, information and the rest of the course

Throughout rest of the course we will explore these trade-offs

- We'll see the ways in which individuals, markets misbehave
- But we'll also see how hard it is to get relevant information
- Degree of intervention optimal will depend on this balance
 - Many interventions don't need to be "government" per se
 - Crucial point is centralization or guiding of decisions
 - Don't focus in doctrinaire way on market v. government
 - Key point is how resources are allocated, trade-offs
 - Most of these are *quantitative* not *qualitative* decisions
 - *How much* should *who* decide on *when*
 - Detailed properties matter a whole lot
 - The coming weeks will tune you into these
 - Beat out of you wrote ideological reactions problems
 - This is what it really means to be an economist