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

- Recitations: TBA
- No required textbooks, but we will frequently use:
  - Dixit and Norman, Theory of International Trade (DN)
  - Feenstra, Advanced International Trade: Theory and Evidence (F)
  - Helpman and Krugman, Market Structure and Foreign Trade (HKa)
- Relevant chapters of all textbooks will be available on Stellar
Course Logistics

Course requirements:

- Four problem sets: 50% of the course grade
- One referee report: 15% of the course grade
- One research proposal: 35% of the course grade
Course outline:

1. Ricardian and Assignment Models (4 weeks)
2. Factor Proportion Theory (2 weeks)
3. Firm Heterogeneity Models (2 weeks)
4. Gravity Models (1 week)
5. Topics:
   1. Economic Geography (1 week)
   2. Offshoring (1 week)
   3. Trade Policy (2 weeks)
A Brief History of the Field
Two hundred years of theory

1. **1830-1980: Neoclassical trade theory**
   - Ricardo
   - Heckscher-Ohlin-Samuelson
   - Dixit-Norman

   - Krugman-Helpman
   - Brander-Krugman
   - Grossman-Helpman
A Brief History of the Field
The discovery of trade data

1. **1990-2000: Empirical trade**
   ⇒ Leamer, Trefler, Davis-Weinstein
   ⇒ Bernard, Tybout

2. **2000-2010: Firm-level heterogeneity**
   ⇒ Melitz
   ⇒ Eaton-Kortum

3. **Where are we now?**
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 income 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?
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
“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
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)
Consider a world economy with $n = 1, \ldots, N$ countries, each populated by $h = 1, \ldots, H_n$ households.

There are $g = 1, \ldots, G$ goods:

- $y^n \equiv (y^n_1, \ldots, y^n_G) \equiv$ Output vector in country $n$
- $c^{nh} \equiv (c^{nh}_1, \ldots, c^{nh}_G) \equiv$ Consumption vector of household $h$ in country $n$
- $p^n \equiv (p^n_1, \ldots, p^n_G) \equiv$ Good price vector in country $n$

There are $f = 1, \ldots, F$ factors:

- $v^n \equiv (v^n_1, \ldots, v^n_F) \equiv$ Endowment vector in country $n$
- $w^n \equiv (w^n_1, \ldots, w^n_F) \equiv$ Factor price vector in country $n$
We denote by $\Omega^n$ the set of combinations $(y, v)$ feasible in country $n$.

- CRS $\Rightarrow \Omega^n$ 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 $n$:

$$r^n(p^n, v^n) = p^n y^n$$ (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

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

where $c^{nh}$ and $u^{nh}$ are the consumption and utility level of the household in equilibrium, respectively
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 (weakly) better off.

Proof:

\[ e(p, u^a) \leq pc^a, \quad \text{by definition of } e \]
\[ = py^a \quad \text{by market clearing under autarky} \]
\[ \leq r(p, v) \quad \text{by definition of } r \]
\[ = e(p, u) \quad \text{by equations (1), (2), and trade balance} \]

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.
With multiple-households, moving away from autarky is likely to create winners and losers.

- How does that relate to the previous comment?

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...

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
- $\tau^h$ the lump-sum transfer from the government to household $h$ ($\tau^h \leq 0 \iff$ lump-sum tax and $\tau^h \geq 0 \iff$ lump-sum subsidy)
**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 $\tau^h$ 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

\[- \sum \tau^h = (p^a - p) \sum c^{ah} - (w^a - w) \sum v^h\]

: definition of \(\tau_h\)

\[= (p^a - p) y^a - (w^a - w) v\]

: mc autarky

\[= -py^a + wv\]

: zp autarky

\[\geq -r(p, v) + wv\]

: definition \(r(p, v)\)

\[= -(py - wv) = 0\]

: eq. (1) + zp free trade
Gains from Trade

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

- **Comments:**
  - Good to know we don't need *international* lump-sum transfers
  - Domestic lump-sum transfers remain informationally intensive ($c^a h$?)
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 $\tau^\text{good}$ and $\tau^\text{factor}$:

\[
p^\text{household} = p + \tau^\text{good}
\]
\[
w^\text{household} = w + \tau^\text{factor}
\]
**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:

\[
\begin{align*}
\tau^{\text{good}} &= p^a - p \\
\tau^{\text{factor}} &= w^a - w
\end{align*}
\]

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

\[
- \sum \tau^h = \tau^{\text{good}} \sum c^{ah} - \tau^{\text{factor}} \sum v^h
\]

\[
= (p^a - p) \sum c^{ah} - (w^a - w) \sum v^h \geq 0,
\]

for the same reason as in the previous proof.
Comments:

1. Previous argument only relies on the existence of production gains from trade.
2. If there is a kink in the PPF, we know that there aren’t any...
4. Factor taxation still informationally intensive: need to know endowments per efficiency units, may lead to different business taxes.
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-Norman-Deardorff (1980)

- Let $t^n \equiv (y^n_1 - \sum c^{nh}, \ldots, y^n_G - \sum c^{nh})$ 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:
  \[ \sum p_g = \sum p^{an}_g = 1, \]

- Notations:
  \[
  \text{cor} (x, y) = \frac{\text{cov} (x, y)}{\sqrt{\text{var} (x) \text{var} (y)}} \\
  \text{cov} (x, y) = \sum_{i=1}^{n} (x_i - \overline{x}) (y_i - \overline{y}) \\
  \overline{x} = \frac{1}{n} \sum_{i=1}^{n} x_i
  \]
Proposition 4 In a neoclassical trade model, if there is a representative household in country \( n \), then \( \text{cor} \left( p - p^a, t^n \right) \geq 0 \)

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 \( u^n(c^n) = u^n \), 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

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

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

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

\[ pt^n = 0 \]

Hence

\[ (p - p^a) t^n \geq 0 \]
Proposition 4 In a neoclassical trade model, if there is a representative household in country $n$, then $\text{cor}\ (p - p^a, t^n) \geq 0$

Proof (Cont.): By definition,

$$\text{cov}\ (p - p^a, t^n) = \sum_g (p_g - p_g^a - \bar{p} + \bar{p}^a) (t_g^n - \bar{t}^n),$$

which can be rearranged as

$$\text{cov}\ (p - p^a, t^n) = (p - p^a) t^n - G (\bar{p} - \bar{p}^a) \bar{t}^n$$

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

$$\text{cov}\ (p - p^a, t^n) = (p - p^a) t^n \geq 0$$

Proposition 4 derives from this observation and the fact that

$$\text{sign} [\text{cor}\ (p - p^a, t^n)] = \text{sign} [\text{cov}\ (p - p^a, t^n)]$$
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...
- In future lectures, we will look at models which relate $p^a$ to (observable) primitives of the model: technology and factor endowments.
14.581 International Economics I
Spring 2013

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