Lecture Note 12 – The Gains from International Trade: Aggregate Evidence and Distributional Consequences

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1 Measuring the Gains from Trade: Feyrer, 2009

- Theory clearly predicts that trade increases national income—that is, the bundle of goods and services a country can purchase.

- But this is a difficult hypothesis to test in practice because it's hard to conduct an experiment. We cannot readily manipulate the trade flows of various countries to study the impact this has on their national incomes.

- Figure 5 of Feyrer (2009) shows that countries that experienced rising trade between 1960 and 1995 also experience rising GDP. Is this relationship causal?

- Thinking back to our causal framework, we would like to measure the causal effect of trade as follows:

$$\gamma_j = Y_j^T - Y_j^A,$$

  where Y is some measure of well-being (let's say income per capita), γ_j is the causal effect of trade on Y in country j (where γ stands for Gain from trade), and the superscripts A and T signify Autarky and Trade.

- As always, the Fundamental Problem of Causal Inference says that we can never directly observe γ_j, that is, we cannot observe income per capita for country j both under both Autarky and free trade *simultaneously*.

- One standard solution would be to contrast incomes of trading and non-trading countries. We could form

$$\hat{\gamma} = E\left[Y^T | T = 1\right] - E\left[Y^A | T = 0\right],$$

  where $T \in \{0, 1\}$ denotes whether or not a country is open to free trade.

- But for $\hat{\gamma}$ to be an unbiased estimate of γ, the following must be true:

$$\begin{aligned} E\left[Y^T | T = 1\right] &= E\left[Y^T | T = 0\right], \\ E\left[Y^A | T = 1\right] &= E\left[Y^A | T = 0\right]. \end{aligned}$$

  That is, the Autarkic economies would have the same income per capita as the trading countries if they opened to trade, and vice-versa for the trading countries if they became Autarkic.

- Are these assumptions plausible? Probably not. The extent to which a country trades is an endogenous outcome that is very likely to be correlated with other factors that directly affect income per capita.

  - Countries that are rich for other reasons might trade more because they can afford to import more goods from overseas.
  - Countries that pursue sound economic policies (i.e., that raise income) may also choose to pursue trade (another sound economic policy).
  - Countries that are rich in natural resources may trade because there is high world demand for their goods. But it may be their rich endowments that account for their wealth, not trade *per se*.

- One should therefore be very skeptical of any 'causal inference' that stems from a naive comparison of the incomes of trading and non-trading countries. (In point of fact, countries that trade more are on average wealthier, but this correlation need not be causal.)

2 Using the method of Instrumental Variables (IV) to measure causal effects

2.1 The basic idea

- What is needed is an 'experiment' that exogenously raises or lowers trade in some group of countries. In past class examples, we've used both 'natural' experiments (the NJ minimum wage change, the rollout of cell phones in Kerala, India) and randomized experiments (the Food Stamps cash-out, the Jensen-Miller rice subsidy) to isolate exogenous variation in the treatment variable of interest.

- In the case of free trade, such experiments are difficult to find. Even policy changes that open or close a country to trade (for example, war, natural disaster, revolutionary overthrow) are potentially suspect; they are quite likely to induce *other* economic and policy shocks (in addition to trade) that also directly raise or lower real income.

- This dilemma—the inability to find a convincing experiment—motivates a subtle and powerful approach to identify causal effects.

- We are interested in the effect of trade on income. Since trade is endogenous, we are reluctant to draw any causal inferences from the observed correlation between trade and income.
- Assume now that there is some third, exogenously assigned variable, $Z \in \{0, 1\}$ that affects the extent to which countries trade.
- Assume further that we have reason to believe that Z has no effect on national income *except*, potentially, through its effect on trade.
- Under these assumptions, Z may serve as an "instrument" that exogenously manipulates trade, allowing us to study trade's effect on income. Economists would say that Z is a valid "instrumental variable" (IV) for analyzing the causal effect of trade on income.

- James Feyrer's 2009 paper, "Trade and Income—Exploiting Time Series in Geography," proposes an ingenious approach for analyzing the causal effect of trade on national per capita income.

- Feyrer's insight is as follows: Historically, most trade between non-contiguous countries occurred by sea. As the cost of air freight fell over the last four decades, a substantially larger share of trade was transported by airplane rather than ship. The impact of this cost reduction is not uniform across different pairs of trading partners. For countries pairs connected by a direct sea route (e.g., Spain and Brazil), the declining cost of air freight is not particularly important; it reduces transport time but not necessarily transport cost. For country pairs that are connected by a highly indirect sea route however (e.g., Japan and the Western Europe), the reduction in the cost of air freight means that traded goods will potentially have to travel a much shorter distance by air than sea. This makes trade much cheaper for these country pairs.

- This is the insight behind Feyrer's approach: As air freight gets cheaper, countries that have a high value of their "Air-Sea Distance Difference"—that is, the distance to their trading partners by air is considerably lower than this distance by sea—will experience a large increase in trade volumes. By contrast, trade in countries that have small or zero Air-Sea Distance Diffs ($ASDD$) will not be greatly affected.

- How is $ASDD$ defined? Let D^S_{jk} be the sea distance between countries j and k and D^A_{jk} be the air distance. Let $ASDD_{jk} = D^S_{jk} - D^A_{jk}$. If country j and k have nothing between

them but water, then their sea and air distances will be the same ($ASDD_{jk} = 0$). If they are separated by land masses that a cargo ship must circumnavigate, then $ASDD_{jk} > 0$.

- Now, define for each country j its average $ASSD$ as the trade-volume weighted $ASDD_{jk}$ for all of its trading partners k. Specifically

$$\overline{ASDD}_j = \frac{\sum_k \left(D^S_{jk} - D^A_{jk}\right) \times T_{jk}}{\sum_k T_{jk}},$$

  where T_{jk} is the trade volume between j and k (in dollars, for example) in 1960.

- If Freyer's supposition is correct that trade differentially rises in countries with relatively high $ASDD$ as air freight gets cheaper, and if $ASDD$ only affects a country's economy via its effect on trade, then $ASDD$ can serve as a valid 'instrumental variable' for trade. That is, cross-country differences in $ASDD$ provide a kind of natural experiment for studying the causal effect of trade on income.

- You object: $ASDD$ is not the *only* determinant of changing trading patterns. The U.S. began trading extensively with China in the 1990s but was trading extensively with Japan decades earlier. Clearly, the China-Japan difference in $ASDD$ is trivial, so the falling cost of air freight cannot be the cause of rising China trade. That's correct! But that's not a problem for the IV (instrumental variables) approach; $ASDD$ need not be the *only* determinant of trade. All we need is that: a) $ASDD$ has a direct causal effect on trade; b) $ASDD$ does not plausibly affect national income through any other channel but trade. It's the second assumption that we'll want to scrutinize in our discussion of this paper.

- Figure 1 of Feyrer shows that air freight came to encompass a substantial share of U.S. trade between 1965 and 2005.

- Figure 3 of Feyrer shows that countries' trading volumes became substantially more sensitive to air distance between 1960 and 1995 and substantially less sensitive to air distance.

- How can we use this information on $ASDD$ to find the causal effect of trade on income?

- Imagine that we have a set of potentially comparable countries that differ according to whether they have High $ASSD$ ($A = 1$) or Low $ASDD$ ($A = 0$). This information may be sufficient for our purposes.

- The argument proceeds in three steps

2.2 Balance of treatment and control groups

- As with our previous examples of causal inference, we must believe that our treatment and control groups are comparable other than for the fact that $ASDD$ differs between them.
- Let Y_{jt} equal the GDP of country j in time t.
- Imagine that there are two time periods, $t = \{0, 1\}$, and that in the early period t_0, traded goods travel exclusively by sea, whereas in the latter, they can travel by air or sea.
- Let ΔY_j equal the change in GDP in country j between $t = 0$ and $t = 1$.
- For each country, imagine two potential outcomes

$$\Delta Y_j \in \left\{\Delta Y_j^1, \Delta Y_j^0\right\},$$

  where ΔY_j^1 is the change in GDP in j if $A = 1$ and ΔY_j^0 is the change in GDP in j if $A = 0$.
- Of course, each country j is either one type or the other ($ASDD$ is either High or Low, $A = 1$ or $A = 0$). So, we will never observe both ΔY_j^1 and ΔY_j^0 (the fundamental problem of causal inference, FPCI). They are counterfactuals of one another.
- Balance of the treatment and control groups requires that

$$\begin{aligned} E\left[\Delta Y_j^1 | A = 1\right] &= E\left[\Delta Y_j^1 | A = 0\right] \\ E\left[\Delta Y_j^0 | A = 1\right] &= E\left[\Delta Y_j^0 | A = 0\right]. \end{aligned}$$

  That is, if the countries with high $ASDD$ were somehow assigned low $ASDD$, their GDP growth would be the same as the the countries that actually have low $ASDD$, and vice versa if the low $ASDD$ countries were somehow assigned to have high $ASDD$.

2.3 First stage relationship.

- Write T_{jt} as the trade volume (in dollar terms, for example) of country j in year t.
- We must believe that $ASDD$ has a causal effect on the amount that countries trade.

- Again, imagine two counterfactual states for each country j, one in which it has Low $ASDD$ ($A = 0$) and the other if it has High $ASDD$ ($A = 1$).

- Define the counterfactual change in trade volume in each country under $ASDD \in \{0, 1\}$ as

$$\Delta T_j \in \left\{\Delta T_j^1, \Delta T_j^0\right\}$$

- We require the following:

$$\Delta T_j^1 \geq \Delta T_j^0 \ \forall \ j,$$

  In words, country $j's$ trade volume must increase by more between time 0 and 1 if $ASDD$ is High than if $ASDD$ is low.

- Due to FPCI, this assumption is also not testable. We only see countries in one state—$ASDD$ is High or Low—or another.

- However, we can test one *necessary but not sufficient* condition for the validity of this relationship, which is:

$$E\left[\Delta T_j | A = 1\right] > E\left[\Delta T_j | A = 0\right].$$

  That is, the average growth in trade in the $A = 1$ countries must be greater than in the $A = 0$ countries.

- We can check this empirically by verifying that:

$$\frac{1}{n_{A=1}} \sum_{j,A=1} \Delta T_j > \frac{1}{n_{A=0}} \sum_{j,A=0} \Delta T_j,$$

  where $n_{A=1}$ is the number of countries with $A = 1$ and similarly for $n_{A=0}$

2.4 Exclusion restriction.

- A second requirement for a valid IV is that it satisfy an "Exclusion Restriction." The exclusion restriction says that the instrumental variable (here $ASDD$) only affects the outcome variable of interest (here GDP) *indirectly* through its effect on the intermediating variable of interest (here, Trade).

- In other words, we must be willing to believe that $ASDD$ *only* affects national income through its impact on trade. Otherwise, we cannot interpret any measured relationship between distance and income as the causal effect of trade on income.

- Let k be some constant. The exclusion restriction can be expressed formally as:

$$E\left[\Delta Y_j | \Delta T_j = k, A = 1\right] = E\left[\Delta Y_j | \Delta T_j = k, A = 0\right].$$

- This equation says that holding T_j constant, $ASDD$ has no effect on GDP.
- Put differently, the only way that $ASDD$ affects GDP (Y_j) is through its effect on T_j. If, counterfactually, country j traded the same amount $T_j = k$ with either $ASDD = 1$ or $ASDD = 0$, its GDP would be the same.
- This hypothesis is also untestable. We cannot manipulate $ASDD$ for a given country, and moreover, if we could, this would also affect T_j (under our hypothesis above). But we need to find the exclusion restriction plausible.
- If we believe that $ASDD$ affects GDP through some other mechanism (e.g., $ASDD$ increases a country's air traffic, and the smell of burning jet fuel makes citizens happier and more productive, which raises GDP), then $ASDD$ will not allow us to isolate the causal effect of trade on GDP.

2.5 Implementation

If we accept the two conditions above, the empirical analysis proceeds as follows:

1. First check that trade grows by more in $ASDD = 1$ than $ASDD = 0$ countries between times $t = 0$ and $t = 1$:

$$E\left[\Delta T_j | A = 1\right] > E\left[\Delta T_j | A = 0\right]$$

$$\text{or } \frac{1}{n_{A=1}} \sum_{j,A=1} \Delta T_j > \frac{1}{n_{A=0}} \sum_{j,A=0} \Delta T_j$$

   If this inequality is satisfied, then A is a candidate instrument for T. If this inequality is not satisfied, then our postulate that $[\Delta T_j | A = 1] > [\Delta T_j | A = 0] \ \forall \ j$ is false. Verifying the inequality above does not prove that the postulate is correct. But rejecting it would demonstrate that the assumption is false.

2. If we pass the first test, we can next test whether GDP rises by more over time (between $t = 0$ and $t = 1$) in $ASDD = 1$ versus $ASDD = 0$ countries. The hypothesis that trade raises income implies that

$$E\left[\Delta Y_j | A = 1\right] > E\left[\Delta Y_j | A = 0\right].$$

That is, having verified above that trade rises by more in $A = 1$ than $A = 0$ countries, GDP should also rise by more in $A = 1$ than $A = 0$ countries if trade raises GDP (and not if it does not).

Let's say that both of these relationships are verified by the data. We might be correct to conclude that trade has a positive causal effect on national income. But we would not *yet* have an estimate of the *causal effect of trade on income*. We need to take one more big step.

2.6 Inferring the causal relationship using 'Instrumental Variables:' Motivation

- We want to estimate the causal effect of trade volumes on GDP. Let's write this as:

$$E\left[\Delta Y|\Delta T\right] = \alpha + \gamma \Delta T, \tag{1}$$

- We found that $ASDD$ is correlated with the change between 1960 and 1995 in the extent that a country trades, and given our assumptions above, we view this correlation as causal:

$$\pi_1 = E\left[\Delta T|A = 1\right] - E\left[\Delta T|A = 0\right] > 0$$

- We compare the change in the incomes of $ASDD$ High and Low countries.

$$\pi_2 = E\left[\Delta Y|A = 1\right] - E\left[\Delta Y|A = 0\right].$$

  Here, π_2 is the causal effect of $ASDD$ (not trade) on GDP.

- That's a start, but we have not yet estimated γ, *the causal effect of trade on GDP*. If we had exogenous (as good as randomly assigned) variation in the change in trade that countries experienced, we could simply estimate equation (1) above, and $\hat{\gamma}$ would be our causal effect estimate.

- We cannot do that because the variation in trade that we observe is endogenous. Naively regressing ΔGDP on $\Delta Trade$ will tell us about the correlation between trade and GDP, but it will not provide an unbiased estimate of γ.

- It turns out that we *can* infer this causal relationship using the observed *causal* relationships between (a) $ASDD$ and ΔT, and (b) $ASDD$ and ΔY.

2.7 Inferring the causal relationship using 'Instrumental Variables:' Algebra

Let's put the pieces together:

- Causal effect of $ASDD$ on Trade

$$\begin{aligned} E\left[\Delta T|Z\right] &= \alpha_1 + \pi_1 A, \\ \text{where } \pi_1 &= E\left[\Delta T|A=1\right] - E\left[\Delta T|A=0\right]. \end{aligned} \tag{2}$$

- Causal effect of $ASDD$ on GDP growth:

$$\begin{aligned} E\left[\Delta Y|Z\right] &= \alpha_2 + \pi_2 Z \\ \text{where } \pi_2 &= E\left[\Delta Y|A=1\right] - E\left[\Delta Y|A=0\right] \end{aligned}$$

- Causal effect of trade on GDP growth.

$$E\left[\Delta Y|\Delta T\right] = \alpha + \gamma \Delta T, \tag{3}$$

  note that γ is the causal effect that we are interested in.

- Substituting (2) into (3) gives us the expression for the causal effect of $ASDD$ on GDP growth:

$$\begin{aligned} E\left[\Delta Y|A=1\right] &= \alpha + \gamma E\left[\Delta T|A=1\right] \\ E\left[\Delta Y|A=0\right] &= \alpha + \gamma E\left[\Delta T|A=0\right] \\ E\left[\Delta Y|A=1\right] - E\left[\Delta Y|A=0\right] &= \gamma\left(E\left[\Delta T|A=1\right] - E\left[\Delta T|A=0\right]\right) \\ \pi_2 &= \gamma \times \pi_1 \end{aligned}$$

  note that we are using the fact that

$$E\left[E\left[\Delta Y|\Delta T\right]|A\right] = E\left[\Delta Y|A\right]$$

  which follows from the exclusion restriction and the Law of Iterated Expectations.

- Thus, our estimate of π_2 is closely related to the causal effect of trade on GDP (γ) in equation (1) above. They only differ by a scalar: $\pi_2 = \gamma \times \pi_1$

- Combining our two causal effects estimates, π_1 and π_2, we can estimate the causal effect of trade on income:

$$\frac{E\left[\Delta Y|Z=1\right]-E\left[\Delta Y|Z=0\right]}{E\left[\Delta T|Z=1\right]-E\left[\Delta T|Z=0\right]}=\frac{\pi_2}{\pi_1}=\frac{\pi_1\times\gamma}{\pi_1}=\hat{\gamma}$$

- We thus estimate the causal effect of trade on income by taking the ratio of the two causal effects: 1) the causal effect of $ASDD$ on GDP growth; and 2) the causal effect of $ASDD$ on trade growth. This ratio gives us $\hat{\gamma}$, our Instrumental Variables (IV) estimate of the causal effect of trade on GDP.

- Intuitively, we are comparing incomes among potentially similar countries that have different $ASDD'$s. This comparison gives us the causal effect of $ASDD$ on income growth ($\hat{\pi}_2=\gamma\times\pi_1$). We convert this number into an estimate of the causal effect of trade on income by re-scaling the GDP growth difference between high and low $ASDD$ countries by the causal effect of $ASDD$ on trade growth.

- Instrumental Variables is a subtle technique that has become central to causal empirical analysis in economics within the last two decades. The IV method was developed in 1928 by the economist, P.G. Wright, who wanted to measure the causal effect of supply changes on the price of flaxseed. He used weather shocks as an exogenous source of variation in supply of flaxseed.

3 Feyrer results

The main figures in the Feyrer paper tell the story. You should understand how each of these figures contribute to the empirical case. See figures *in this order*:

1. Figure 1: Air freight shares to the U.S.
2. Figure 3: Change in elasticity of trade with respect to Sea and Air distance over time
3. Figure 2: Air imports to the US versus 1960 GDP per capita
4. Figure 6 panel B (right-hand side): Air and Sea Distance Differential ($ASDD$) versus Average Trade Growth 1960-1995
5. Figure 7 panel B (right-hand side): $ASDD$ and per capita GDP growth, 1960-1995

Jim Feyrer was kind enough to make a special table *exclusively for 14.03/14.003* that shows the key results in a format that perfectly complements the analytic tools above. See the last slide in the class presentation.

- The first column shows the Ordinary Least Squares (OLS) relationship between the change in GDP and the change in trade at the country level during 1960 - 1995 for 76 countries:

$$\text{Column } (1): \ \Delta \ln GDP_{j,60-95} = \alpha + \beta_1 \Delta \ln Trade_{j,60-95} + e_j.$$

  The point estimate of 0.55 says that a 1% rise in trade is *associated with* a 0.55% rise in GDP (an elasticity of 0.55). You should not view this relationship as causal.

- The second and third column show the relationship between $ASDD$ and trade growth (column 2) and GDP growth (column 3).

$$\text{Column } (2): \ \Delta \ln Trade_{j,60-95} = \alpha' + \pi_1 ASDD_j + e'_j,$$

  where Feyrer estimates that $\hat{\pi}_1 = 5.30$

- And

$$\text{Column } (3): \ \Delta \ln GDP_{j,60-95} = \alpha'' + \pi_2 ASDD_j + e''_j,$$

  where $\hat{\pi}_2 = 4.00$.

- Recall that $\hat{\pi}_2 = \gamma \times \pi_1$. Hence, we can calculate the causal effect of trade on GDP as:

$$\hat{\gamma} = \frac{\pi_1 \times \gamma}{\pi_1} = \frac{\hat{\pi}_2}{\hat{\pi}_1} = \frac{4.00}{5.30} = 0.75$$

- This is exactly what Feyrer obtains in Column 4:

$$\text{Column } (4): \ \Delta \ln GDP_{j,60-95} = \alpha''' + \gamma \Delta T_j^* + e'''_j.$$

  Feyrer estimates that $\gamma = 0.75$. I've denoted the change in trade in this equation with an asterisk (ΔT_j^*) because this is *not* the endogenous trade variable available in the data. Rather, it is the exogenous component due to $ASDD$, which is found in column 2 of the Feyrer table.

- Thus, our causal estimate of the effect of trade on GDP is that a one percent rise in trade raises GDP per capita by three-quarters of a percentage point.

- We'll talk further about this evidence (both its strengths and limitations) in class.

4 Why is Free Trade Controversial?

- The analysis above suggests that if countries trade, the gains from trade are positive—otherwise, countries will not trade.

- Moreover, in contrast to popular perceptions, trade is not a Robin Hood operation that takes from rich countries to give to poor countries, or the opposite. See for example the *NY Times* editorial by Nicholas Kristof ("Let Them Sweat").

- This raises a puzzle: If trade is so terrific, why isn't everyone in favor of it? Here are two potential explanations:

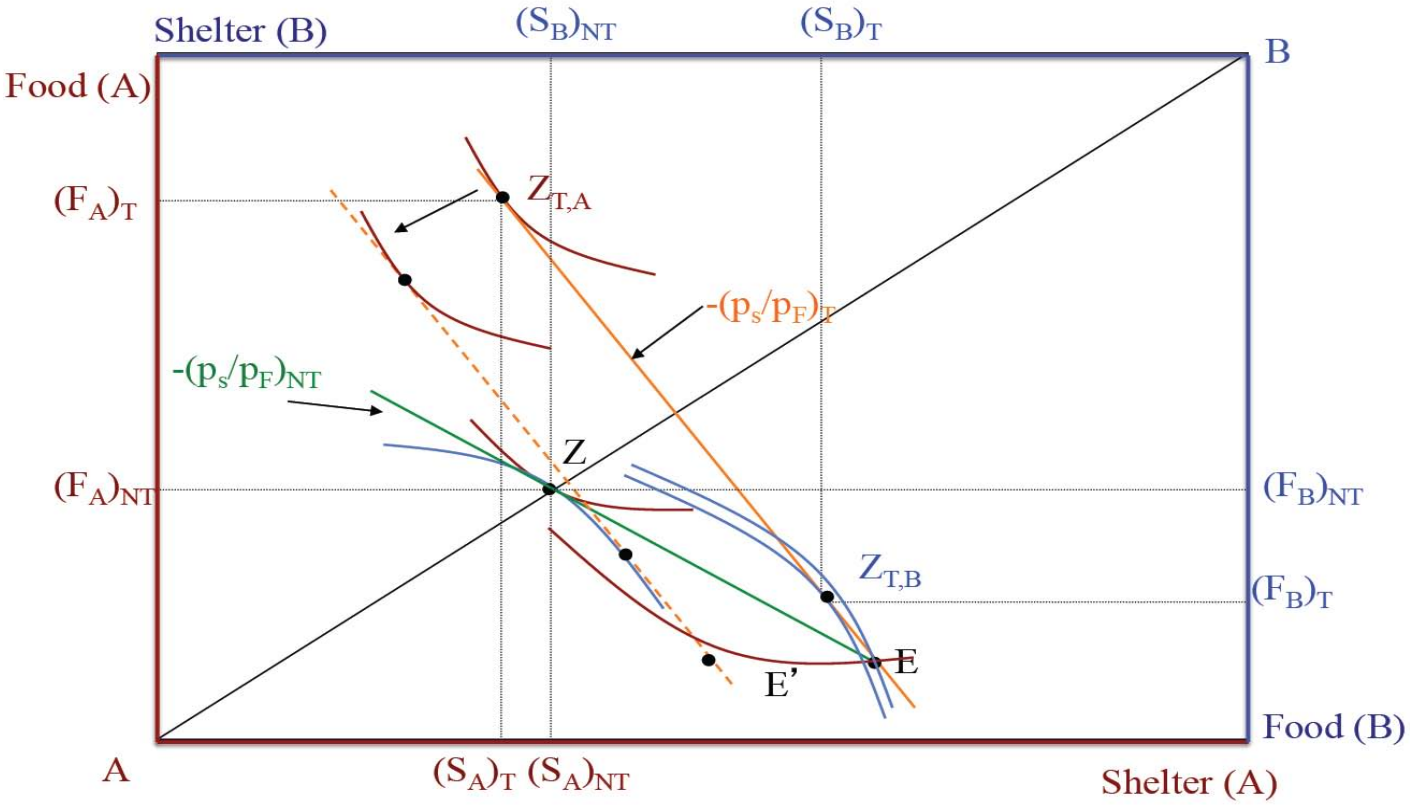
    1. Politicians and lay people just don't get it. Like much of economics, the principle of Comparative Advantage is simple and yet not immediately intuitive. Once you understand the principle of Comparative Advantage, you start to ask, how could anyone else think differently?

       But in fact there is a long tradition of thinking differently. An influential school of thought called Mercantilism believes that trade is a zero-sum game; if a foreign country buys my goods, I win and it loses. And vice versa if I buy its goods. This view is spelled out in Krugman's paper on your reading list, "Ricardo's Difficult Idea." (Ricardo was the economist who first formally articulated the principle of Comparative Advantage.)

    2. But it's also possible that there is something problematic about trade that people *do* recognize. This thing, also implied by the model, is that although trade improves aggregate consumer surplus, it typically creates winners and losers. This is because international trade maximizes the pie and *changes* the sizes of the slices. It is quite possible for trade to improve aggregate consumer surplus while leaving certain groups distinctly worse off than they would have been in Autarky, meaning under domestic trade alone (though not worse off than they would have been in the absence of any trade, i.e., consuming their initial endowments). Here is why...

Refer to the following figure:

- In this economy:


Shelter (B)
$(S_B)_{NT}$
$(S_B)_T$
B
Food (A)
$(F_A)_T$
$Z_{T,A}$
$-(p_s/p_F)_T$
$-(p_s/p_F)_{NT}$
Z
$(F_A)_{NT}$
$(F_B)_{NT}$
$Z_{T,B}$
$(F_B)_T$
E
E'
Food (B)
A
$(S_A)_T$ $(S_A)_{NT}$
Shelter (A)

- E is the initial endowment.
- The two goods are F and S (food and shelter) on the X and Y axes respectively.
- $A's$ consumption is increasing as we move from the lower-left corner to the upper-right corner, and vice versa for consumer B.
- The subscripts NT and T refer to "No International Trade" and "International Trade." (We assume that trade among consumers within the Home economy always occurs.)

- First, consider the equilibrium under no trade (NT).
  - The equilibrium price ratio that clears the market is $-(p_s/p_f)_{NT}$ and consumption is at point Z on the Contract Curve (CC).
  - The markets for Food and Shelter both clear.
  - Consumers A and B are both better off relative to their initial indifference curves (those intersecting point E). Point Z represents a Pareto improvement relative to point E.

- Now consider what would have occurred had Home opened itself to international trade instead starting from the initial endowment, E.

- Assume that the world price ratio is given by $(p_s/p_f)_T$. This ratio places a higher relative value on shelter than the home price ratio: $(p_s/p_f)_T > (p_s/p_f)_{NT}$.

- Now, the equilibrium looks quite different:
  - The price ratio rotates clockwise to $-(p_s/p_f)_T$.
  - Although both A and $B's$ chosen bundles are tangent to the world price ratio, they are not tangent to one another. That is $Z_{T,A}$ and $Z_{T,B}$ both lie along the budget set $-(p_s/p_f)_T$, but they are not the same point.
  - Consumer A is now consuming much more food than under the NT equilibrium and slightly less shelter.
  - Consumer B is now consuming more food than under the NT equilibrium and much *less* shelter.
  - Home is now a net exporter of shelter and a net importer of food. Home's chosen consumption bundle would not have been feasible absent trade.

4.1 Now, let's do a welfare analysis in three parts.

4.1.1 Is the equilibrium under free trade Pareto superior to the initial allocation, E?

Yes. It's clear that both A and B prefer $Z_{T,A}$ and $Z_{T,B}$ to E.

Moreover, there is no way that trade could make them worse off than they were at E since either party could always choose to consume his or her initial endowment rather than trade.

Free trade is Pareto improving relative to the initial allocation.

4.1.2 Is the equilibrium under free trade Pareto superior to the equilibrium under Autarky (only within-country trade)?

Interestingly, the answer is **no**.

It's clear that party A is much better off at $Z_{T,A}$ than Z and party B is considerably worse off at $Z_{T,B}$ than Z.

Why did this happen? Because trade raised the relative price of shelter and lowered the relative price of food. Consumer A was relatively rich in shelter and consumer B was relatively rich in food. So, trade increased the value of $A's$ bundle and decreased the value of $B's$ bundle.

Moreover, you can see that no matter which way trade rotates the price ratio (assuming it has this effect), either A or B will be worse off than the at point Z. If the price ratio rotates clockwise, A ends up further from his origin and B ends up closer to his origin. If the budget set rotates counter-clockwise, the opposite occurs.

Hence, international trade does not yield a Pareto improvement relative to the Autarkic setting. One party wins, the other loses.

This is a fundamental result. Trade increases consumer welfare by altering prices—and, conversely, if trade does not change prices, it does not affect consumer welfare. The change in prices raises consumer surplus by allowing consumers to consume bundles that were not previously feasible given the old endowment and prices. However, it also necessarily devalues the endowments of consumers who are specialized in the good whose relative price has fallen. So, if you were a holder of food, and you opened to trade with a country that had a relatively abundant supply of food, you may be made effectively poorer by the trade-opening since your bundle of food cannot buy as much shelter as it could under the Autarky equilibrium (however, your shelter could buy you even more food than before).

4.1.3 Is there a potential Pareto improvement from opening to international trade?

The Second Welfare Theorem says that there is no trade-off between equity and efficiency. But we seem to have found one here. We showed previously that trade raises 'national welfare,' yet this seemingly comes at the expense of harming at least one consumer.

Now ask: Are the gains from trade *large enough* that we could make consumer A better off without making B worse off by redistributing the gains from trade. If yes, there is a *potential* Pareto improvement here.

Keeping B as well off as he was at point Z requires that he consume on the same indifference curve on which point Z lies.

Consider moving the endowment from point E to point E'. That is, we redistribute some shelter from A to B (a lump-sum transfer).

Now, starting from point E', the same world price ratio prevails: $(p_s/p_f)_T$. (Remember that Home is a price-taker on world markets.)

If we draw the ray with slope $-(p_s/p_f)_T$ extending from point E', this ray is tangent to $B's$ indifference curve intersecting Z. Therefore, B is indifferent between trade under autarky and world trade with redistribution from E to E'.

Crucially, A is unambiguously better off. He can still consume on a higher indifference curve.

This answers our question above. There is no trade-off between equality and efficiency. Through an appropriate set of transfers, we can both exhaust all gains from trade and achieve any Pareto efficient allocation desired. The aggregate gains from trade do not *necessarily* come at the expense of equity—a *potential Pareto improvement* (sometimes called a 'Kaldor improvement') is always feasible. International trade does not overturn the $1st$ and $2nd$ welfare theorems.

How do we know that the Kaldor criterion will always be satisfied—that is, that the gains from trade are necessarily large enough to potentially make both parties better off? The answer is that international trade is equivalent to relaxing one constraint in our Edgeworth box. In the Autarkic Edgeworth box, the equilibrium required both that consumption was Pareto efficient (MRS equated among consumers) and that the sum of demands of all consumers was equal to the aggregate economy wide endowment. Trade relaxes the second constraint. Although the MRS of all consumers is equated to the price ratio under international trade, it no longer has to be the case that a country consumes only what it produces. So long as another country is

willing to trade with our country, our consumption may exceed our endowment in some goods (though not all goods—since this would imply a trade imbalance).

But all of this good news contains some less pleasant caveats. International trade necessarily improves national welfare (crudely, GDP), by allowing countries to consume a different bundle than what they produce. But international trade does not necessarily raise welfare of all citizens. Indeed, it will typically make some worse off. The analysis above says that equity *does not have to* suffer due to trade. Gains from trade are inherently large enough to fully compensate the losers and still produce some winners. But trade generally will produce **both** winners and losers unless governments implement redistributive policies to prevent this from occurring.

5 Conclusion

The principle of comparative advantage is a fundamental economic insight of great relevance and generality. This principle explains why, almost to a person, economists support free trade everywhere and always.

The argument is as fundamental as the general welfare theorems, and closely analogous. The welfare theorems (as seen in the Edgeworth box) demonstrate that allowing individuals to trade freely with one another until all gains from trade are exhausted necessarily benefits all parties.

The principle of comparative advantage says that allowing countries to trade always raises welfare in both countries.

But there is a key difference between these two conclusions. International trade does *not necessarily* benefit every individual. It's likely to create winners and losers. By contrast, free trade among individuals always generates Pareto improvements.

The principle of comparative advantage combined with the 1st and 2nd welfare theorems proves that it is *possible* to make each citizen better off through trade than under autarky, when trade is combined with lump-sum transfers.

Whether this occurs depends upon the politically feasibility of implementing redistributive policies to counteract the redistribution accompanying trade liberalization. Little in the vast sweep of history suggests that the gains from trade are typically redistributed so that the losers are compensated.

5.1 Relevance

This insight is relevant to the political economy of trade in developed countries such as the U.S., Japan, the OECD, the U.K., etc.

As Feyrer demonstrates, trade appears to increase GDP across the board in developing and developed economies.

But, trade between the developed and less-developed countries (LDCs) will generally tend to lower the wages of less-educated workers in developed countries. This is because developed economies have comparative advantage (relative to most other countries) in technology- and skill-intensive products and services. So, opening of developed countries to trade with LDCs generally raises the wages of highly skilled workers in developed economies and reduces the wages of less skilled workers in these economies.

By the same token, trade raises the earnings of less-educated workers in LDCs because LDCs hold a comparative advantage in low-skill, labor-intensive production such as agriculture and mass production.

The Second Welfare theorem says that we could compensate less-educated workers in Developed countries for their losses and still make everyone else better off. But the political reality is that this is quite unlikely to happen. Perhaps as a consequence, trade unions and less educated workers are generally strongly opposed to international trade.

These interest groups are probably neither sinister or foolish; they do not oppose *Pareto* improvements in general. But they may understand that international trade without accompanying redistribution makes them worse off. Politically, opening to trade is comparatively easy. Redistributing gains from winners to losers is politically extremely difficult. Permitting the first without pursuing the second may have strong redistributive consequences—and the redistribution induced by trade in industrialized economies is typically (though not always) from less affluent to more affluent workers.

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