International Trade: Lecture 1

The Gains from Trade

Sifan Xue
NSD, Peking University

Sep 11, 2024

The Gains from Trade

Start with the broadest normative questions:

- When and why are there potential gains from trade?
- Are the potential gains from trade realized in the marketplace?
  - Do all countries share in the gains?
  - Do all individuals in a country share in the gains?

This is an artificial policy comparison of free trade and autarky.

No country contemplates autarky as a real policy alternative.

But the comparison is pedagogically useful.

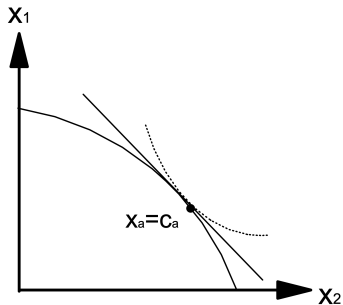
Perfect Competition and Representative Consumer

Assume:

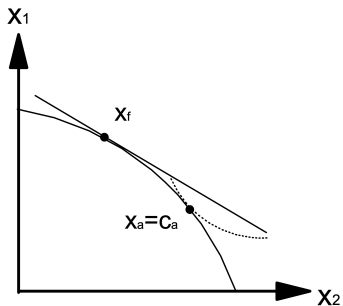
- Perfect competition
- Convex technology (no IRS)
- Identical households with homothetic preferences (to allow us to neglect intra-national distributional issues for the moment)

Define a *small country*: A small country can trade as much as it wishes at exogenously given terms of trade.

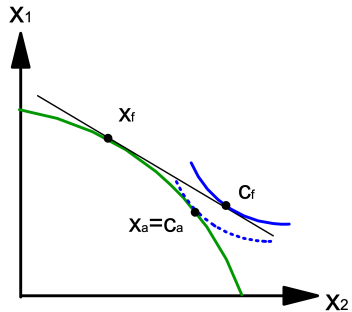
Small Country: Autarky vs. Free-Trade Equilibrium



Autarky Equilibrium



Free-Trade Production Point



Free-Trade Equilibrium

Trade is like technological progress: provides a new means to convert one good into another.

Small Country (cont'd)

How general is the situation depicted in the figure?

- Profit maximization drives us to a point with MRT $=$ p*.
- Consumption takes place at point of tangency with prices; but $X_a = C_a$ lies inside the hyperplane formed by price line. That is, C_a lies in the interior of the free-trade budget set.
- So, we will be able to make a general revealed-preference argument that $C_f \succ C_a$.
- Does not depend on the number of goods and factors
- Does require that $p^* \neq p_a$

Also can see that FT dominates any other competitive (trade) equilibrium. Any production point other than x_f gives a budget set that lies inside the FT budget set. For a small country, trade is like another production activity; GFT follows from FTWE.

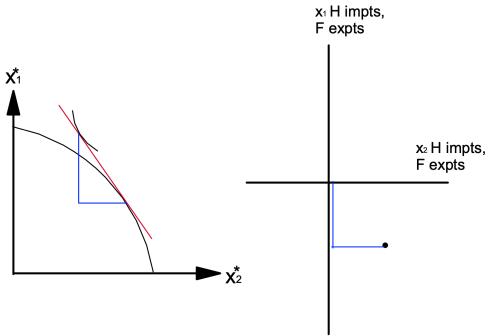
Large Country

First need to represent the trading opportunities facing a large country, which cannot trade all it wants at fixed TOT.

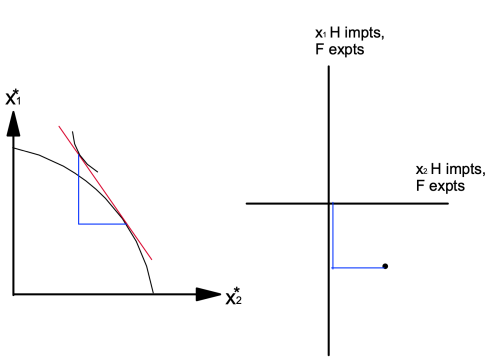
Use construct of an offer curve. This is the general equilibrium analog to the (import) supply curve.

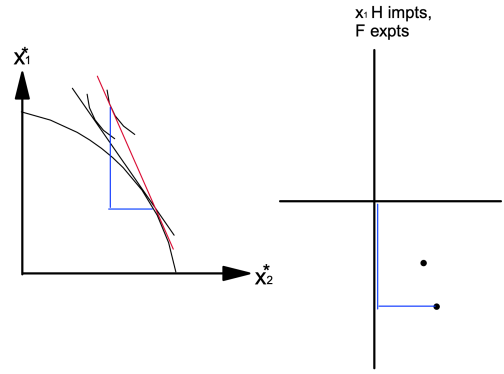
- Call offer prices.
- Observe trades that the foreign country would be willing to make at those prices, under competitive conditions.
- Connect all the possible trades for all conceivable prices.

Foreign Offer Curve

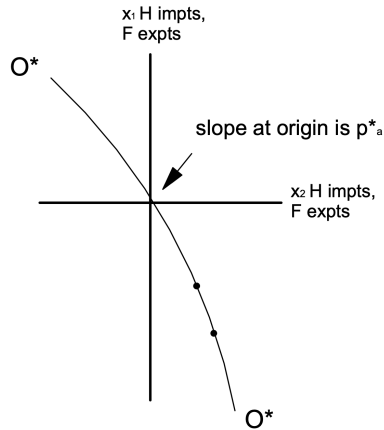


Foreign Offer Curve



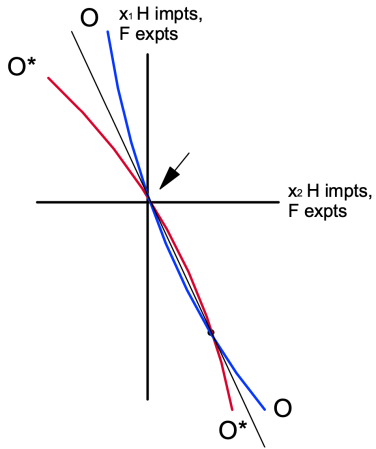


Foreign Offer Curve (cont'd)



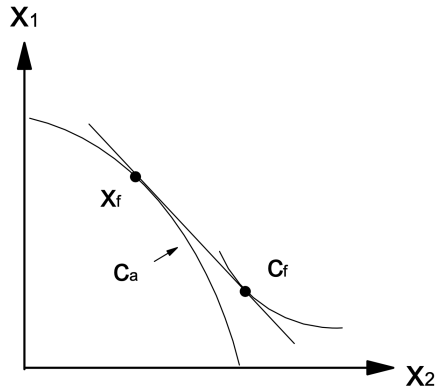
Equilibrium World Price

Superimpose the two offer curves:



Gains from Trade: Large Country

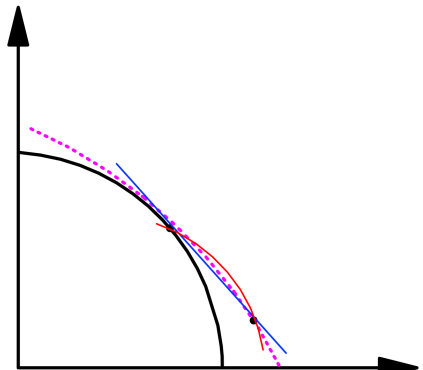
Make revealed preference argument with respect to equilibrium world price:



Consumption Availability Set

Alternatively, we can derive the "consumption availability set":

- Take price
- Find production point
- Find foreign offer, add to production point
- Mark consumption point
- Repeat



This emphasizes again that trade is like technological progress.

Formalization

Let $\mathbf{x}$ be a vector of "outputs":

- Some negative elements may be inputs
- Some may be non-tradable

Let $\mathbf{c}$ be a vector of consumption

$\mathbf{M} = \mathbf{c} - \mathbf{x}$.

Let $\mathbf{p}$ be a vector of prices:

- $\mathbf{p}^{\mathbf{a}}$ is vector of autarky equilibrium prices
- $\mathbf{p}^{\mathbf{f}}$ is vector of free-trade equilibrium prices

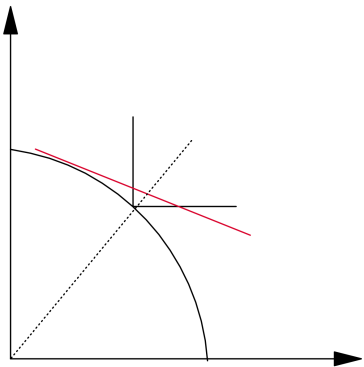
Gains from Trade Proof

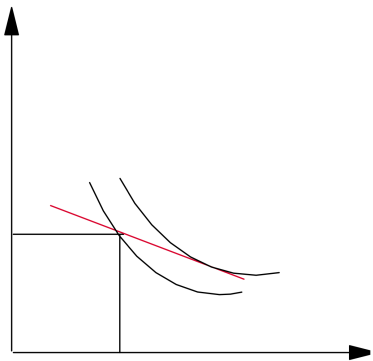
$$p^f \cdot M^f = 0$$
$$p^f \cdot c^f = p^f \cdot x^f$$
$$p^f \cdot c^f \geq p^f \cdot x^a$$
$$p^f \cdot c^f \geq p^f \cdot c^a$$

Hence, c^f is at least as good as c^a. When better?

Gains from Trade Proof (cont'd)

- Need p^f not proportional to p^a: with competition, gains from trade requires differences in autarky prices
- Need some substitutability
  - Substitutability on the output side; or Substitutability in consumption.





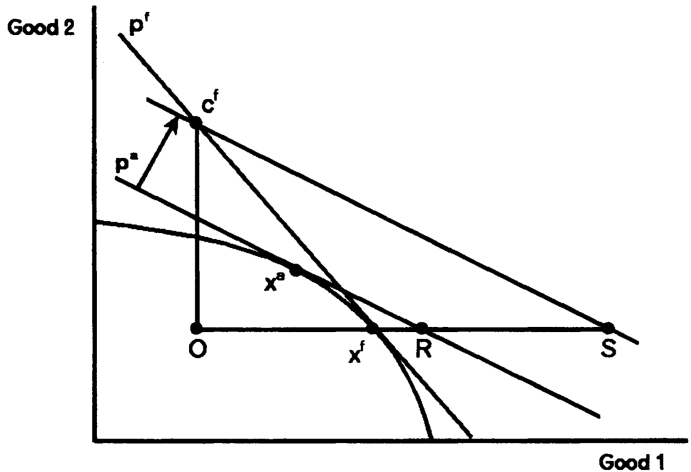
Bernhofen and Brown, AER 2005

Regard opening of Japan's economy in 1850's as a natural experiment:

- Opening of trade arose exogenously
- Relative price shock and degree of exposure to prevailing world prices strong enough to identify reallocation of resources posited by theory of comparative advantage
- Significant price differences were brought about by industrial revolution, since modern technologies were not available in Japan
- Rapid adjustment: imports grew by 100 times in 15-20 years.

Look at equivalent variation: Extra income needed in 1850's to consume hypothetical free-trade consumption vector at autarky prices.

Bernhofen and Brown, AER 2005 (cont'd)



$\Delta W = RS$

But don't observe c_f 1850's (or c_f 1870's).

Bernhofen and Brown, AER 2005 (cont'd)

$$\begin{aligned}\Delta W_{1850's} &= e(p^a_{1850's}, c^f_{1850's}) - e(p^a_{1850's}, c^a_{1850's}) \\ &= p^a_{1850's}(c^f_{1850's} - x^f_{1850's}) + p^a_{1850's}(x^f_{1850's} - x^a_{1850's}) \\ &\leq p^a_{1850's} M^f_{1850's}\end{aligned}$$

i.e., use x^fS as an upper bound. (Overestimate depends on curvature).

- Use $M^f_{1870's}$ adjusted for growth to estimate $M^f_{1850's}$.
- Have autarky prices for 97% of exports and 61% of imports.
- Must assume that technology transfers between 1850's and 1870's were not important cause of shift of resources.
- Bottom Line: Static GFT due to comparative advantage no more than 8-9% of GDP;
  $\Rightarrow$ evidently, significant changes in commodity prices do not necessarily translate into large welfare gains.

Optimality of Free Trade! (Small Country)

Compare f with some other equilibrium b. For small country, $p^f = p^b$, except for non-tradables.

$$p^f \cdot c^f = p^f \cdot x^f$$
$$p^f \cdot c^f \geq p^f \cdot x^b$$
$$p^f \cdot c^f \geq p^f \cdot (x^b + m^b)$$
$$p^f \cdot c^f \geq p^f \cdot c^b$$

Optimality of Free Trade? (Large Country)

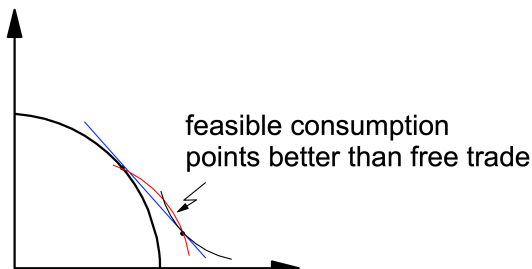
This won't work, because $p^f \neq p^b$:

$$p^f \cdot c^f = p^f \cdot x^f$$

$$p^f \cdot c^f \geq p^f \cdot x^b$$

$$p^f \cdot c^f \geq p^f \cdot x^b + p^b \cdot m^b$$

$$p^f \cdot c^f \geq p^f \cdot c^b + (p^b - p^f) \cdot m^b$$



Redistributing the Gains from Trade

Now we drop the assumption that all households have identical, homothetic preferences. Are there still gains from trade?

- Without compensation
  - No guarantee of (Pareto) gains
  - For example, let Household 1 have a fixed endowment of good 1 and Household 2 has a fixed endowment of good 2; change in relative price from $p^a \to p^f$ bound to benefit one and harm the other.
- Lump-Sum Transfers
  - Can construct a set of lump-sum transfers so that trade makes all consumers better off
  - To begin, define "fictitious" factors so that all production factors have CRS; i.e., if $F^i(V^i)$ has DRS, write $\tilde{F}^i(V^i, Z^i)$ so that $\tilde{F}^i$ is homogeneous of degree one. (The fictitious factors absorb the rents.)

Redistributing the Gains from Trade: Lump-Sum Transfers

- Let factor supplies be negative elements in the consumption vector so that factor income is negative spending.
- Household i chooses c^i to maximize $U^i(c^i)$ subject to $p^f \cdot c^i \leq T^i$.
- Now give each household exactly enough transfer to allow it to purchase its autarky consumption bundle; $T^i = p^f \cdot c^{ai}$

$$\sum_i T^i = p^f \cdot \sum_i c^{ai} = p^f \cdot x^a \leq p^f \cdot x^f = 0$$

Redistributing the Gains from Trade: Lump-Sum Transfers (cont'd)

- So each household can buy (at least) autarky bundle and the scheme raises positive revenue. But, government must know individual preferences to implement scheme. If it does not, households can manipulate mechanism by altering their announcements or autarky behavior. In other words, lump-sum transfers typically are not *incentive compatible*.
- Dixit and Norman (1986 JIE) provide an alternative scheme that does not suffer from this problem. Requires only information about aggregates, not about individuals.

Redistributing the Gains from Trade: Taxes/Subsidies

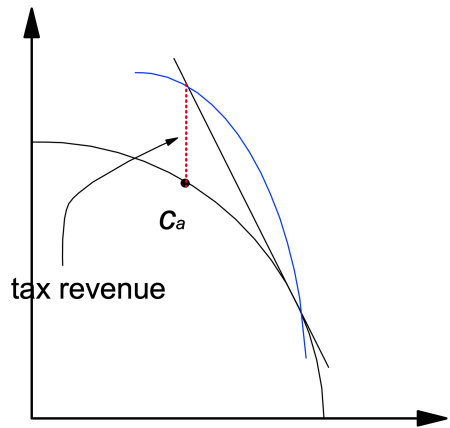
- Consider a scheme with taxes and subsidies on all goods and factors. (This requires ability to tax the fictitious factors (firm-specific quasi-rents) at different rates, which comes close to lump-sum taxation in these cases.)
- Let us compute the tax rates implicitly.
  - Set consumer prices in the trade equilibrium equal to the autarky prices: $p^{cf} = p^{a}$
  - Without lump-sum taxes, the budget constraint becomes: $p^{cf} \cdot c^{fi} \leq 0$
  - Free trade has by construction same prices as autarky and same budget set as autarky $\rightarrow c^{f} = c^{a}$
  - World prices are given by world market clearing, given the aggregate demands and supplies that arise at home. Tax rates are given implicitly by $t = p^{cf} - p^{f}$

Redistributing the Gains from Trade: Taxes/Subsidies (cont'd)

- How much does this scheme cost/raise?

$$(p^{cf} - p^f) \cdot c^f = (p^a - p^f) \cdot c^a = p^a \cdot x^a - p^f \cdot x^a$$
$$= 0 - p^f \cdot x^a \geq -p^f \cdot x^f = 0$$

- Tax revenue is positive! Now, if all households are on the same side of the market for at least one good or factor, can cut a tax or raise a subsidy to generate Pareto improvement.
- Intuition: This scheme sacrifices the consumer gains from trade, but preserves the gains from reorganizing production.



Redistributing the Gains from Trade: Taxes/Subsidies (cont'd)

In practice this would be difficult to implement. Need to tax/subsidize pure profits. And computational requirements are severe. But it establishes an important principle: in the face of distributional conflicts, there are better ways to redistribute income than by restricting trade.

Comparative Advantage

What determines the pattern of trade?

- In competitive theory, we need to focus on *differences* of autarky prices between countries: endowments, tastes, technologies, institutions.
- Our GFT result can be used to prove a very general correlation result, without introducing details of specific models.
- We can also show that it will never be possible to predict the pattern of trade good by good without introducing substantial structure.
- We will then turn to particular sources of comparative advantage and see what we can then say about the pattern of trade.

A Correlation Result

Assume households have identical homothetic preferences, or compensation makes trade equilibrium Pareto superior to autarky.

- Use weak axiom of revealed preference:

$$p^a \cdot c^f \geq p^a \cdot c^a = p^a \cdot x^a \geq p^a \cdot x^f \quad \Rightarrow \quad p^a \cdot M^f \geq 0 \quad \Rightarrow \quad (p^a - p^f) \cdot M^f \geq 0$$

- On average, countries import goods that are relatively expensive in autarky and export goods that are relatively cheap in autarky.
- We can normalize prices so that $\sum_i (p^{ai} - p^{fi}) = 0$. With this normalization, import vector is positively correlated with price changes.

A Correlation Result: Two Countries

With two countries:

$$
\begin{aligned}
p^a \cdot M^f &\geq 0 \\
p^{a*} \cdot M^{f*} &\geq 0 \\
M^{f*} &= -M^f \\
\Rightarrow (p^a - p^{a*}) \cdot M^f &\geq 0
\end{aligned}
$$

Bernhofen and Brown, JPE 2004

Direct test of correlation result using data from Japan for 1850's-1870's:

$$p^a_{1870's} \cdot M^f_{1870's} \geq 0, \quad (p^a_{1870's} - p^f_{1870's}) \cdot M^f_{1870's} \geq 0$$

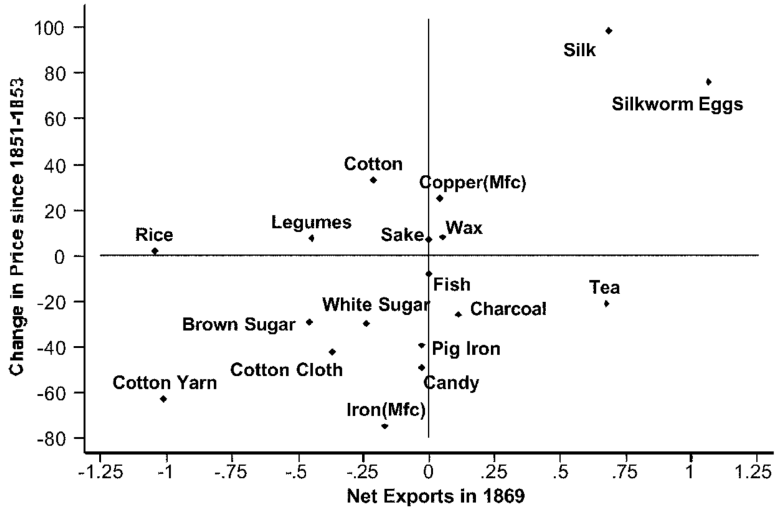
Define $\varepsilon = p^a_{1850's} - p^a_{1870's}$; suppose $\varepsilon \cdot M^f_{1870's} \geq 0$.

- This requires either that there is no correlation between changes in autarky prices under (hypothetical) closed-economy growth path, or that autarky prices would have fallen, on average, for goods that the economy actually exported in 1870's; i.e., the hypothetical growth path in a closed Japan would not have been biased toward import sectors.
- With this, then law of comparative advantage implies:

$$\left(p^a_{1850's} - p^f_{1870's}\right) \cdot M^f_{1870's} \geq 0$$

- Notice that we have substituted the observed $p^a_{1850's}$ for the unobserved $p^a_{1870's}$.

Bernhofen and Brown, JPE 2004 (cont'd)



Bernhofen and Brown, JPE 2004 (cont'd)

TABLE 2
APPROXIMATE INNER PRODUCT IN VARIOUS TEST YEARS (Millions of Ryō)

COMPONENTS	YEAR OF NET EXPORT VECTOR							
	1868	1869	1870	1871	1872	1873	1874	1875
1. Imports with observed autarky prices	−2.24	−4.12	−8.44	−7.00	−5.75	−5.88	−7.15	−7.98
2. Imports of woolen goods	−.98	−.82	−1.29	−1.56	−2.16	−2.50	−1.56	−2.33
3. Imports with approximated autarky prices (Shinbo index)	−1.10	−.95	−.70	−.85	−1.51	−2.08	−1.60	−2.65
4. Exports with observed autarky prices	4.07	3.40	4.04	5.16	4.99	4.08	5.08	4.80
5. Exports with approximated autarky prices (Shinbo index)	.09	.03	.07	.07	.15	.07	.11	.10
Total inner product (sum of rows 1–5)	**−.18**	**−2.47**	**−6.31**	**−4.17**	**−4.28**	**−6.31**	**−5.11**	**−8.06**

SOURCE.—For sources of price data, see Sec. IV*B* and n. 17. For rows 3 and 5, current silver yen values are converted to values of 1851–53 by deflating them with the price indices for exports and imports found in Shinbo (1978, table 5–10).

NOTE.—All values are expressed in terms of millions of ryō. The ryō equaled about $1.00 in 1873 and was equivalent to the yen when it was introduced in 1871. The estimates are of the approximation of the inner product $(\bar{\mathbf{p}}_i \cdot \overline{\mathbf{T}})$ valued at autarky prices prevailing in 1851–53. An explanation of the assumptions underlying the approximation is contained in the text.

Chain of Comparative Advantage

Can we predict the pattern of trade good by good using a comparison of autarky prices?

- $p^a > p^f \Leftrightarrow M > 0$?
- $p^{a1} > p^{a2} \Leftrightarrow M^1 > 0$?

Consider Nepal, a mountainous, mostly vegetarian country.

Nepal produces three goods: beef, leather, and guided hiking trips.

- Mountainous $\Rightarrow$ few cattle $\Rightarrow$ $p^{aut,leather}$ is high.
- Vegetarian $\Rightarrow$ low demand for beef $\Rightarrow$ $p^{aut,beef}$ is low.

Now let Nepal trade. With access to cheap cattle from abroad, it shifts resources from cattle raising to tourism. Suppose, for example, that it specializes in tourism. Then Nepal will import beef despite $p^{aut,beef}$ being lower than the world price.