Econ 266 International Trade
— Lecture 1 —
Comparative Advantage and Gains from Trade

Today's Plan

1. Course logistics
2. A Brief History of the Field
3. Neoclassical Trade: Standard Assumptions
4. Neoclassical Trade: General Results
    1. Gains from Trade
    2. Law of Comparative Advantage

Course Logistics

- **Lecture**: Monday and Wednesday 11:30AM-1:20PM
- **Instructor**: Dave Donaldson
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  - Office hours: just email me

Course Logistics

- No required textbooks, but you will frequently find it helpful to refer to:
  - Dixit and Norman, *Theory of International Trade*
  - Feenstra, *Advanced International Trade: Theory and Evidence*

Course Logistics

- **Course requirements**:
  - 15 short 'paper responses' (roughly one per week): 50% of the course grade
  - One mock referee report: 20% of the course grade
  - One research proposal: 30% of the course grade

Course Logistics

- **Course outline:**
  1. General setup (gains from trade, comparative advantage) [2 lectures]
  2. Ricardian and Assignment Models [5 lectures]
  3. "New" trade theory (trade with increasing returns to scale) [2 lectures]
  4. Firm-level Trade [4 lectures]
  5. Gravity Models [3 lectures]
  6. Economic Geography [3 lectures]

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A Brief History of the Field

Two hundred years of theory

1. **1830-1980: Neoclassical trade theory**
   - $\Rightarrow$ Ricardo
   - $\Rightarrow$ Heckscher-Ohlin-Samuelson
   - $\Rightarrow$ Dixit-Norman
2. **1980-1990: "New" trade theory**
   - $\Rightarrow$ Krugman-Helpman
   - $\Rightarrow$ Brander-Krugman
   - $\Rightarrow$ Grossman-Helpman

A Brief History of the Field

The discovery of trade data

1. **1990-2000: Empirical trade**
2. **2000-2010: Firm-level heterogeneity**

A Brief History of the Field

Where are we now?

- Strong convergence of theory and empirics
- Wide range of topics under study from both theoretical and empirical perspectives (offshoring, multinationals, growth, innovation, trade policy, international institutions (GATT/WTO), political economy)
- Remarkable growth of new data sources (multi-origin sourcing of firms, multi-destination sales of firms, multi-product sourcing/sales of firms, household scanner data, better price data, firms, firms matched to matched firms, workers matched to firms, remote sensing, multinationals) often particularly rich in developing countries
- Heightened integration of intra-national and inter-national trade/spatial issues (e.g. richer notion of space; allowing for factor mobility)

The Role of Empirics in International Trade

- There is a rich interaction between theory and empirics in International Trade that is perhaps without comparison in most areas of economics.
- The evolution of the theoretical study of trade since 1975 has been heavily influenced by empirical work. Some examples:
  - Evidence on intra-industry trade, trade between similar countries $\Rightarrow$ 'New trade theory' in 1980s (e.g. Krugman, 1980).
  - Evidence on within-industry heterogeneity, firm-level facts about exporters $\Rightarrow$ firm-level approach to trade (e.g. Melitz, 2003).
  - More recent developments have been heavily data-driven: intra-firm trade, multinational production, multiproduct firms.
  - Ongoing debates about 'trade and wage inequality': continuous feedback of empirical findings into debate about sets of theories that are empirically relevant.

Empirical Methods in International Trade

- We will see examples of wide range of empirical methods:
  - Descriptive methods and simple tests.
  - 'Reduced-form' econometric methods (ie not explicitly estimating model parameters): *Mostly Harmless Econometrics* is a great resource for learning these methods.
  - 'Structural' econometric methods: no textbook, but Reiss and Wolak (2007, *Handbook of Econometrics* chapter), Paarsch and Hong (2006, Auctions book) and Ackerberg, Benkard, Berry and Pakes (2007, *Handbook of Econometrics* chapter) are great introductions.
  - 'Sufficient statistic' approaches (e.g. Chetty, ARE 2009).

Is Empirical Trade Different?

(From empirical work in other fields...)

- Empirical work in trade is typically theory-driven, but not always explicitly 'structural':
  - But history of famous mistakes from empirical work not taking theory seriously enough have left their mark on the field.
  - Impossible to do empirical work without solid theoretical understanding.
- Unique tension:
  - Like macro: studying policy issues that are national in nature (e.g. tariffs).
  - Unlike macro: essential feature and focus is heterogeneity (across countries, industries, firms, factors, consumers, intra-national locations...)
- General equilibrium
  - *Interaction* between heterogeneous agents is paramount.
  - E.g., in basic 2×2 Ricardian model, if you think in PE you conclude that absolute advantage matters, but if you think in GE you conclude that comparative advantage (ie interactions crucial).

How Do You Do GE Empirics?

A common theme in this course

- Other heavily empirical fields are rarely forced to (or choose to) grapple with GE.
- But there are some great exceptions that include:
  - Labor: Heckman, Lochner and Taber (AERPP, 1998). Peer effects literature (e.g. Manski, Restud 1993). Acemoglu, Autor and Lyle (JPE 2004) on large labor supply shock. National-level (e.g. Borjas) vs city-level (e.g. Card) approach to immigration. Crepon et al (2012 QJE) on labor market policies.
  - Macro: Caballero-Engel (various), Bloom (Ecta 2007).
  - PF/Health: Finkelstein (QJE 2007) on individual-level vs aggregate (state)-level estimated effects of medicare.
  - Development: Miguel and Kremer (Ecta 2004) on de-worming spillovers across children within villages.
  - IO: Strategic interactions between firms within industries (Ericsson and Pakes (Restud, 1995); Bajari, Benkard and Levin (Ecta, 2007); Bajari, Hong and Nekipelov (2010) survey of game estimation literature; and many more).

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International Trade: Standard Assumptions

- What distinguishes trade theory from abstract general-equilibrium analysis is the existence of a **hierarchical market structure**:
  1. **"International"** good markets
  2. **"Domestic"** factor markets
- Typical asymmetry between "**goods**" and "**factors**":
  - Goods enter consumers' utility functions directly, are elastically supplied and demanded, and can be freely traded internationally
  - Factors only affect utility through the goods they generate, they are in fixed supply domestically**,** and they cannot be traded at all
- **Central Issues**:
  - How does the integration of good markets affect good prices?
  - How do changes in good prices, in turn, affect factor prices, factor allocation, production, and welfare?

International Trade: Standard Assumptions (Cont.)

- While these assumptions are less fundamental, we will also often assume that:
  - Consumers have identical homothetic preferences in each country (representative agent)
  - Model is static (long-run view)
- Many of these assumptions look very strong, but they can be dealt with by clever reinterpretations of the model:
  - Transport costs could be handled by interpreting one of the good as transportation services
  - Factor mobility could be dealt with by defining as a good anything that can be traded
  - Goods and factors can be distinguished by locations, time, and states of nature

Neoclassical Trade: Standard Assumptions

- **"Neoclassic trade models"** characterized by three key assumptions:
  1. *Perfect competition*
  2. *Constant returns to scale (CRS)*
  3. *No distortions*

- **Comments:**
  - We could allow for decreasing returns to scale (DRS) by introducing hidden factors in fixed supply
  - Increasing returns to scale (IRS) are a much more severe issue addressed by "New" trade theory (see lectures 8 and 9)

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Neoclassical Trade: General Results

- Not surprisingly, there are few results that can be derived using only Assumptions 1-3
- In future lectures, we will derive sharp predictions for special cases: Ricardo, Assignment, Ricardo-Viner, and Heckscher-Ohlin models
- Today, we'll stick to the general case and show how simple revealed preference arguments can be used to establish two important results:
  1. *Gains from trade* (Samuelson 1939)
  2. *Law of comparative advantage* (Deardorff 1980)

Basic Environment

- Consider a world economy with $n = 1, ..., N$ countries, each populated by $h = 1, ..., H_n$ households
- There are $g = 1, ..., G$ goods:
  - $y^n \equiv (y_1^n, ..., y_G^n) \equiv$ Output vector in country n
  - $c^{nh} \equiv (c_1^{nh}, ..., c_G^{nh}) \equiv$ Consumption vector of household h in country n
  - $p^n \equiv (p_1^n, ..., p_G^n) \equiv$ Good price vector in country n
- There are $f = 1, ..., F$ factors:
  - $v^n \equiv (v_1^n, ..., v_F^n) \equiv$ Endowment vector in country n
  - $w^n \equiv (w_1^n, ..., w_F^n) \equiv$ Factor price vector in country n

Supply

The revenue function

- We denote by Ω^n the set of combinations (y, v) that are feasible in country n
  - CRS $\Rightarrow$ Ω^n is a convex cone
- **Revenue function** in country n is defined as

$$r^n(p, v) \equiv \max_y \{py | (y, v) \in \Omega^n\}$$

- Comments (see Dixit-Norman pp. 31-36 for details):
  - Revenue function summarizes all relevant properties of technology
  - Under perfect competition, y^n maximizes the value of output in country n:

$$r^n(p^n, v^n) = p^n y^n \tag{1}$$

Demand

The expenditure function

- We denote by u^{nh} the utility function of household h in country n
- **Expenditure function** for household h in country n is defined as

$$e^{nh}(p, u) = \min_{c} \left\{ pc | u^{nh}(c) \geq u \right\}$$

- Comments (see Dixit-Norman pp. 59-64 for details):
  - Here factor endowments are in fixed supply, but easy to generalize to case where households choose factor supply optimally
  - Holding p fixed, $e^{nh}(p, u)$ is increasing in u
  - Household's optimization implies

$$e^{nh}(p^n, u^{nh}) = p^n c^{nh}, \tag{2}$$

where c^{nh} and u^{nh} are the consumption and utility level of the household in equilibrium, respectively

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Gains from Trade

One household per country

- In the next propositions, when we say *"in a neoclassical trade model,"* we mean in a model where equations (1) and (2) hold in any equilibrium.
- Consider first the case where there is just one household per country
- Without risk of confusion, we drop h and n from all variables
- Instead we denote by:
  - (y^a, c^a, p^a) the vector of output, consumption, and good prices under autarky
  - (y, c, p) the vector of output, consumption, and good prices under free trade
  - u^a and u the utility levels under autarky and free trade

- **Proposition 1** *In a neoclassical trade model with one household per country, free trade makes all households in the world (weakly) better off.*

- Proof:

$$\begin{aligned} e(p, u^a) &\leq pc^a, && \text{by definition of } e(.) \\ &= py^a && \text{by market clearing under autarky} \\ &\leq r(p, v) && \text{by definition of } r(.) \\ &= e(p, u) && \text{by equations } (1), (2), \text{ and trade balance} \end{aligned}$$

Since $e(p, \cdot)$ increasing, we get $u \geq u^a$

- **Comments:**
  - Two inequalities in the previous proof correspond to consumption and production gains from trade
  - Previous inequalities are weak. Equality if kinks in IC or PPF
  - Previous proposition only establishes that households always prefer "free trade" to "autarky." It does **not** say anything about the comparisons of trade equilibria

Gains from Trade

Multiple households per country (I): domestic lump-sum transfers

- With multiple-households, moving away from autarky is likely to create winners and losers
- In order to establish the Pareto-superiority of trade, we will therefore need to allow for policy instruments. We start with *domestic* lump-sum transfers and then consider commodity/factor-based taxes.
- We now reintroduce the index h explicitly and denote by:
  - c^{ah} and c^h the vector of consumption of household h under autarky and free trade
  - v^{ah} and v^h the vector of endowments of household h under autarky and free trade
  - u^{ah} and u^h the utility levels of household h under autarky and free trade
  - τ^h the lump-sum transfer from the government to household h ($\tau^h \leq 0 \Leftrightarrow$ lump-sum tax and $\tau^h \geq 0 \Leftrightarrow$ lump-sum subsidy)

Gains from Trade

Multiple households per country (I): domestic lump-sum transfers

- **Proposition 2** *In a neoclassical trade model with multiple households per country, there exist domestic lump-sum transfers such that free trade is (weakly) Pareto superior to autarky in all countries*

- **Proof:** We proceed in two steps...

  Step 1: For any h, set the lump-sum transfer τ^h such that

  $$\tau^h = (p - p^a)\, c^{ah} - (w - w^a) v^h$$

  Budget constraint under autarky implies $p^a c^{ah} \leq w^a v^h$. Therefore

  $$p c^{ah} \leq w v^h + \tau^h$$

  Thus c^{ah} is still in the budget set of household h under free trade

- **Proposition 2** *In a neoclassical trade model with multiple households per country, there exist domestic lump-sum transfers such that free trade is (weakly) Pareto superior to autarky in all countries*

- **Proof (Cont.):**
  Step 2: By definition, government's revenue is given by

$$\begin{aligned}
-\sum \tau^h &= \left(p^a - p\right)\sum c^{ah} - \left(w^a - w\right)\sum v^h && \text{: definition of } \tau_h \\
&= \left(p^a - p\right) y^a - \left(w^a - w\right) v && \text{: mc autarky} \\
&= -py^a + wv && \text{: zp autarky} \\
&\geq -r\left(p, v\right) + wv && \text{: definition } r\left(p, v\right) \\
&= -\left(py - wv\right) = 0 && \text{: eq. } (1) + \text{zp free trade}
\end{aligned}$$

Gains from Trade

Multiple households per country (I): domestic lump-sum transfers

- **Comments:**
  - Good to know we don't need *international* lump-sum transfers
  - But these domestic lump-sum transfers remain informationally intensive (c^{ah}?)

- With this last comment in mind, we now restrict the set of instruments to commodity and factor taxes/subsidies

- More specifically, suppose that the government can affect the prices faced by all households under free trade by setting τ^{good} and τ^{factor}

$$\begin{aligned} p^{\text{household}} &= p + \tau^{\text{good}} \\ w^{\text{household}} &= w + \tau^{\text{factor}} \end{aligned}$$

- **Proposition 3** *In a neoclassical trade model with multiple households per country, there exist commodity and factor taxes/subsidies such that free trade is (weakly) Pareto superior to autarky in all countries*
- **Proof:** Consider the two following taxes:

$$\begin{aligned} \tau^{\text{good}} &= p^a - p \\ \tau^{\text{factor}} &= w^a - w \end{aligned}$$

By construction, household is indifferent between autarky and free trade. Now consider government's revenues. By definition

$$\begin{aligned} -\sum \tau^h &= \tau^{\text{good}} \sum c^{ah} - \tau^{\text{factor}} \sum v^h \\ &= (p^a - p) \sum c^{ah} - (w^a - w) \sum v^h \geq 0, \end{aligned}$$

for the same reason as in the previous proof.

Gains from Trade

Multiple households per country (II): commodity and factor taxation

- **Comments:**
  - Previous argument only relies on the existence of *production gains* from trade
  - If there is a kink in the PPF, we know that there aren't any...
  - Factor taxation still informationally intensive: need to know endowments in efficiency units, may lead to different taxes across firms

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Law of Comparative Advantage

Basic Idea

- The previous results have focused on normative predictions
- We now demonstrate how the same revealed preference argument can be used to make positive predictions about the pattern of trade
- **Principle of comparative advantage:**
  Comparative advantage—meaning differences in relative autarky prices—is the basis for trade
- Why? If two countries have the same autarky prices, then after opening up to trade, the autarky prices remain equilibrium prices. So there will be no trade....
- **The law of comparative advantage (in words):**
  Countries tend to export goods in which they have a CA, i.e. lower relative autarky prices compared to other countries

Law of Comparative Advantage

Dixit and Norman (1980), Deardorff (1980)

- Let $t^n \equiv \left(y_1^n - \sum c^{nh}, ..., y_G^n - \sum c^{nh}\right)$ denote net exports in country n
- Let u^{an} and u^n denote the utility level of the representative household in country n under autarky and free trade
- Let p^{an} denote the vector of autarky prices in country n
- Without loss of generality, normalize prices such that:

$$\sum p_g = \sum p_g^{an} = 1,$$

- Notation:

$$\begin{aligned} cor\left(x,y\right) &= \frac{cov\left(x,y\right)}{\sqrt{var\left(x\right)var\left(y\right)}} \\ cov\left(x,y\right) &= \sum_{i=1}^{n}\left(x_i - \overline{x}\right)\left(y_i - \overline{y}\right) \\ \overline{x} &= \frac{1}{n}\sum_{i=1}^{n} x_i \end{aligned}$$

Law of Comparative Advantage

Dixit and Norman (1980), Deardorff (1980)

- **Proposition 4** *In a neoclassical trade model, if there is a representative household in country n, then cor* $(p - p^a, t^n) \geq 0$
  Proof: Since $(y^n, v^n) \in \Omega^n$, the definition of r implies

$$p^a y^n \leq r\left(p^a, v^n\right)$$

Since $u^n\left(c^n\right) = u^n$, the definition of e implies

$$p^a c^n \geq e\left(p^a, u^n\right)$$

The two previous inequalities imply

$$p^a t^n \leq r\left(p^a, v^n\right) - e\left(p^a, u^n\right) \tag{3}$$

Since $u^n \geq u^{an}$ by Proposition 1, $e\left(p^a, \cdot\right)$ increasing implies

$$e(p^a, u^n) \geq e(p^a, u^{na}) \tag{4}$$

Law of Comparative Advantage

Dixit and Norman (1980), Deardorff (1980)

- **Proposition 4** *In a neoclassical trade model, if there is a representative household in country n, then cor* $(p - p^a, t^n) \geq 0$
  Proof (Cont.): Combining inequalities (3) and (4), we obtain

$$p^a t^n \leq r\left(p^a, v^n\right) - e(p^a, u^{na}) = 0,$$

where the equality comes from market clearing under autarky. Because of balanced trade, we know that

$$pt^n = 0$$

Hence

$$\left(p - p^a\right) t^n \geq 0$$

Law of Comparative Advantage

Dixit and Norman (1980), Deardorff (1980)

- **Proposition 4** *In a neoclassical trade model, if there is a representative household in country n, then* $cor\left(p - p^a, t^n\right) \geq 0$
  Proof (Cont.): By definition,

$$cov\left(p - p^a, t^n\right) = \sum\nolimits_g \left(p_g - p_g^a - \overline{p} + \overline{p}^a\right)\left(t_g^n - \overline{t}^n\right),$$

which can be rearranged as

$$cov\left(p - p^a, t^n\right) = \left(p - p^a\right) t^n + G\left(\overline{p} - \overline{p}^a\right)\overline{t}^n$$

Given our price normalization, we know that $\overline{p} = \overline{p}^a$. Hence

$$cov\left(p - p^a, t^n\right) = \left(p - p^a\right) t^n \geq 0$$

Proposition 4 derives from this observation and the fact that

$$sign\left[cor\left(p - p^a, t^n\right)\right] = sign\left[cov\left(p - p^a, t^n\right)\right]$$

Law of Comparative Advantage

Dixit and Norman (1980), Deardorff (1980)

- **Comments:**
  - With 2 goods, each country exports the good in which it has a CA, but with more goods, this is just a correlation
  - Core of the proof is the observation that $p^a t^n \leq 0$
  - It directly derives from the fact that there are gains from trade. Since free trade is better than autarky, the vector of consumptions must be at most barely attainable under autarky ($p^a y^n \leq p^a c^n$)
  - For empirical purposes, problem is that we rarely observe autarky...(but see next lecture for a nice example).
  - In future lectures, we will look at models which relate p^a to (observable) primitives of the model (technology and factor endowments) in order to make progress.