# ECO364H1S: International Trade Theory
## Lecture 1

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## Welcome

- This class will study issues in international trade through the lense of theoretical economic models

- Why do countries trade? When is trade beneficial? When is it harmful? What factors affect the pattern of trade in goods and services?

- What are the implications of tariffs, quotas, export subsidies, etc?

- We will study these issues using economic modelling
  - *Two Cheers for Formalism* by Paul Krugman

- **Goal: Provide theoretical frameworks to understand and reason about real-world issues in international trade**

# Course Information

- Course Name: ECO364H1S International Trade Theory
- Section: L5101
- Term: Winter 2019
- When: Tuesday 6-9pm (8-9pm are for tutorials / office hours)
- Where: SS 2135

# Instructor

- Palermo Penano
- Slack channel: See syllabus for instructions
- Email:
- Office Hours: By appointment

# Teaching Assistants

- Swapnika Rachapalli
  - Email:
- Billur Gorgulu
  - Email:
- See Syllabus for office hours and location

# Course Pre-requisite and Expectation

- ▶ Please make sure you have the correct pre-requisites for this course
  - The university does check prerequisites and may de-enroll you from the course (I am powerless against this)
- ▶ Math you need:
  - Calculus (partial and total derivatives) and linear algebra
  - Basic constrained optimization (Langrangians and Kuhn-Tucker conditions) as covered in second-year microeconomics
  - Will provide brief math review next week
- ▶ Emphasis will be placed on the meaning and insights revealed by the math

# Textbook

- **International Economics: Theory and Policy** by Paul R. Krugman, Marc J. Melitz, and Maurice Obstfeld, 11th Edition
- Recommended—not required
- Online version available (see syllabus for details on how to purchase)

# Course Website

- All course materials (syllabus, lecture slides, problem sets, etc.) will be posted on Quercus

# Grade Distribution

- Four problem sets: 5% each
- In-class Midterm Exam: 30%
- Final Exam: 50%
- Important dates and deadlines are on the syllabus

# Course Outline

# Outline for the Course

- Ricardian Model
  - How does differences in productivity determine specialization?
- Heckscher-Ohlin Model
  - How does differences in the abundance of factors (e.g. capital, labour) determine specialization?
- Specific-Factors Model
  - Assuming some factors are immobile (land), how will differences in abundance of factors drive specialization?
- Midterm

# Outline for the Course

- ▶ Trade Policy
  - • Tariffs, quotas, export subsidies, voluntary export restraints
  - • Why limit / encourage trade? Why do we have the WTO?

- ▶ Trade with increasing returns and imperfect competition
  - • Does trade encourage cost savings through economies of scale?
  - • Does trade increase or decrease market power?
  - • Do more productive firms benefit from trade liberalization?
  - • Does trade encourage firms to invest in productivity improving technologies?

# Outline for Today

- Why is trade important?
- Trade facts for Canada, China, Mexico, and the U.S.
  - Trade over time
  - Trade by commodity
  - Trade by partner country
- Ricardian Model

# What is International Trade?

- ▶ One aspect: exchange of goods and services across independent nations
  - • Globalization: greater interaction between people and nations in the world
- ▶ Other aspects:
  - • International Finance (flow of money)
  - • Immigration (flow of people)
  - • Technology and Culture (flow of ideas)

# Trade Over Time

- ▶ World export of manufactured goods / world industrial production

Figure 2-5  **The Fall and Rise of World Trade**

Ratio of manufactures trade to production
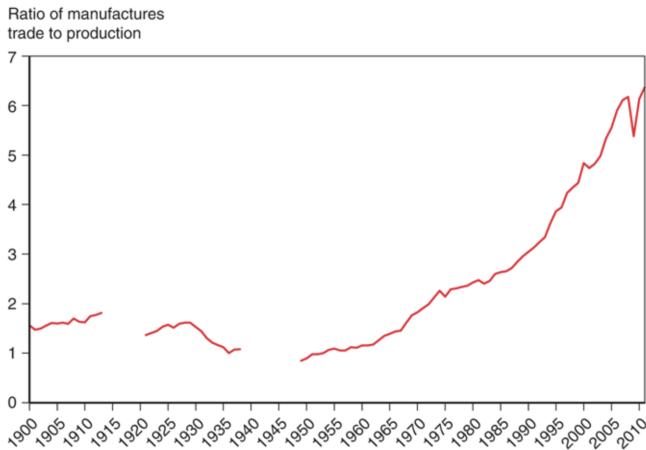
# Trade Over Time



Figure 1-1 **Exports and Imports as a Percentage of U.S. National Income (Shaded areas indicate U.S. recessions.)**

Both imports and exports have risen as a share of the U.S. economy, but imports have risen more.
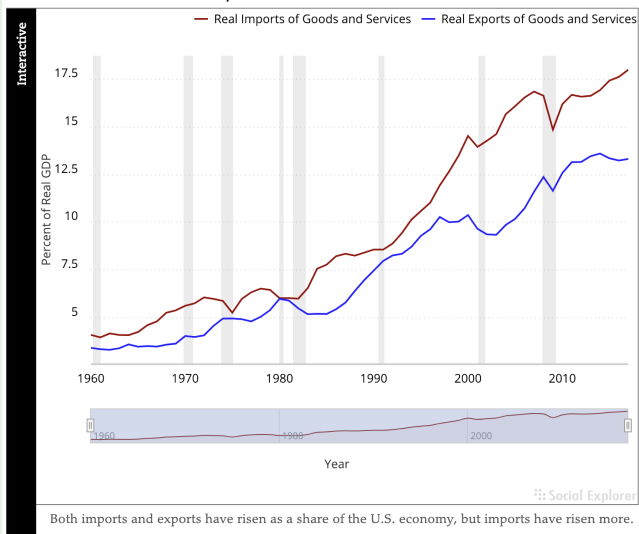
# Trade Over Time

- Trade, as a share of GDP, has grown since the 1960s, with rapid increases beginning in the 1980s
- This is true for both advanced and developing countries

# Trade by Commodity

**Exports by Commodities (%) (1980)**

| Type of Goods | Canada | China | Mexico | United States |
|---|---|---|---|---|
| Cars and Airplanes | 13.8 | 0.3 | 1.5 | 11.6 |
| Chemicals | 3.0 | 2.7 | 2.2 | 4.0 |
| Food | 10.2 | 14.5 | 9.6 | 13.2 |
| Textiles | 0.3 | 9.3 | 1.5 | 0.6 |

Source: Robert Feenstra, "World Trade Flows"

# Trade by Commodity

**Exports by Commodities (%) (1990)**

| Type of Goods | Canada | China | Mexico | United States |
|---|---|---|---|---|
| Cars and Airplanes | 23.5 | 0.9 | 11.0 | 15.2 |
| Chemicals | 2.2 | 2.0 | 2.5 | 3.7 |
| Food | 6.8 | 7.7 | 6.9 | 8.1 |
| Textiles | 0.2 | 18.8 | 1.8 | 0.6 |

Source: Robert Feenstra, "World Trade Flows"

# Trade by Commodity

**Exports by Commodities (%) (2000)**

| Type of Goods | Canada | China | Mexico | United States |
|:---:|:---:|:---:|:---:|:---:|
| Cars and Airplanes | 23.6 | 1.6 | 18.8 | 12.4 |
| Chemicals | 1.5 | 1.5 | 1.0 | 3.4 |
| Food | 5.5 | 3.5 | 3.5 | 4.7 |
| Textiles | 0.7 | 13.6 | 5.6 | 0.6 |

Source: Robert Feenstra, "World Trade Flows"

# Trade by Commodity: Evidence of Specialization?

- Developed countries produce more cars, airplanes, and chemicals
- Developing countries produce more textiles and food
- Countries appear to be specializing based on their level of development

# Trade by Partners

- Who are countries trading with?

# Trade by Partners

**Canada**

| Export Share (1970) | % | Export Share (1995) | % |
|---|---|---|---|
| United States | 65.3% | United States | 75.0% |
| United Kingdom | 9.4% | Japan | 5.5% |
| Japan | 5.5% | Germany | 1.9% |
| (West) Germany | 2.9% | United Kingdom | 1.9% |
| Italy | 1.3% | China | 1.4% |

Source: Robert Feenstra, "World Trade Flows"

# Trade by Partners

**China**

| Export Share (1970) | % | Export Share (1995) | % |
|---|---|---|---|
| Hong Kong | 28.0% | Hong Kong | 30.0% |
| Japan | 15.2% | United States | 20.9% |
| Singapore | 7.6% | Japan | 15.5% |
| (West) Germany | 4.6% | Germany | 4.8% |
| Malaysia | 4.5% | South Korea | 3.2% |

Source: Robert Feenstra, "World Trade Flows"

# Trade by Partners

**U.S.A**

| Export Share (1970) | % | Export Share (1995) | % |
|---|---|---|---|
| Canada | 20.6% | Canada | 17.5% |
| Japan | 12.1% | Japan | 12.0% |
| West Germany | 6.6% | Mexico | 8.5% |
| United Kingdom | 6.0% | United Kingdom | 5.1% |
| France | 4.1%. | Germany | 5.0% |

Source: Robert Feenstra, "World Trade Flows"

# Trade by Partners



Figure 2-2 **The Size of European Economies and the Value of Their Trade with the United States**
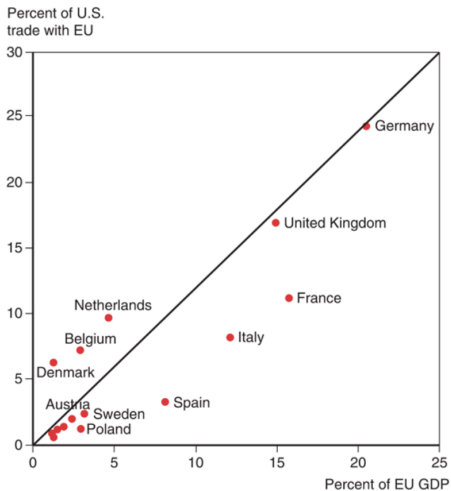
Source: U.S. Department of Commerce, European Commission.

# Take Away

- Trade flows appear to be greatest between economically large and geographically near countries

  - Larger economies produce more goods and services: more things to sell in the export market
  - Larger economies generate more income from goods and services sold: they can buy more imports

- The implication is large countries are more likely to trade with each other

# Take Away

- Economists model this observation by repurposing a mathematical formula describing a foundational law in physics: large and close bodies generate greater gravitational force

- In trade theory, we call this the Gravity Model of Trade:
  - Countries $i$ and $j$
  - $Y$ is GDP, $D$ is distance, $A$ is a constant

$$\text{Trade Flows}_{ij} = A \frac{Y_i^a Y_j^b}{D_{ij}^c}$$

  - The superscripts $a, b, c$ amplify the importance of each term to bilateral trade flows
  - $A, a, b, c$ can be estimated using trade flows data using regression analysis

# Limitations of the Gravity Model

- ► Limitations of the gravity model:
  - • Does not account for what goods each country produces
    - • Trade flow is simply a function of GDP and distance
  - • Does not account for factor prices, such wages and return on capital
    - • Factor cost has significant implications on production output
  - • Cannot predict welfare implications of trade
    - • When is trade beneficial? When is it harmful?
- ► We will develop economic models that overcome these limitations

# Ricardian Model

# Comparative Advantage / Absolute Advantage

- Why do countries trade?
- Why might the U.S. trade with Canada?
  - One could argue that the U.S. is technologically superior to Canada yet it would still be in their favour to trade
- **Comparative Advantage** v.s. **Absolute Advantage**
  - To understand the difference, we define the idea of **Opportunity Cost**

# Opportunity Cost

- **The value of what you give up by choosing the alternative**
- You went to university which entailed going to classes, studying, writing exams, solving problem sets, etc. all of which, as you may be fondly aware, take a tremendous amount of time
  - Alternatively, you could have worked soon after high school
  - Opportunity cost of going to college: wage earned from full-time employment
  - You hope that it is worth it

# Opportunity Cost

- In terms of production:
  - The amount of another good that could have been produced with the resources used to produce one unit of a good (KOM, Ch 3.1)

# Comparative Advantage

- For a given task, what does it mean for a person to have a **comparative advantage** over another person?
- Joe has a comparative advantage over Bob if the **opportunity cost for** completing the task is lower than the **opportunity cost** for Bob to do same task
    - **What is the value of the thing that Joe will have to give up in order to complete the task?**
    - Compare this to the value of what Bob has to give up to do the same task
    - If it is lower for Bob, then Bob should do the task

# Comparative Advantage

- Attorneys are likely more efficient than their legal secretaries in most tasks related to their practice
- An attorney's time, however, is better spent practicing law and delegating the more mundane part of their practice to their legal secretary
- Both parties benefit and are more productive
- Another example: Doctors and nurses

# Comparative Advantage

- For countries, instead of tasks, consider their choice on what goods to produce
- When producing shoes, how many sandals could they have produced instead with the same resources
- Measure value in terms of the number of outputs (300 pairs of sandals)

# Absolute Advantage

- Absolute advantage, on the other hand, makes raw comparisons of ability
- We say that Joe has an **absolute advantage** over Bob in a given task if Joe can do it faster, more efficiently, and with greater proficiency than Bob
- E.g. the U.S. may have an absolute advantage over most developing countries when it comes to producing most goods and services
  - It has a more advanced manufacturing system, for example
  - Despite this, the U.S. can only have a comparative advantage over some goods
    - To produce textiles, it must give up producing some computers

# Formal Model

- Let's see how comparative advantage and opportunity costs are used in a formal model
- How does differences in technology make it mutually advantageous to trade?

# Model Assumptions

1. Two countries: Canada (North: N) and Mexico (South: S)
2. Two goods: Computers, C and Textiles, T (e.g. clothing)
   - Assume there is value in producing a fraction of a good (e.g. 1/2 a computer)
3. One factor of production: labour, L
4. Labour cannot move across countries, but can move across industries
   - Implication for wages

# Model Assumptions, continued...

5. Perfect competition (price = marginal cost)
6. Homothetic preferences
   - Implies that proportion of each good consumed does not change across income levels, only across relative prices
   - e.g. Whether a rich or a poor country: 40% Computers, 60% Textile

# Definitions

- **Unit Labour Requirement**
  - *The amount of labour needed to create one unit of a good*
  - "Labour for one unit requirement"
  - e.g. For computers, ULR = 3 -> 3hrs of labour to make one computer
  - Denoted by $a_j^i$: country $i$ (N or S) and type of good $j$ (C or T)

- **Marginal Product of Labour** (*MPL*)
  - With one unit of labour, how many units of a good can we create
  - Inverse of the unit labour requirements:
    - $a_C^i = 3$, $MPL_C^i = \frac{1}{a_C^i} = \frac{1}{3}$
  - e.g. If it takes 3 hrs to create a computer, then working for an hour creates $1/3$ of a computer

# Example

- Canada: $a_C^N = 5$, $a_T^N = 5$
- Mexico: $a_C^S = 10$, $a_T^S = 5$
  - Note: values based strictly on level of economic development and not innate ability

Table: Unit Labour Requirements

| Country | Computers | Textiles |
|---------|-----------|----------|
| Canada  | 5         | 5        |
| Mexico  | 10        | 5        |

# Example

Table: Unit Labour Requirements

| Country | Computers | Textiles |
|---------|-----------|----------|
| Canada  | 5         | 5        |
| Mexico  | 10        | 5        |

- Canada has an absolute advantage over Mexico
  - Takes only 5 hours to produce either Computer or Textiles
- Takes Mexico 10 hours of labour to produce a Computer
- Should Canada take over production of all goods?

# Example

Table: Unit Labour Requirements

| Country | Computers | Textiles |
|---------|-----------|----------|
| Canada  | 5         | 5        |
| Mexico  | 10        | 5        |

- With 5 hours of labour, Canada can create 1 Textile
- But with the same amount of labour they could have created 1 Computer
- In Canada, the opportunity cost of 1 Textile is 1 Computer

# Example

Table: Unit Labour Requirements

| Country | Computers | Textiles |
|---------|-----------|----------|
| Canada  | 5         | 5        |
| Mexico  | 10        | 5        |

- For Mexico, 1 Textile takes 5 hours of labour
- With this amount of labour, they can create $1/2$ a Computer
- In Mexico, the opportunity cost of 1 Textile is $1/2$ a Computer

# Example

Table: Unit Labour Requirements

| Country | Computers | Textiles |
|---------|-----------|----------|
| Canada  | 5         | 5        |
| Mexico  | 10        | 5        |

- Canada has an absolute advantage over Mexico in producing both goods
- But Mexico gives up fewer Computers to produce 1 Textile, which means that they have a comparative advantage over Canada in textile production
- Because each country has a finite amount of labour for production, aggregate output would be greater if Canada were to focus its production in Computers and Mexico in Textiles

## Checking for Comparative Advantage

- Here's a quick way to check that Mexico indeed has a comparative advantage in textile production

- Mexico has a comparative advantage in the production of Textile if

$$\frac{\text{Textiles made}}{\text{Computers given up}}_N < \frac{\text{Textiles made}}{\text{Computers given up}}_S$$

$$\frac{\frac{1}{a_T^N}}{\frac{1}{a_C^N}} = \frac{a_C^N}{a_T^N} = 1 < 2 = \frac{a_C^S}{a_T^S} = \frac{\frac{1}{a_T^S}}{\frac{1}{a_C^S}}$$

- Mexico gives up fewer computers than Canada to produce the same number of textiles. Their opportunity cost in producing textiles is lower than Canada's. Therefore, they should specialize in textile production.

# Checking for Comparative Advantage

- Conversely, we can see that Canada has a comparative advantage over Mexico in the production of Computers
- With 1 hour of labour, Canada produces 1/5 of a Computer and gives up 1/5 of a Textile
- Mexico, on the other hand, produces 1/10 of a Computer and gives up 1/5 of a Textile
- Canada was able to create more computers with their 1 hour of labour
- Therefore, Canada's comparative advantage is in Computer production

# Checking for Comparative Advantage

- No Comparative Advantage if

$$\frac{\frac{1}{a_T^N}}{\frac{1}{a_C^N}} = \frac{a_C^N}{a_T^N} = \frac{a_C^S}{a_T^S} = \frac{\frac{1}{a_T^S}}{\frac{1}{a_C^S}}$$
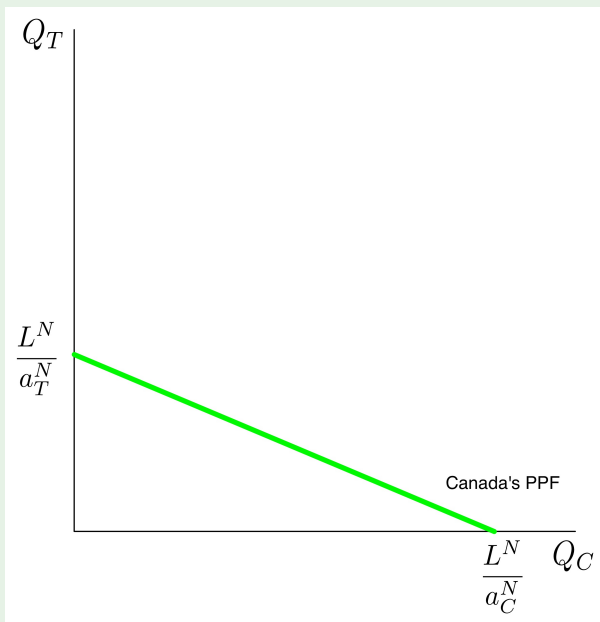
# Definition: Autarky

- **Autarky**: a state in which a country does not trade
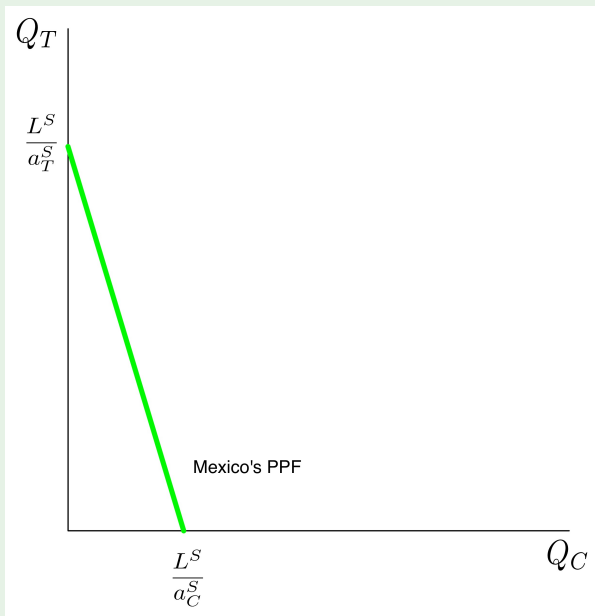  - Will be used as a baseline

# Definition: Production Possibility Frontier

- **Production Possibility Frontier (PPF)**: the set of outputs across all goods such that all resources are used
  - Canada: $a_C^N Q_C^N + a_T^N Q_T^N = L^N$
  - Mexico: $a_C^S Q_C^S + a_T^S Q_T^S = L^S$
  - Note: PPF curve may not be linear
- $L^i$: Labour endowment in country $i$
  - Max number of hours of labour available
- The unit labour requirements and labour endowments are *given*

# Canada's PPF Curve



Canada's PPF

$Q_T$

$\dfrac{L^N}{a_T^N}$

$\dfrac{L^N}{a_C^N}$

$Q_C$

# Mexico's PPF Curve



$Q_T$

$\dfrac{L^S}{a_T^S}$

Mexico's PPF

$\dfrac{L^S}{a_C^S}$

$Q_C$

# Budget Constraint

- Consider Canada as a consumer with the budget constraint:

$$P_C^N Q_C^N + P_T^N Q_T^N \leq w^N L^N$$

- Under Autarky, consumption is equal to production
- Labour is free to move across industries (hence, one wage for whole country)
- We can also represent the budget constraint in the output space
- But before we do that, because of perfect competition, unit revenue = unit cost (marginal revenue = marginal cost)

$$P_C^N = w^N a_C^N$$

$$P_T^N = w^N a_T^N$$

# Budget Constraint overlaps PPF

- Substitute into budget constraint to see that it overlaps the PPF curve
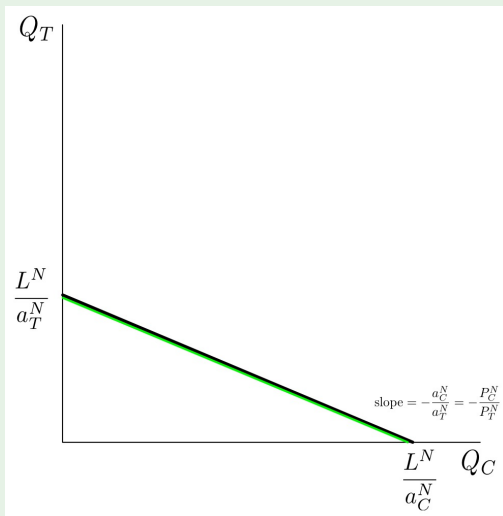
# Budget Constraint overlaps PPF

▸ From the perfect competition assumption the slopes of the budget constraint and PPF are equal

$$\frac{P_C^N}{P_T^N} = \frac{a_C^N}{a_T^N}$$

▸ This is also true for the southern country, Mexico

$$\frac{P_C^S}{P_T^S} = \frac{a_C^S}{a_T^S}$$

▸ To calculate the optimal level of production for each good, we need to make some assumptions about preferences

# Preferences

- By homothetic preferences, we can consider the whole country as one consumer
    - Each consumer will consume the same share of each good, they only differ in their level of income
- One type of utility function that characterizes homothetic preferences is the Cobb-Douglas

$$U = Q_C^{0.5} Q_T^{0.5}$$

# Consumer Maximization under Autarky

- The consumer's problem is to choose the level of $Q_C$ and $Q_T$ that solves

$$max \ U = Q_C^{0.5} Q_T^{0.5}$$

$$s.t. \ P_C^N Q_C^N + P_T^N Q_T^N \leq w^N L^N$$

$$P_C^N = w^N a_C^N, \ P_T^N = w^N a_T^N$$

# Consumer Maximization under Autarky