

Lecture Note 12 – International Trade and the Principle of Comparative Advantage

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1 International Trade and the Principle of Comparative Advantage

We now want to add international trade to our study of general equilibrium, Pareto efficiency, and social welfare. Our objective is to answer the following questions:

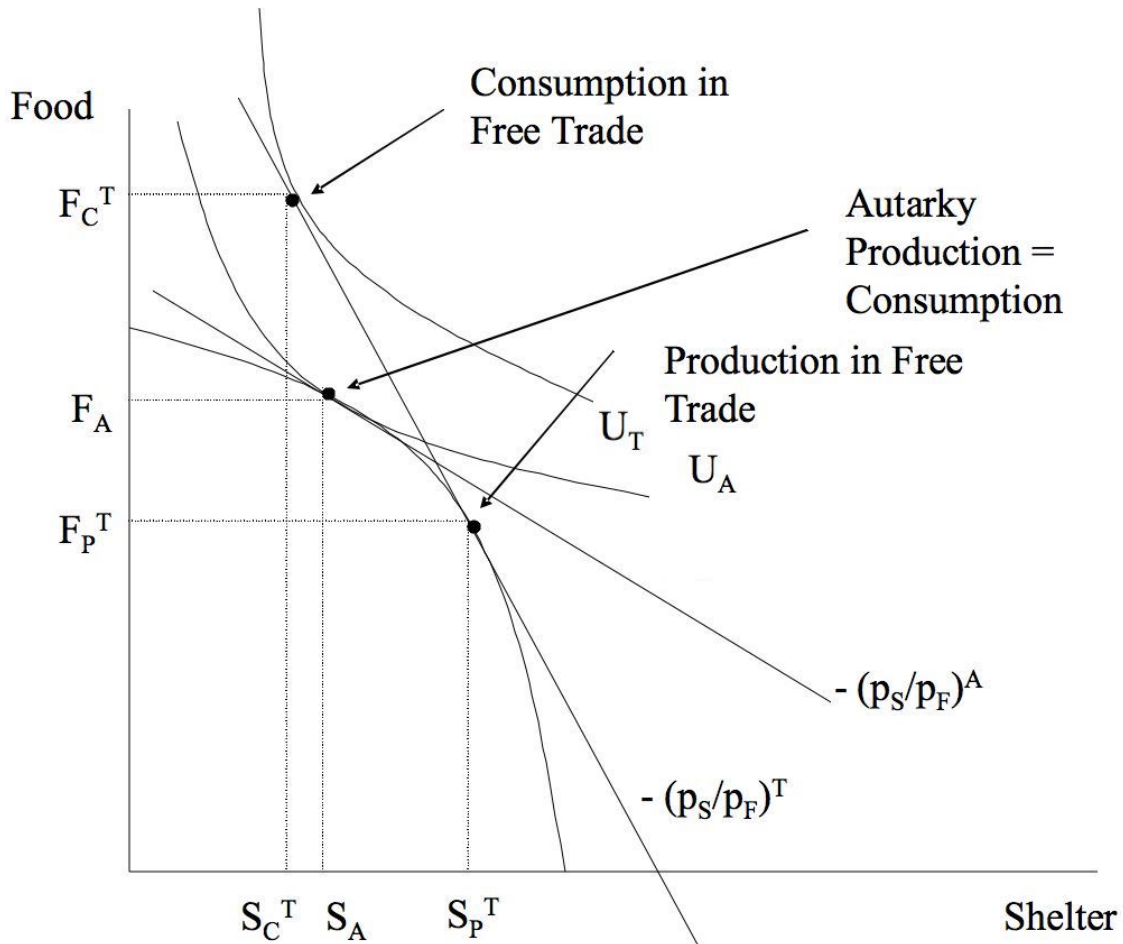
1. Are the gains from international trade necessarily positive in aggregate? Or does the answer depend upon which country we are trading with?
2. What are the underlying economic factors that give rise to gains from trade?
3. Why is it only differences in the price ratio across countries that matter for trade, rather than differences in the absolute level of prices?
4. If the gains from (international) trade are necessarily positive in aggregate, why is trade so often strongly opposed?

In the notes below, we use word trade somewhat differently than in our previous discussion of the Edgeworth box. Here, we will distinguish between trade meaning international trade, and *autarky*, meaning trade only among citizens of a given country. In both cases, citizens engage in trade, but under autarky, this trade does not cross borders.

1.1 Trade in the General Equilibrium Diagram

- As discussed in Lecture Note 10, we can think of the General Equilibrium problem as a utility maximization subject to three constraints:
 1. No actor is worse off in the market equilibrium than in the initial allocation. This is satisfied because a person could always refuse to trade and consume her original endowment instead.
 2. In equilibrium, no party can be made better off without making another party worse off (otherwise there are un-exhausted gains from trade).
 3. No more goods can be demanded/consumed than the economy is endowed with. That is, sum of the consumption of both parties cannot exceed the total endowment.
- Now, we want to analyze how opening to international trade affects utility in the previously closed economy.

- A critical thing to notice here is that *opening to International trade relaxes the 3rd constraint*. Countries that are trading can potentially swap part (or all) of their endowments with their trading partners. In an equilibrium with international trade, residents of a country may consume more of certain goods than it's original endowment (e.g., it could trade some food for shelter and hence consume more shelter than it could possibly produce). That doesn't mean it can buy anything it wants; it has to be able to afford the goods it desires by trading the goods it has. But the budget set of residents in this country can now extend beyond the borders of the country-level Edgeworth box (but remember that nobody can consume less than zero of any good).
- To illustrate this point, let's draw the *Production Possibilities Frontier* (PPF) for an entire country. I'll spend a number of subsequent bullet points walking you through this figure.



- The initial consumption possibilities for the country called Home under *autarky* (no trade) is depicted by the Production Possibility Frontier (PPF) for Food and Shelter (F and S).

- The PPF represents the set of bundles that the country Home could create using its initial endowment. The concavity of this *PPF* stems from an underlying assumption that as Home devotes more and more of its resources to either food or shelter, it experiences diminishing marginal returns to the expanding sector. For example, if Home doubles the resources used to produce food, it gets less than double the output. Why would this be true? It's likely that the suitability of land for farming in Home varies across locations—some areas offer flat fertile fields, others rocky hilltops. Similarly, it's likely that some heavily wooded areas are suitable for shelter production whereas others offer mostly tall grasses.¹ Efficient resource utilization implies that Home will devote the best farming land to farming and the best shelter land to construction of shelter. If Home were to produce exclusively food, it would have to place low quality growing land into production, leading to diminishing marginal returns. Conversely, if it devoted all land to shelter production, shelter output per acre of land would also fall. [Even if all land in Home were identical, it is still likely that Home would have a concave PPF for another reason: variation in the suitability of labor (i.e., skills) for farming versus shelter construction. Specifically, workers trained as carpenters don't necessarily make productive farmers and vice versa.]
- We call U_A the “community indifference curve”, which represents the preferences of a country. There are whole sub-fields of economics studying the extent to which we can model a country's “preferences” like we model an individual person's preferences, and you'll learn all about the exciting technical details if you enroll in an Economics PhD program. In this lecture, we want to show how trade can open up new opportunities for large groups of people, so we won't sweat the technical definition of what it means for a country to have preferences: just think of this as the preferences of a country's residents in a broad sense.
- Assume for simplicity that $\left(\frac{P_S}{P_F}\right)_A = 1$. Hence, the slope of the *PPF* at the point of tangency with U_A is equal to 1. This won't affect our main results and will simplify notation.
- In the world before trade, production/consumption of F and S are given by F_A and S_A .
- Now imagine this country Home opens to world trade. For simplicity, take the case where Home is *small* relative to the rest of the world: Home's consumption has no

¹Houses made out of sod (tall grasses) were commonplace in the American prairie in the 19th century and earlier. When railroads began to provide a relatively inexpensive supply of lumber to the prairie, sod houses were quickly displaced by wood frame houses.

effect on World prices (i.e. it is a price taker). This means that the World price ratio $\left(\frac{P_S}{P_F}\right)_W$ is constant from Home's perspective: no matter how much F, S it buys/sells on world markets, the world price will be the same.

- How will Home's production, consumption, and utility be affected by the option to engage in international trade?
- Provided that $\left(\frac{P_S}{P_F}\right)_A \neq \left(\frac{P_S}{P_F}\right)_W$, the movement from autarky to free trade effectively expands the domain of Home's budget set. Aggregate utility must rise. To see this, draw a ray with slope $\left(\frac{P_S}{P_F}\right)_W$ tangent to the PPF . Denote the points S_P, F_P as the quantities of S, F that correspond to this tangency point. The subscript P refers to Production. These points are the quantities of F, S produced.
- This ray is the new budget set for Home, I_H . Why? Because as far as Home is concerned, the world endowment of S_P, F_P available to them is any bundle satisfying:

$$I_H = S_P P_S^w + F_P P_F^w,$$

All combinations of P, S that lie on this set are now feasible.

- Except for the single point of tangency, the new budget set lies strictly above the original PPF at every point. Home will necessarily achieve a higher level of aggregate utility, represented in the figure by U_T . Home can produce one bundle, represented by S_P, F_P and consume *any other* bundle on the new budget set. In this case, this new bundle is given by S_C, F_C where the subscript C denotes consumption.
- Notice that for each good, the quantity produced differs from the quantity consumed. Hence, there will be imports and exports. In particular

$$\text{Exports} = S_P - S_C,$$

$$\text{Imports} = F_C - F_P.$$

- Will there be a trade imbalance? Bundles (S_C, F_C) and (S_P, F_P) lie on the same budget line, so they must cost the same:

$$\begin{aligned} S_P P_S^w + F_P P_F^w &= S_C P_S^w + F_C P_F^w, \\ P_S^w (S_C - S_P) + P_F^w (F_C - F_P) &= 0. \end{aligned}$$

There is no trade imbalance.

- This is an important observation because many policy discussions confuse the question of trade balance with trade itself. Trade itself is beneficial in aggregate—and of course there is no *aggregate* trade imbalance summing over all countries (every import is someone else’s export). For a given country, a trade imbalance may be harmful or beneficial—but this is a distinct and separable question.
- So to summarize:
 - Home still produces on the original *PPF*.
 - But Home consumes above its original *PPF*.
 - This gap between production and consumption indicates that Home gained from trade.

- Note also that it is not an accident which good Home is importing and which good it is exporting. Because

$$\left(\frac{P_S}{P_F}\right)_W > \left(\frac{P_S}{P_F}\right)_A,$$

Home holds a *comparative advantage* in producing shelter. It can produce *S* relative to *F* at comparatively low cost relative to the rest of the world.

- Accordingly, as Home opens to trade, it increases its production of *S* and decreases its production of *F*.
- Notably, after trade opening, Home’s total consumption of *S* has fallen and its total consumption of *F* has risen. Why? Because, when choosing consumption, Home faces the world price of these goods. Why not its original autarky price $\left(\frac{P_S}{P_F}\right)_A$? Because Home can now sell *S*, *F* at the world prices, the *opportunity cost* of consuming them at Home is the price they could have fetched on the world market. The rise in consumption of *F* follows from its lower price on the world market. (Note that it is also possible for consumption of *S* to rise somewhat due to the income effect, if *S* is a normal good and the gains from trade are sufficiently large.)
- This last observation (i.e., the decline in consumption of *S*) explains why, for example, Colombians usually drink pretty bad coffee, despite the fact that Colombia is one of the world’s leading coffee growers. Because consumers worldwide are willing to pay a relatively steep price for Colombian coffee, its opportunity cost of consumption—even in Colombia—is high in terms of foregone earnings.

2 Where do the gains from trade come from?

- The first thing to notice is that if $\left(\frac{P_F}{P_S}\right)_A = \left(\frac{P_F}{P_S}\right)_W$, there will be no gains from trade.
- This is a crucial observation: *Gains from trade come entirely from differences between countries.* If there were truly “a level playing field” among trading partners—as many politicians demand as a condition for trade—then there would be no point in trading. The gains from trade come precisely from the fact that *relative* prices differ between Home and World. Hence, both countries will want to (and be able to) consume bundles that would not be feasible under their initial endowments (e.g., consuming more coffee than was previously feasible while giving up some sushi).
- This observation immediately raises two further questions:
 1. Why do relative prices differ among countries?
 2. Why is it *relative not absolute* prices that matter?
- Let’s take these in turn.

2.1 Why do relative prices differ among countries?

- Based on our analysis of General Equilibrium price setting, there are three underlying factors that affect prices: tastes, technologies, and endowments:
 1. Tastes: Two otherwise identical countries might have different prices for the same goods if for example (facing the same prices) consumer’s in Country *A* prefer sushi to coffee and consumer’s in Country *B* prefer coffee to sushi. There would be gains from trade because *A* would export coffee and import sushi and vice versa for *B*.
 2. Technology: If countries *A, B* have different technologies but are otherwise identical, they will have different relative prices. So, if country *A* has better sushi chefs and country *B* has better baristas, then *A* will export sushi and *B* will export coffee, even if tastes are identical.
 3. Endowments: If countries *A, B* have different endowments but are otherwise identical, there will also be gains from trade. For example, if consumers in *A, B* have the same taste for coffee and sushi but *A* has a hot climate suitable for coffee growing and *B* has abundant coastal waters for fishing, then *A* will be an exporter of coffee and *B* an exporter of sushi.

- As these examples show, any or all of these factors—tastes, technology, endowments—may give one country a comparative advantage in selling sushi relative to coffee or vice versa. These differences make trade beneficial. In general, the larger the differences, the more trade permits countries to consume bundles that are desired but otherwise infeasible under their initial endowments.

2.2 Why do only relative prices matter for trade? Comparative versus absolute advantage

- We have noted that it's only the *relative* price of F versus S in Home versus World that determines what the gains are from trade. But doesn't the *absolute* level of prices matter? Put more concretely, it's easy to see that the U.S. would benefit from trade with China since China makes just about everything cheaper than the U.S. does. It has an *absolute advantage* in that all goods are cheaper to produce in China. But doesn't that mean that China will *not* benefit from trade with the U.S. since everything the U.S. makes is too expensive for China (i.e., the U.S. has an absolute disadvantage in all goods production)? Is free trade with China good for the U.S. but bad for the Chinese (or v.v.)?
- This is a profoundly important question to which the answer is **no**. As long as relative prices differ between China and the U.S., both countries experience gains from trade.
- The explanation is *the principle of Comparative Advantage*, which is one of the most fundamental—and least widely understood—ideas in economics.
- We said that for an equilibrium to be Pareto efficient, the Marginal Rate of Substitution among goods for all consumers must be equated (How? By the price ratio.). Otherwise, there are gains from trade. This same idea extends naturally to trade among countries. If two countries in autarky (no trade) have different marginal rates of substitution among goods (due to tastes, technologies, or endowments), then trade between these countries will potentially make both countries better off (i.e., by equating their MRS's and thereby realizing gains from trade).
- Comparative Advantage is closely analogous to the trade that goes on in the Edgeworth box. It is immediately apparent in the Edgeworth box that, relative to the initial endowment, no party can be harmed by trade and generally both parties benefit—that is, no one expects the consumer with the smaller endowment to be “exploited” by

trade with the consumer with the larger endowment. This is also true for trade among countries.

- Note that the principle of comparative advantage follows directly from the notion of opportunity costs. In Home under Autarky, the opportunity cost of making one more unit of shelter at the margin is $\left(\frac{P_S}{P_F}\right)_A$, which is the amount of food the economy is foregoing at the margin to produce shelter instead. Notice that we can use the price ratio to express this value because the price ratio is equal to the slope of the PPF at the equilibrium production mix.
- Similarly, in World (excluding Home), the opportunity cost of making one more unit of shelter at the margin is simply $\left(\frac{P_S}{P_F}\right)_W$, the amount of food one must forego to obtain shelter instead.
- So, if it is the case that

$$\left(\frac{P_S}{P_F}\right)_W > \left(\frac{P_S}{P_F}\right)_A,$$

then the opportunity of shelter relative to food is relatively higher in the rest of the World relative to home.

- If so, Home should specialize further in shelter and buy more of its food from World, which is exactly what is shown in Figure 1: Home reallocates production from F to S until its opportunity cost of F relative to S is identical to that in the rest of the World.
- The key point is that trade allows Home to specialize in production of the good in which it has comparative advantage relative to the rest of the world. If Home has a lower internal cost of producing shelter relative to the rest of the world, then consumer utility will rise in Home if it produces more shelter and less food and then trades shelter for food on world markets. The converse is also true for the rest of the world.
- This conclusion in no way depends on whether both F and S prices are in *absolute* terms higher or lower in the World than they are at Home. All that matters is that Home's cost of producing shelter relative to its cost of producing food is less than World's cost of producing shelter relative to World's cost of producing food.

2.3 A Concrete Example

- When I (Prof Autor) was a graduate student, I coauthored a research paper with my thesis advisor, Lawrence Katz. The paper involved both theory and empirical work. I did most of the empirical work and my thesis advisor did most of the theoretical

work. I initially thought that this division of labor was due to the fact that my advisor recognized that I (a 2nd year graduate student) was already a world-class empirical researcher. But I eventually realized that this was not quite what Katz had in mind. Not long into the project, I made the rude discovery that Katz was much faster than I at empirical work—and also *far* better at theoretical work. He had an *absolute advantage* in both activities.

- So the question: Why did Katz bother to coauthor with me if he could do the entire paper faster or better by himself? The answer is comparative advantage. Katz, as it turned out, was about twenty-five times as good at empirical work but several hundred times as good at theoretical work (perhaps even infinite, since I knew squat about theory at the time). By arranging for me to do the empirical work, Katz freed his time to do the theoretical work, where his comparative advantage lay.
- Let’s make this example explicit. Say that writing a research paper has two components E and T (Empirical and Theoretical) and the only input into both activities is labor.
- The value of a completed paper is \$10,000 for a solo authored paper. If we coauthor the paper, it’s worth \$5,000 to each of us.
- My advisor, Katz, can do E in 75 hours and T in 25 hours. Were he writing the paper himself, it would take him 100 hours.
- His internal rate of conversion of time into output is the following:

$$\left(\frac{P_E}{P_T}\right)_K = \frac{75}{25} = 3.$$

One way to look at this “price ratio” is that the opportunity cost of one hour is $1/75^{\text{th}}$ of the empirical part of a paper or $1/25^{\text{th}}$ of the theory part of the paper.

- Let’s say that I (as a graduate student) could do E in 2,000 hours and T in 8,000 hours. So, it would take me 10,000 hours to write the paper.

$$\left(\frac{P_E}{P_T}\right)_A = \frac{2,000}{8,000} = 0.25.$$

- These price ratios, expressed as opportunity costs of each of our time, indicate that our internal trade-offs differ. In particular

$$\left(\frac{P_E}{P_T}\right)_K > \left(\frac{P_E}{P_T}\right)_A,$$

Katz's opportunity cost of doing Empirical work is implicitly higher than Autor's opportunity cost of doing empirical work. So, there *should be* gains from trade.

- Note, however that $P_E^K < P_E^A$ and $P_T^K < P_T^A$. That is, Katz has a lower time cost (an *absolute* advantage) in doing *either* activity.
- Consider the following production possibilities

	Time E	Time T	Time Katz	Time Autor	\$/hr Katz	\$/hr Autor
Katz	75	25	100	0	\$100	
Autor	2,000	8,000	0	10,000		\$1.00
Katz: E	75	8,000	75	8,000	\$66.67	\$0.63
Autor: T						
Katz: T	2,000	25	25	2,000	\$200	\$2.50
Autor: E						

Consider Katz's choices:

1. If Katz does the paper himself, he spends 100 hours. Hence, his effective wage is \$100 per hour for the solo-authored paper.
2. If Katz does E and Autor does T , Katz spends 75 hours. Katz earns \$66.67 per hour for the joint-authored paper. He is better off to solo-author the paper.
3. If Katz does T and Autor does E , Katz spends 25 hours. His effective wage is \$200 per hour for the joint paper.

Consider Autor's choice:

1. If Autor does the paper solo (not likely!), he spends 10,000 hours and earns \$1 per hour, consistent with the terms of his graduate stipend.
2. If Autor does T and Katz does E , Autor spends 8,000 hours, and his effective wage is \$0.63 per hour for the joint-authored paper. Notice that even though Autor is absolutely worse at both activities than Katz, Autor is worse off still coauthoring with Katz than writing the paper solo. [Intuition might suggest that Autor would be better off to coauthor with Katz regardless of the allocation of tasks, simply because Katz has an absolute advantage in writing papers. Clearly, this is not so when Autor and Katz must split the benefits from writing the paper.]

3. If Autor does E and Katz does T , Autor spends 2,000 hours, and his effective wage is \$2.50 per hour for the joint-authored paper (which is pretty much off the charts for a graduate student).
- So, although Katz has an absolute advantage in both activities, both Katz and Autor gain from joining forces to have Autor do E and Katz do T . This is because Katz's comparative advantage is in T and Autor's comparative advantage is in E . Conversely, if each does the task in which they comparative *disadvantage* (Katz does E , Autor does T), they are *both* worse off than not collaborating (at least if they must split the proceeds of the paper). This is true despite the fact that Katz has an absolute advantage at both activities.

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