

International Trade I: Theory

Gains from competitive trade

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Outline of the Lecture

- 1 Introduction
- 2 Gains from Trade
- 3 Formula for Gains from Trade
- 4 Optimality of Free Trade
- 5 Redistributing the Gains from Trade
- 6 Pattern of Trade

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Objectives

- 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.
 - ▶ Recent quantitative work focuses on measuring this.

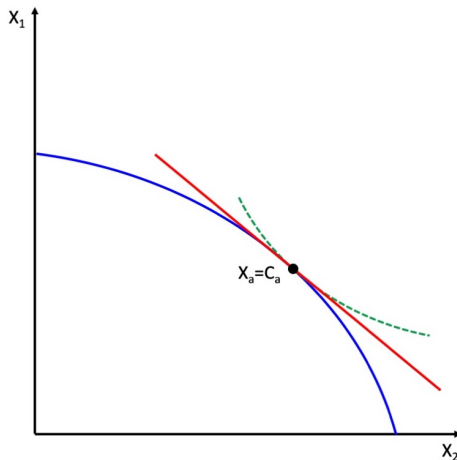
Perfect Competition and the Representative Consumer

- Assume:
 - ▶ perfect competition
 - ▶ convex technology (no IRS)
 - ▶ identical households with homothetic preferences (to allow us to neglect intra-national distributional issues for the time being)
- Define a **small country**: A small country can trade as much as it wishes at exogenously given terms of trade.

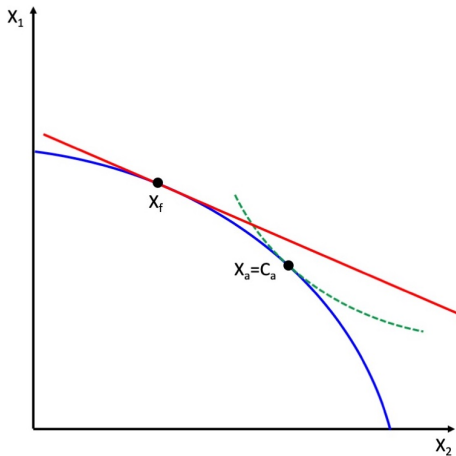
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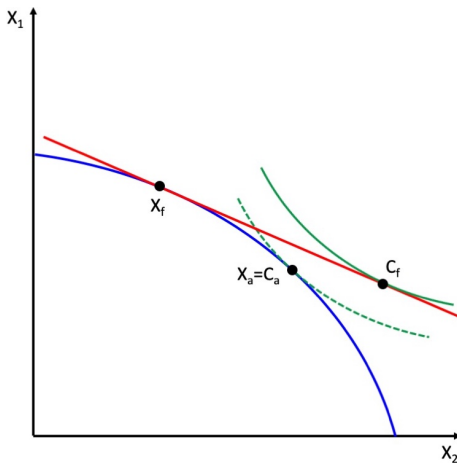
Small Country: Autarky Equilibrium



Small Country: Free Trade Production Point



Small Country: Free Trade Equilibrium



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

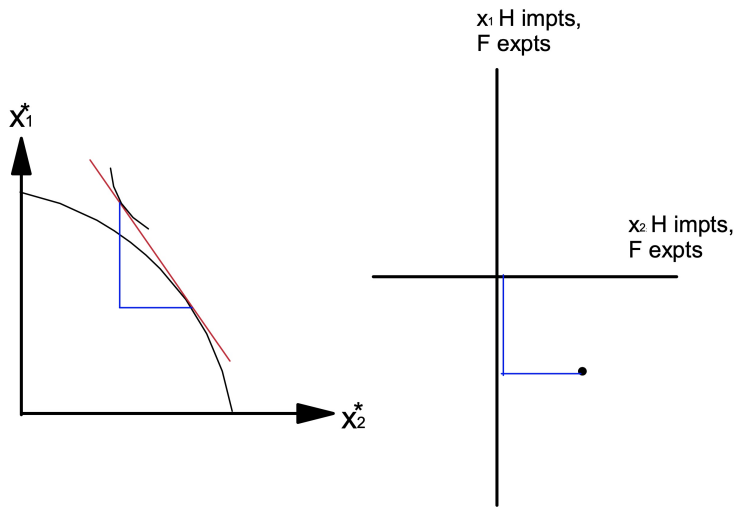
Small Country (continued)

- 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 $p^* \neq p^a$
- \Rightarrow For a small country, trade is like another production activity; GFT follows from FTWE.

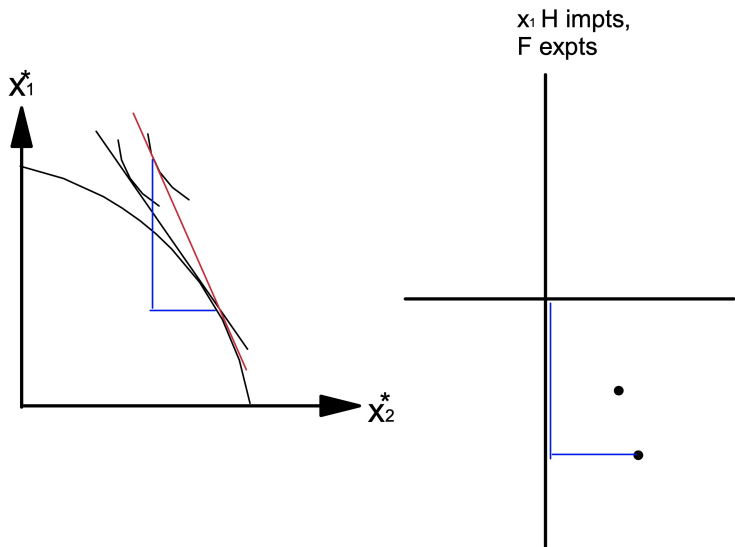
Large Country

- 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 off 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
- \Rightarrow For a small country, trade is like another production activity; GFT follows from FTWE.

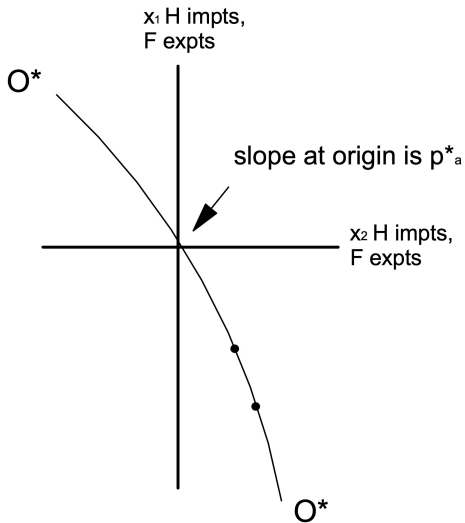
Offer Curve



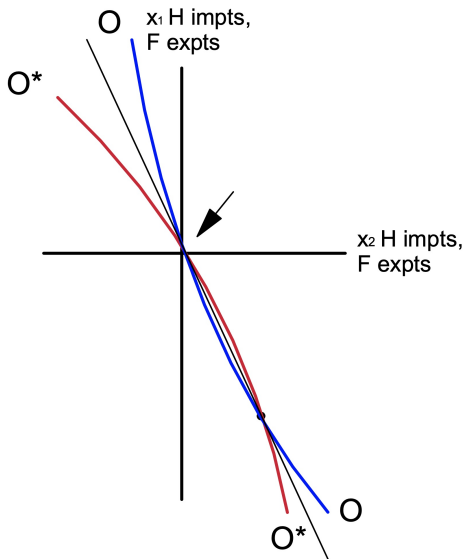
Offer Curve (continued)



Foreign Offer Curve

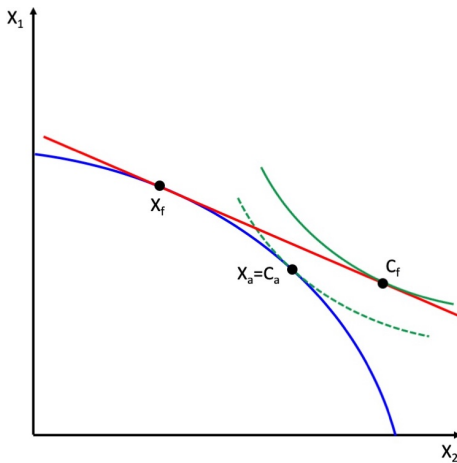


Equilibrium World Price



Gains from Trade: Large Country

Make revealed preference argument wrt equilibrium world price:



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}^a is vector of autarky equilibrium prices
 - ▶ \mathbf{p}^f is vector of free-trade equilibrium prices
- Gains from Trade: $0 \leq \mathbf{p}^f \cdot (\mathbf{c}^f - \mathbf{c}^a)$

Gains from Trade Proof

We have:

$$\mathbf{p}^f \cdot (\mathbf{c}^f - \mathbf{c}^a) = \mathbf{p}^f \cdot (\mathbf{M}^f - \mathbf{M}^a) + \mathbf{p}^f \cdot (\mathbf{x}^f - \mathbf{x}^a) \quad (1)$$

$$= \mathbf{p}^f \cdot (\mathbf{x}^f - \mathbf{x}^a) \quad (2)$$

$$\geq 0 \quad (3)$$

where lines 1 to 3 hold:

- ❶ by definition (consumption is imports plus domestic production)
- ❷ by balanced trade (the value of aggregate imports is zero) and by $\mathbf{M}^a = 0$
- ❸ by profit maximization and perfect competition (the vector of prices \mathbf{p}^f maximizes the value of production \mathbf{x}^f).

Strict Gains?

- Need \mathbf{p}^f not proportional to \mathbf{p}^a : with competition, gains from trade requires differences in autarky prices
- Need some substitutability on production or consumption side

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Formula for GFT with Complete Specialization

- Arkolakis, Costinot, Rodríguez-Clare (AER, 2012)
- Assumptions:
 - ▶ Preferences have constant elasticity of substitution (Dixit-Stiglitz)

$$U = \left[\int q(\omega)^{(\sigma-1)/\sigma} \right]^{\sigma/(\sigma-1)}$$

- ▶ One factor of production (labor) and constant returns to scale
- ▶ “Iceberg” trade costs
- ▶ Import demand system is CES: Partial equilibrium (given wages) elasticity of aggregate bilateral trade flow relative to domestic demand is ϵ wrt to trade costs τ_{ij} for any i and j
 - ★ The CES preferences get us part of the way there, but that is not enough
 - ★ To satisfy assumption with perfect competition, ACR show that we need **complete specialization**; i.e., measure of goods produced in two countries is zero

Formula for GFT with Complete Specialization

Define a “foreign shock” as any change in (foreign) endowments and trade costs that do not affect a country’s endowment or its ability to serve its own market. Define $\hat{W} = W'/W$ and $\hat{\lambda}_{jj} = \lambda'_{jj}/\lambda_{jj}$.

Proposition

The change in country j real income associated with any foreign shock can be computed as $\hat{W}_j = \hat{\lambda}_{jj}^{1/\epsilon}$, where λ_{ij} is the share of country j spending on country i goods.

Corollary

Gains from trade relative to autarky can be computed as $\hat{W}_j = \lambda_{jj}^{-1/\epsilon}$.

Implication

In 2000, US spent 93% of income on domestic goods. Trade elasticities have been estimated in range of -5 to -10. This gives (small) GFT in range from 0.7 to 1.4 percent of real income.

Proof for Armington Case

- Prove for Armington case, in which each country produces exactly one good from one inelastically supplied factor.
 - ▶ One unit of output per unit of national labor
 - ▶ Labor inelastically supplied \Rightarrow essentially an endowment economy
- Spending in j on goods from i :

$$X_{ij} = \left(\frac{w_i \tau_{ij}}{P_j} \right)^{1-\sigma} Y_j$$

where $Y_j = w_j L_j$ is total expenditure, $\epsilon = 1 - \sigma$ is the import elasticity in this case, and

$$P_j = \left[\sum_i^n (w_i \tau_{ij})^{1-\sigma} \right]^{1/(1-\sigma)}$$

is the price index. Note that $W_j = Y_j / P_j$.

Proof for Armington Case

- Let labor in j be numéraire. Then $dY_j = 0$ for a foreign shock. Then

$$d \ln W_j = - \sum_1^n \lambda_{ij} (d \ln w_i + d \ln \tau_{ij})$$

where $\lambda_{ij} = X_{ij}/Y_j$.

- From equation for X_{ij}

$$d \ln \lambda_{ij} - d \ln \lambda_{jj} = (1 - \sigma)(d \ln w_i + d \ln \tau_{ij})$$

- Now substitute

$$d \ln W_j = \frac{\sum_{i=1}^n \lambda_{ij} (d \ln \lambda_{jj} - d \ln \lambda_{ij})}{1 - \sigma} = \frac{d \ln \lambda_{jj}}{1 - \sigma}$$

where the equality uses $\sum_{i=1}^n \lambda_{ij} = 1$.

Broader Applicability

- ACR show that same formula applies for a broader set of models (that we will see later in course); e.g., Krugman (1980) and Melitz (2003)
- Still need one factor, complete specialization, balanced trade
- Can have fixed entry cost and fixed cost of exporting to a given market
- Can have monopolistic competition with free entry or restricted entry, provided that aggregate profits gross of any entry costs in j are a constant share of country j aggregate revenues

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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)

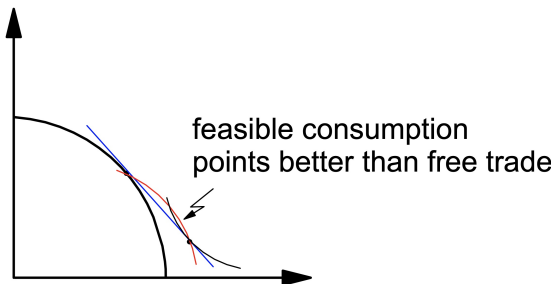
This won't work, because $p^f \neq p^b$!

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

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

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

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



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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 fixed endowment of good 1 and Household 2 has fixed endowment of good 2; change in relative price from $p^a \rightarrow p^f$ 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 prodn fcts 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.

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 max $U^i(c^i)$ 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 $T^i = p^f \cdot c^{ai}$

$$\begin{aligned}
 \sum_i T_i &= p^f \cdot \sum_i c^{ai} \\
 &= p^f \cdot x^a \\
 &\leq p^f \cdot x^f \\
 &= 0
 \end{aligned}$$

Lump-Sum Transfers (continued)

- So each household can buy (at least) autarky bundle and 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 provide an alternative scheme that does not suffer from this problem. Requires only information about aggregates, not about individuals.

Consumption 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

$$t = p^{cf} - p^f$$

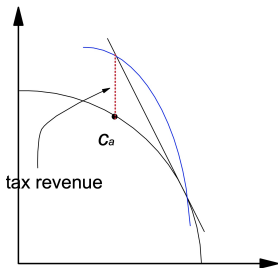
Consumption Taxes/Subsidies

- How much does this scheme cost/raise?

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

Consumption Taxes/Subsidies

- 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 raises a subsidy to generate Pareto improvement.
- Intuition: This scheme sacrifices the consumer gains from trade, but preserves the gains from reorganizing production



Consumption Taxes/Subsidies

- 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.

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Comparative Advantage

- What determines the pattern of trade?
 - ▶ In competitive theory, we need to focus on **differences** 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:

$$\begin{aligned}
 p^a \cdot c^f &\geq p^a \cdot c^a \\
 &= p^a \cdot x^a \\
 &\geq p^a \cdot x^f
 \end{aligned}$$

$$\Rightarrow p^a \cdot M^f \geq 0$$

$$\Rightarrow (p^a - p^f) \cdot M^f \geq 0$$

- On average, countries import goods that are relative expensive in autarky and export goods that are relative 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

$$p^{1a} \cdot M^{1f} \geq 0$$

$$p^{2a} \cdot M^{2f} \geq 0$$

and we have $M^{2f} = -M^{1f}$

$$\Rightarrow (p^{1a} - p^{2a}) \cdot M^{1f} \geq 0$$

Chain of Comparative Advantage?

- Can we predict the pattern of trade good by good using a comparison of autarky prices?
 - ▶ $p^a > p^f \Leftrightarrow M > 0$?
 - ▶ $p^{1a} > p^{2a} \Leftrightarrow M^1 > 0$?
- Consider “Nepal”, a mountainous, mostly vegetarian country. Nepal produces three goods: beef, leather and guided hiking trips
 - ▶ mountainous \Rightarrow few cattle $\Rightarrow p_{leather}^a$ is high
 - ▶ vegetarian \Rightarrow low demand for beef $\Rightarrow p_{beef}^a$ 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 $\Rightarrow p_{beef}^a$ lower than world price.