1.4 — Ricardian One-Factor Model

ECON 324 • International Trade • Fall 2020

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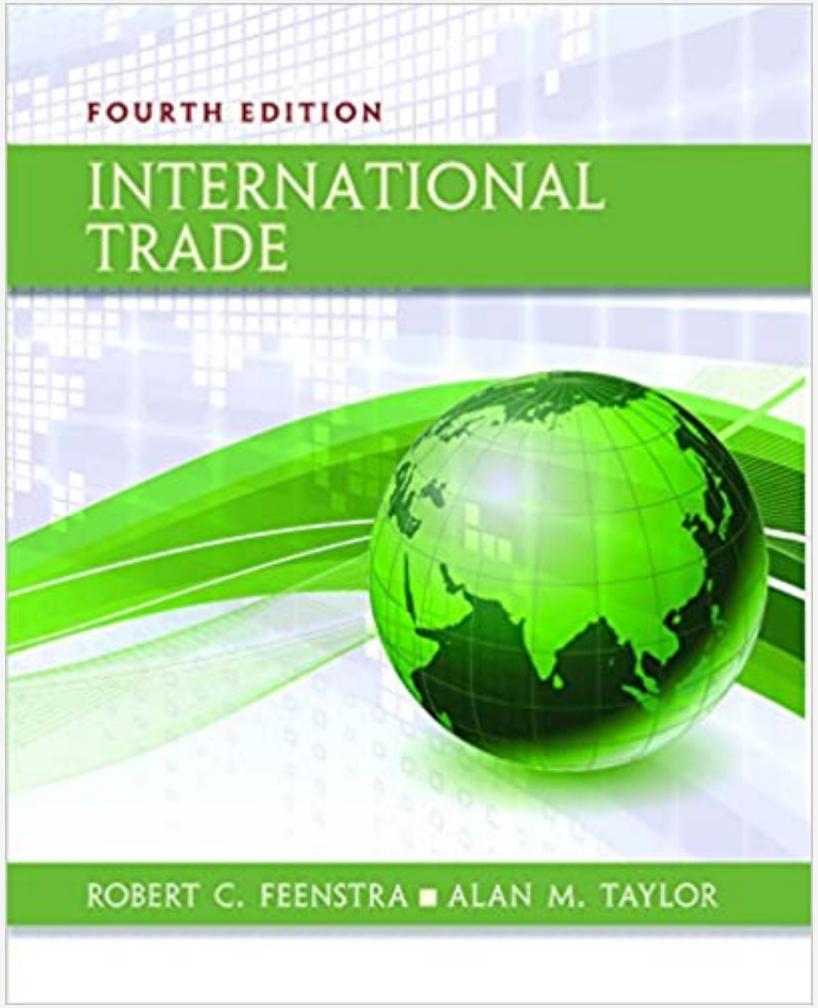
Outline

A Note of Caution and A Judgment Call

- Feenstra and Taylor dive right into a Ricardian model in Ch. 2 with some advanced features; Ch. 4 is H-O Model
    - A lot of moving parts are thrown at you rather quickly
- In my experience (and from using other textbooks), it's better to build up slowly:
    1. Simplified Ricardian model
    2. Standard "neoclassical model" (not in F&T)
    3. H-O Model
- So if you are reading the textbook, it won't exactly match up to class for 1-2 weeks 😕



Assumptions of the Ricardian One-Factor Model

Assumptions of the One-Factor Model

1. Markets (both output and factors) are perfectly competitive
2. “Labor” is homogenous and non-specific
3. Labor is mobile *domestically*, but *not internationally*
4. Production of goods requires only varying amounts of labor as an input
    - The “one factor”
    - The marginal product of labor is constant
5. No barriers to trade or transactions costs
6. Technology is constant within each country
7. Resource endowments are fixed

Setting up the Model

- Imagine 2 countries, Home and Foreign
- Each country can produce two goods, xylophones (x) and yams (y)
- Each country has a fixed total supply of labor
  - L for Home and L' for Foreign
- Let:
  - l_x: amount of labor to make 1 x
  - l_y: amount of labor to make 1 y

Setting up the Model: Home

- Home's **production set** and total possible allocations of labor within a country is:

$$l_x x + l_y y \leq L$$

- To find the **frontier (PPF)**, assume Labor Demand (left) and Labor Supply (right) are equal:

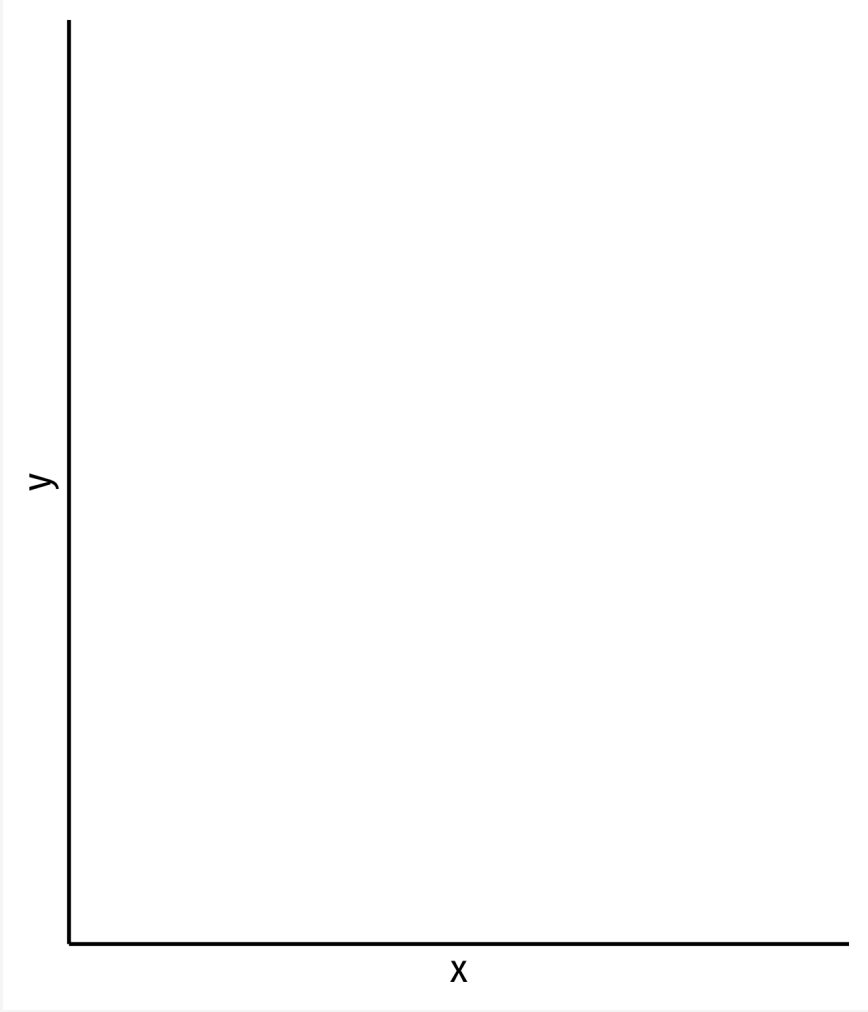
$$l_x x + l_y y = L$$

Setting up the Model: Home

$$l_x x + l_y y = L$$

- Solve for y to graph

$$y = \frac{L}{l_y} - \frac{l_x}{l_y} x$$



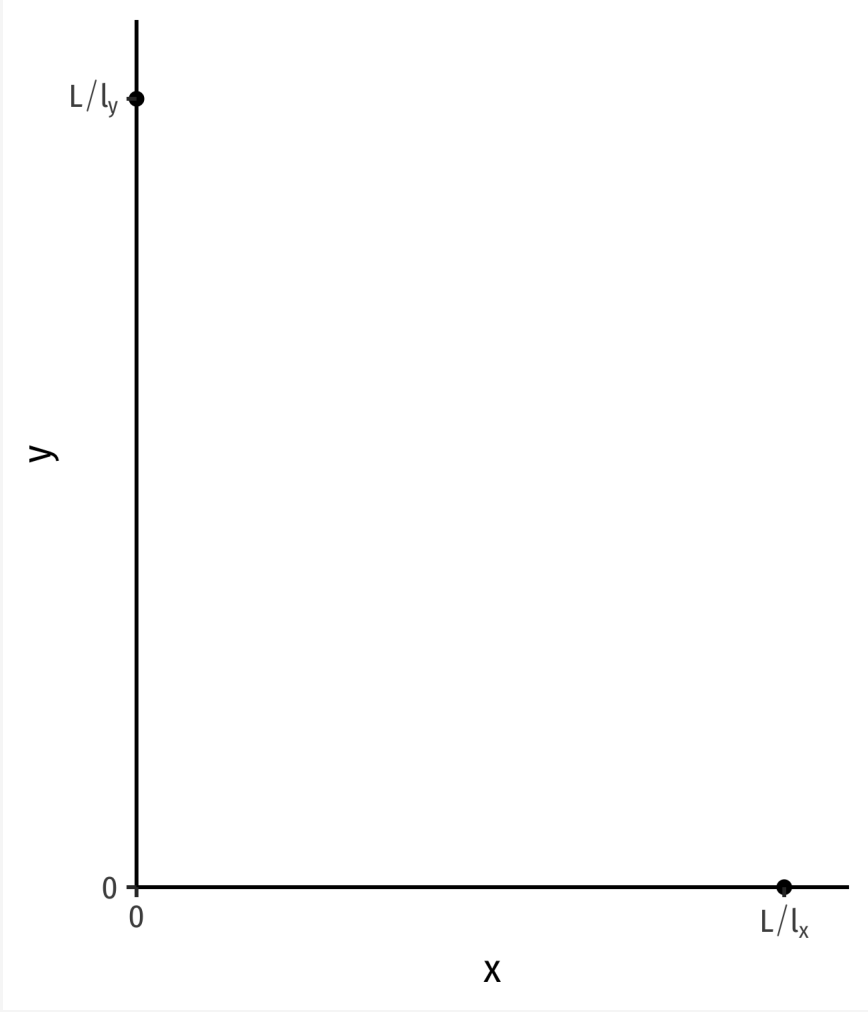
Setting up the Model: Home

$$l_x x + l_y y = L$$

- Solve for y to graph

$$y = \frac{L}{l_y} - \frac{l_x}{l_y} x$$

- y-intercept: $\frac{L}{l_y}$ (max y production)
- x-intercept: $\frac{L}{l_x}$ (max x production)



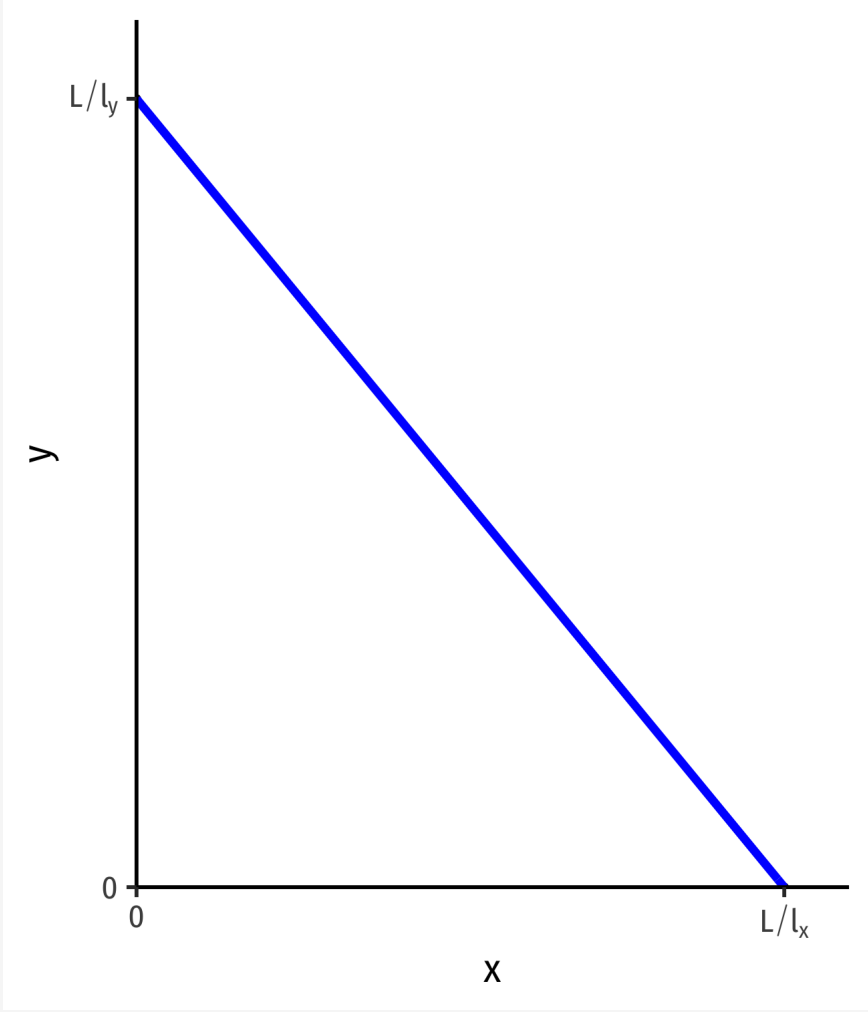
Setting up the Model: Home

$$l_x x + l_y y = L$$

- Solve for y to graph

$$y = \frac{L}{l_y} - \frac{l_x}{l_y} x$$

- y-intercept: $\frac{L}{l_y}$ (max y production)
- x-intercept: $\frac{L}{l_x}$ (max x production)
- slope: $-\frac{l_x}{l_y}$



Setting up the Model: Home

$$l_x x + l_y y = L$$

- Solve for y to graph

$$y = \frac{L}{l_y} - \frac{l_x}{l_y} x$$

- y-intercept: $\frac{L}{l_y}$ (max y production)
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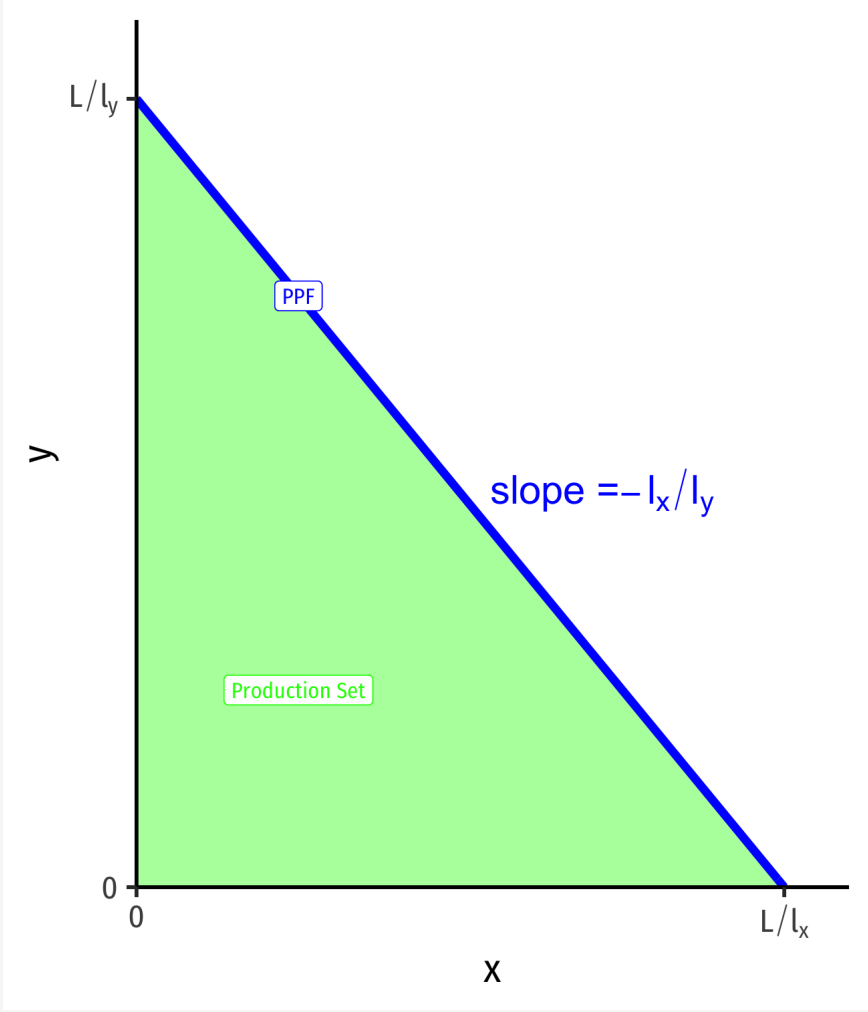
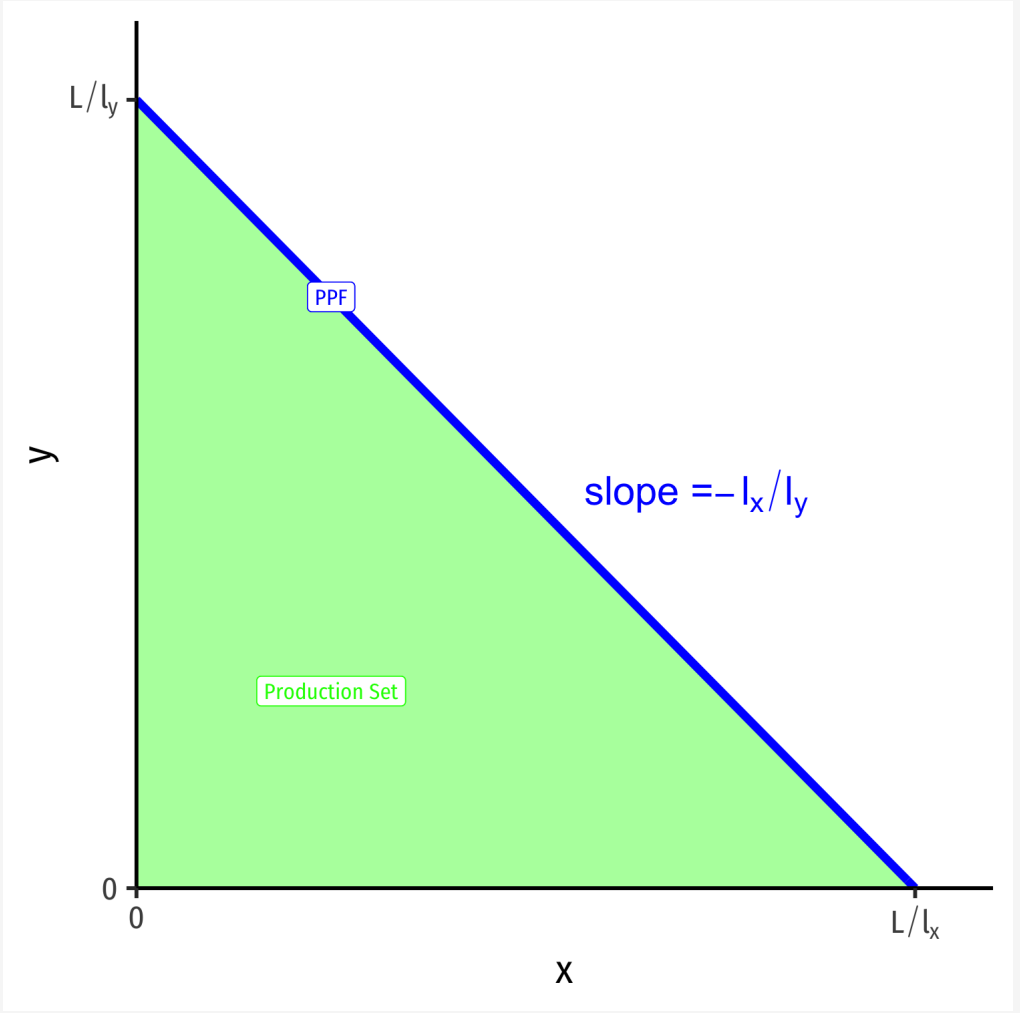
- slope: $-\frac{l_x}{l_y}$



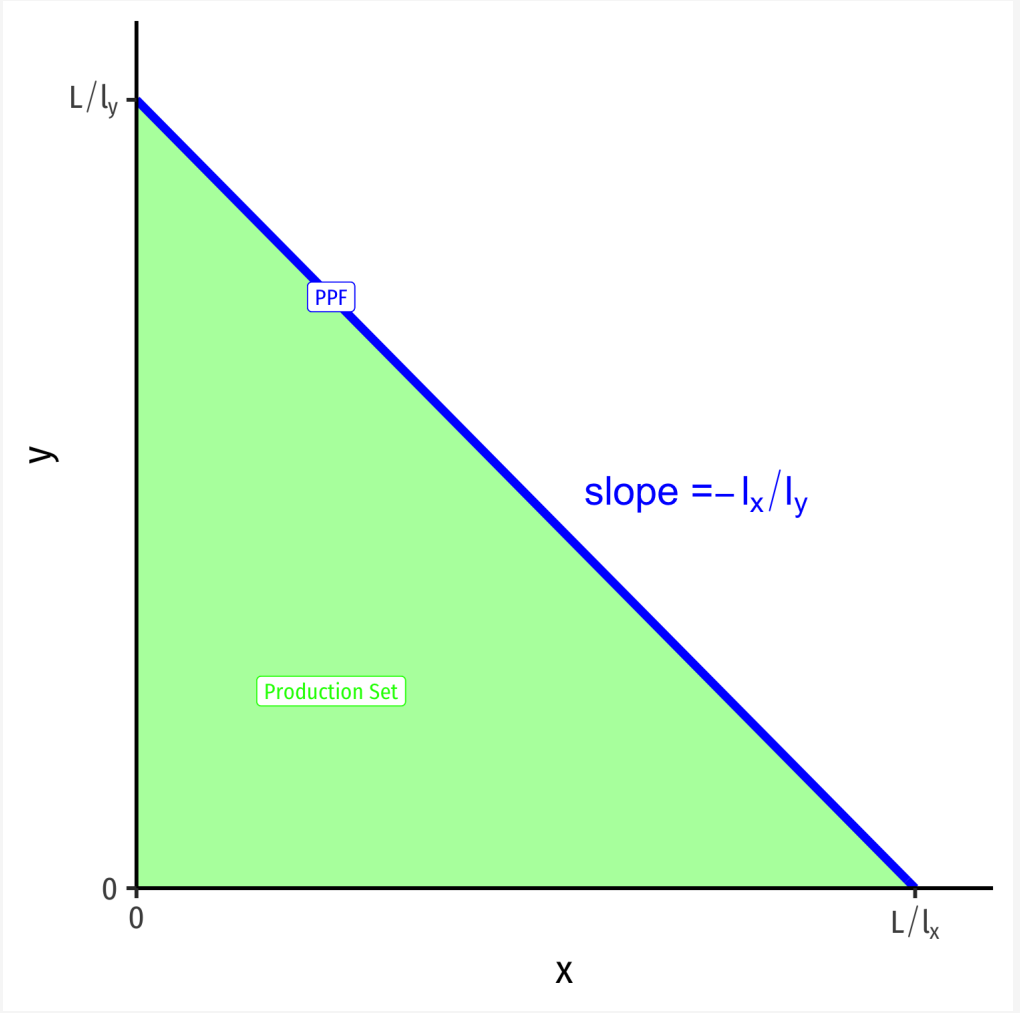
Same As Before

- Points **on the frontier** are efficient (uses all available labor supply)
- Points **beneath the frontier** are feasible (in **production set**) but inefficient (does not use all available labor supply)
- Points **above the frontier** are impossible with current constraints (labor supply, technology, trading opportunities)



Understanding the Tradeoff

- Slope of PPF: **marginal rate of transformation (MRT)**
- Rate at which (domestic) market values **tradeoff** between goods x and y
- **Relative price of x** (in terms of y), or **opportunity cost of x**: how many units of y must be given up to produce one more unit of x



Absolute and Comparative Advantages (Autarky)

Absolute Advantage

- A country has an **absolute advantage** if it requires less labor to produce (a unit of) a good

- **Examples:**
  - if $l_x < l'_x$, then Home has an absolute advantage in producing x
  - if $l_y > l'_y$, then Foreign has an absolute advantage in producing *y*

Comparative Advantage

- A country has a ***comparative* advantage** in a producing a good if the opportunity cost of producing that good is *lower* than other countries
- Recall the slope of PPF (the MRT) is the relative price (opp. cost) of x
- **Examples:**
  - if $\frac{l_x}{l_y} < \frac{l'_x}{l'_y}$, then Home has a comparative advantage in producing x
  - if $\frac{l_x}{l_y} > \frac{l'_x}{l'_y}$, then Foreign has a comparative advantage in producing x

Comparative Advantage, Some Hints

- PPF slope = opportunity cost of good x (amount of y given up per 1 x)
- If countries have different PPF slopes, have different opportunity costs
- Country with **flatter slope (smaller magnitude)** has **lower opportunity cost of x** (or .hi-purple[higher cost of y) implies a **comparative advantage in x**
- Country with **steeper slope (larger magnitude)** has **higher opportunity cost of x** (or **lower cost of y)** implies a **comparative advantage in y**

An Example in Autarky

Ricardian One-Factor Model Example

Example: Suppose the following facts to set up:

- Home has 100 Laborers
  - Requires 1 worker to make x
  - Requires 2 workers to make y
- Foreign has 100 Laborers
  - Requires 1 worker to make x
  - Requires 4 workers to make y

1. For each country, find the equation of the PPF and graph it.
2. Which country has an *absolute* advantage in producing x and y?
3. Which country has an *comparative* advantage in producing x and y?

Ricardian One-Factor Model Example: Solving for PPFs

Home

$$l_x x + l_y y = L$$

Foreign

Ricardian One-Factor Model Example: Solving for PPFs

Home

$$l_x x + l_y y = L$$
$$1x + 2y = 100$$

Foreign

Ricardian One-Factor Model Example: Solving for PPFs

Home

$$l_x x + l_y y = L$$
$$1x + 2y = 100$$
$$2y = 100 - x$$

Foreign

Ricardian One-Factor Model Example: Solving for PPFs

Home

$$l_x x + l_y y = L$$
$$1x + 2y = 100$$
$$2y = 100 - x$$
$$y = 50 - 0.5x$$

Foreign

Ricardian One-Factor Model Example: Solving for PPFs

Home

$$l_x x + l_y y = L$$
$$1x + 2y = 100$$
$$2y = 100 - x$$
$$y = 50 - 0.5x$$

Foreign

$$l'_x x + l'_y y = L'$$

Ricardian One-Factor Model Example: Solving for PPFs

Home

$$l_x x + l_y y = L$$
$$1x + 2y = 100$$
$$2y = 100 - x$$
$$y = 50 - 0.5x$$

Foreign

$$l'_x x + l'_y y = L'$$
$$1x + 4y = 100$$

Ricardian One-Factor Model Example: Solving for PPFs

Home

$$
\begin{aligned}
l_x x + l_y y &= L \\
1x + 2y &= 100 \\
2y &= 100 - x \\
y &= 50 - 0.5x
\end{aligned}
$$

Foreign

$$
\begin{aligned}
l'_x x + l'_y y &= L' \\
1x + 4y &= 100 \\
4y &= 100 - x
\end{aligned}
$$

Ricardian One-Factor Model Example: Solving for PPFs

Home

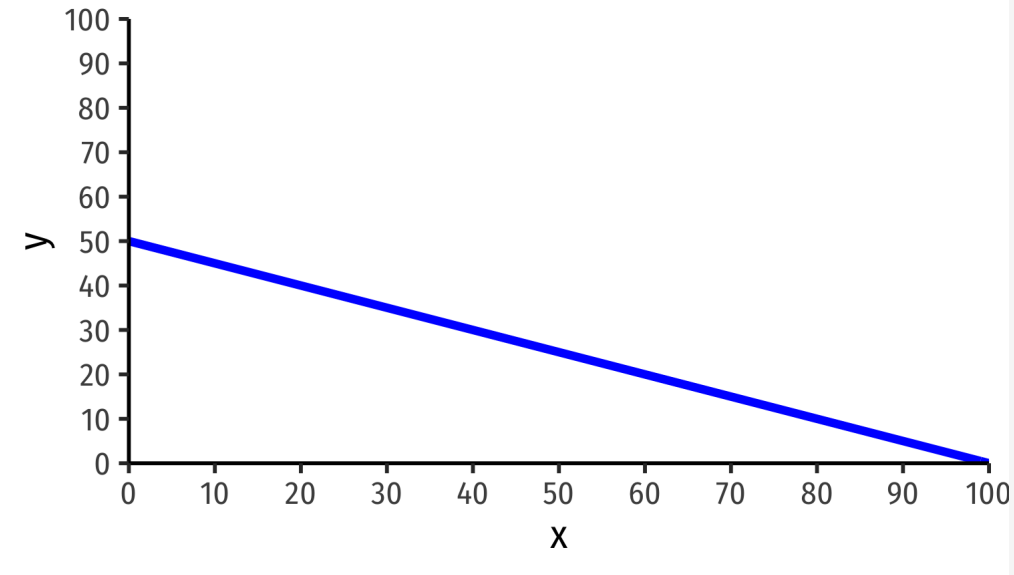
$$
\begin{aligned}
l_x x + l_y y &= L \\
1x + 2y &= 100 \\
2y &= 100 - x \\
y &= 50 - 0.5x
\end{aligned}
$$

Foreign

$$
\begin{aligned}
l'_x x + l'_y y &= L' \\
1x + 4y &= 100 \\
4y &= 100 - x \\
y &= 25 - 0.25x
\end{aligned}
$$

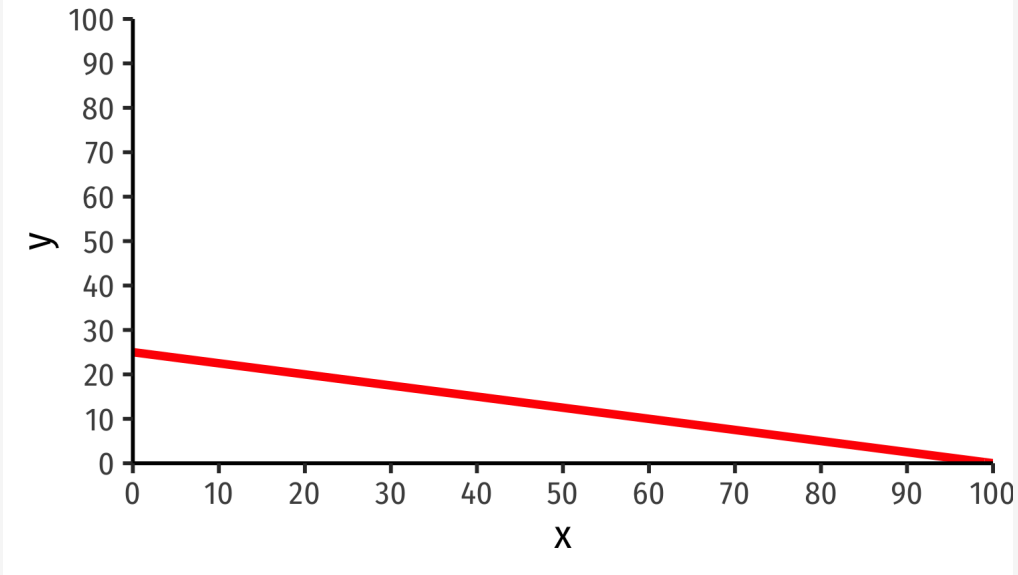
Ricardian One-Factor Model Example: Graphing PPFs

Home



$$y = 50 - 0.5x$$

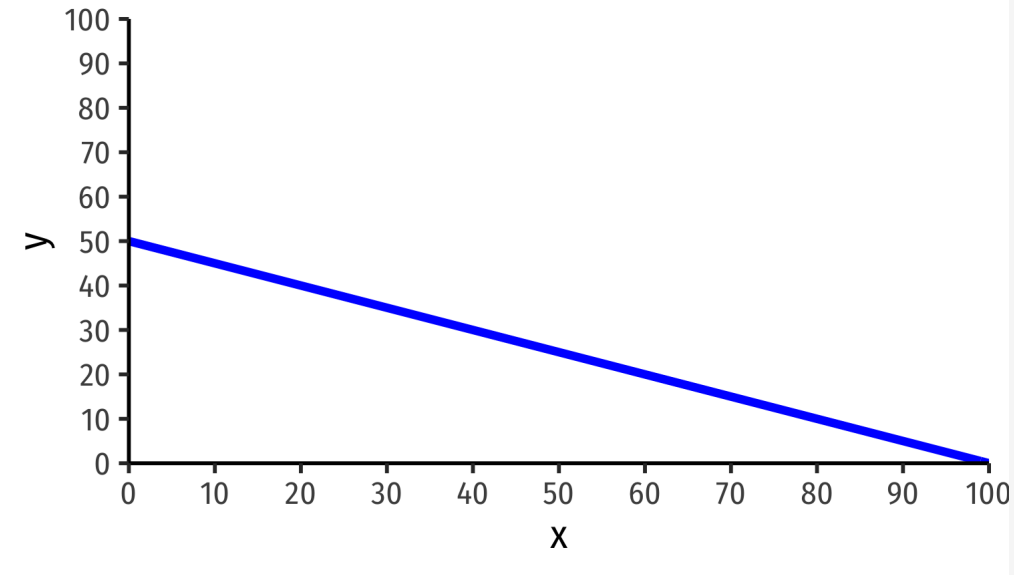
Foreign



$$y = 25 - 0.25x$$

Example: Absolute Advantage

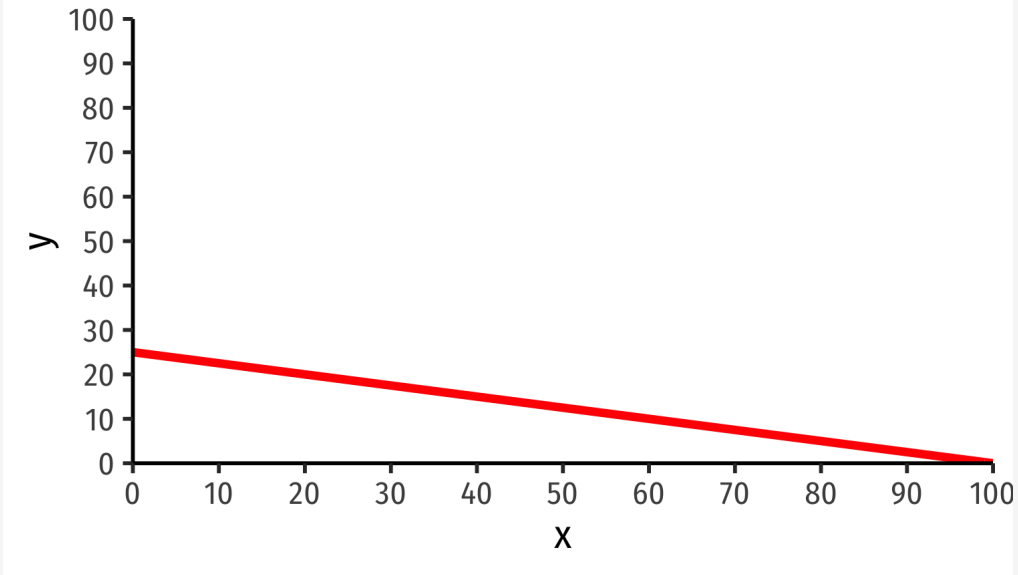
Home



$$l_x = 1$$

$$l_y = 2$$

Foreign

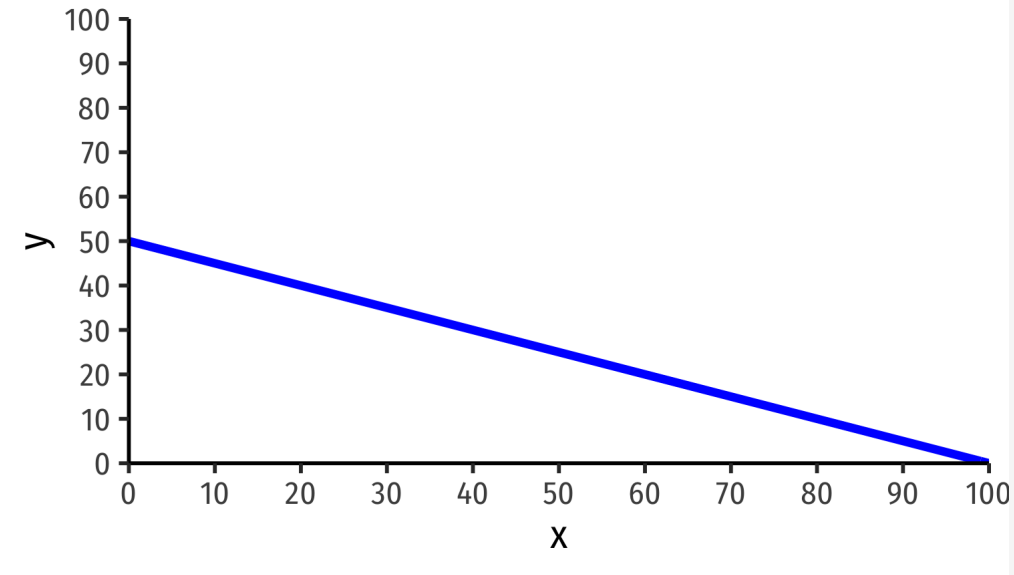


$$l'_x = 1$$

$$l'_y = 4$$

Example: Absolute Advantage

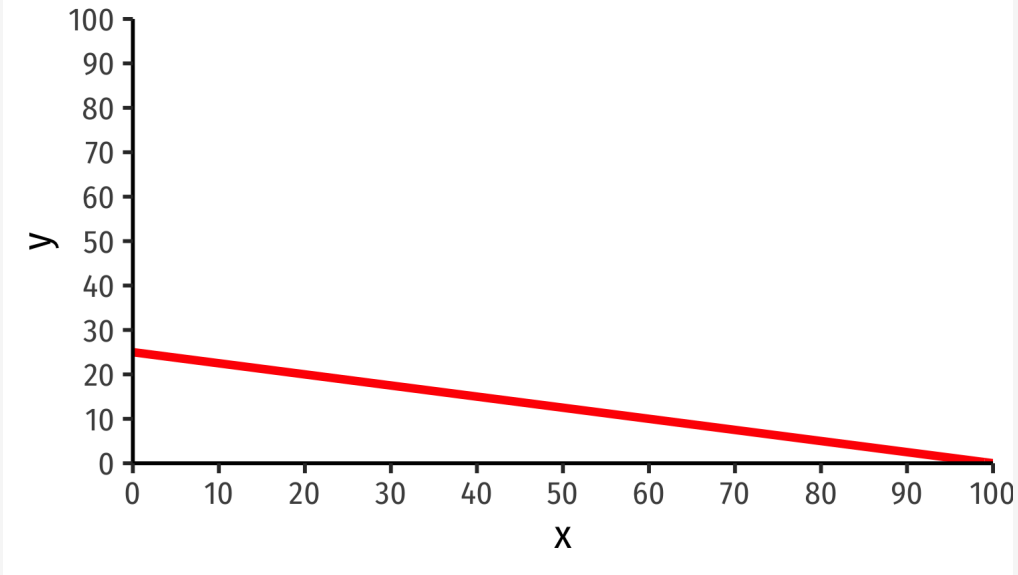
Home



$l_x = 1$ (Equal)

$l_y = 2$ (**Absolute advantage**)

Foreign



$l'_x = 1$ (Equal)

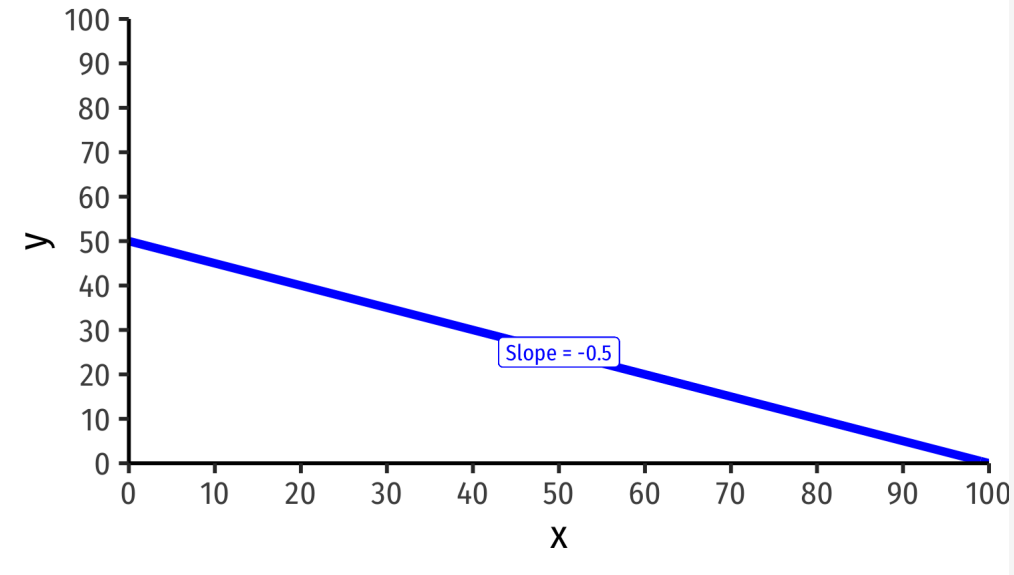
$l'_y = 4$ (Absolute disadvantage)

Comparative Advantage and Autarky Relative Prices

- So far, we assume countries are in **autarky**, they are not trading with one another
- To find **comparative advantage** for each country, we need to compare **opportunity costs** of producing each good in each country, or **relative prices in autarky**
- A country with a **lower autarky relative price of a good** than another country has a comparative advantage in producing that good

Example: Comparative Advantage

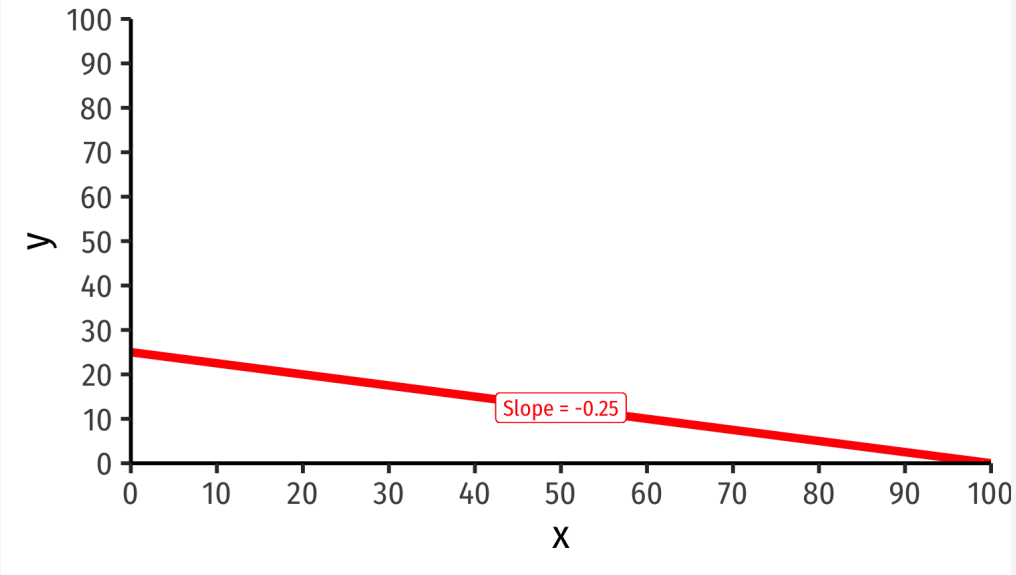
Home



Autarky relative price of x: 0.5y [PPF slope!]

Autarky relative price of y: 2x

Foreign



Autarky relative price of x: 0.25y [PPF slope!]

Autarky relative price of y: 4x

Example: Comparative Advantage

Autarky Relative Prices (Opportunity Costs)

	1x	1y
Home	0.5y	2x
Foreign	0.25y	4x

- Home has a comparative advantage in producing y
- Foreign has a comparative advantage in producing x

Example: Opening up Trade

Autarky Relative Prices (Opportunity Costs)

	1x	1y
Home	0.5y	**2x**
Foreign	**0.25y**	4x

- Suppose now countries open up trade
- We considered the relative prices **in autarky**
- We next need to consider what might relative prices be **under international trade**

The Example with International Trade

Example: Opening up Trade

Autarky Relative Prices (Opportunity Costs)

	1x	1y
Home	0.5y	**2x**
Foreign	**0.25y**	4x

- A bit of handwaiving here:
- Ricardo assumes a **labor theory of value** and constant marginal products of labor
- We have hidden the $MPL^{\dagger}$ for simplicity here
- We are also in direct exchange (barter) between goods, there is no money here
- Suffice it to say that we can show that the ratio of labor requirements (PPF slope) is equal to the ratio of prices of the final goods:

$$\underbrace{\frac{l_x}{l_y}}_{slope} = \frac{p_x}{p_y}$$

  - a clearer explanation of this with our next model!

Example: Opening up Trade

Autarky Relative Prices (Opportunity Costs)

	1x	1y
Home	0.5y	**2x**
Foreign	**0.25y**	4x

- Home will:
  - buy x if $p_x < 0.5y$
  - sell y if $p_y > 2x$
- The autarky price of y:
  - At Home: 2x
  - In Foreign: 4x
- Home can export y to Foreign and sell at higher price!
  - All L in Home will move to (higher-paying) y industry

Example: Opening up Trade

Autarky Relative Prices (Opportunity Costs)

	1x	1y
Home	0.5y	**2x**
Foreign	**0.25y**	4x

- Foreign will:
  - sell x if $p_x > 0.25y$
  - buy y if $p_y < 4x$
- The autarky price of x:
  - At Home: 0.5y
  - In Foreign: 0.25y
- Foreign can export x to Home and sell at higher price!
  - All L' in Foreign will move to (higher-paying) x industry

Example: Opening up Trade

Autarky Relative Prices (Opportunity Costs)

	1x	1y
Home	0.5y	**2x**
Foreign	**0.25y**	4x

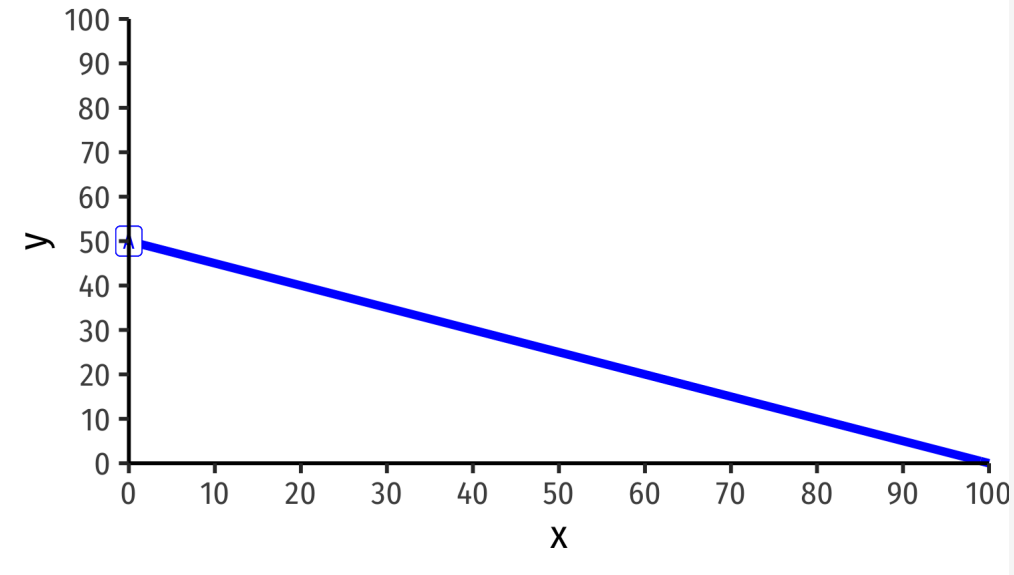
Possible range of ***world*** **relative prices**:

$$0.25y < p_x < 0.5y$$

$$2x < p_y < 4x$$

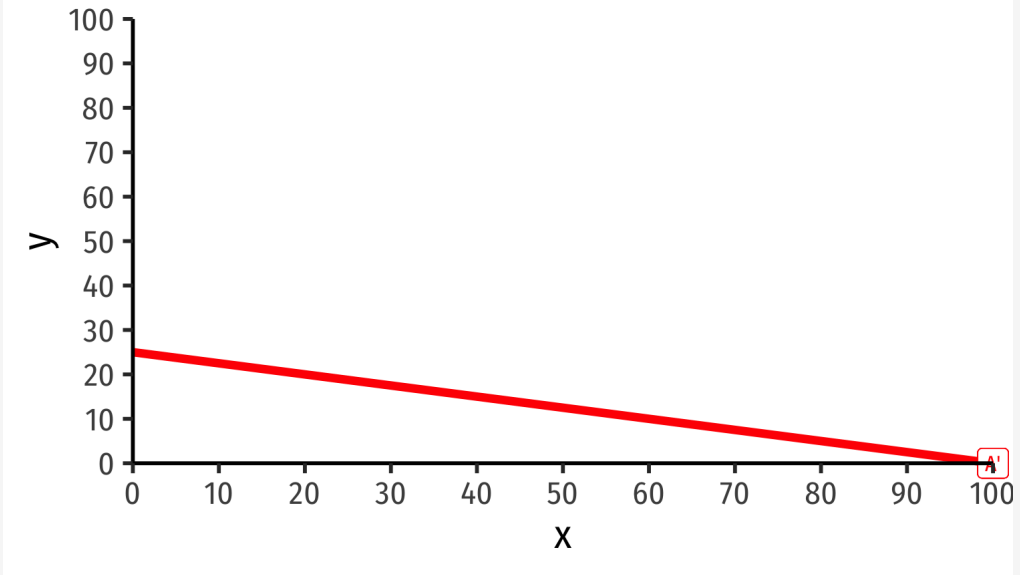
Example: Specialization

Home



Home specializes in only producing y at point A

Foreign



Foreign specializes in only producing x at point A'

International Trade Equilibrium: Price Adjustments

- Home exports y $\Longrightarrow$ *less* y sold in Home $\Longrightarrow$ $\uparrow p_y$ in Home
- As y arrives in Foreign $\Longrightarrow$ *more* y sold in Foreign $\Longrightarrow$ $\downarrow p_y$ in Foreign
- Foreign exports x $\Longrightarrow$ *less* x sold in Foreign $\Longrightarrow$ $\uparrow p_x$ in Foreign
- As x arrives in Home $\Longrightarrow$ *more* x sold in Home $\Longrightarrow$ $\downarrow p_y$ in Home

International Trade Equilibrium: World Relative Prices

- **International trade equilibrium**: relative prices adjust so they **equalize across countries**

$$\frac{p_x^\star}{p_y^\star} = \frac{p_x}{p_y} = \frac{p'_x}{p'_y}$$

- Must be within mutally agreeable range:

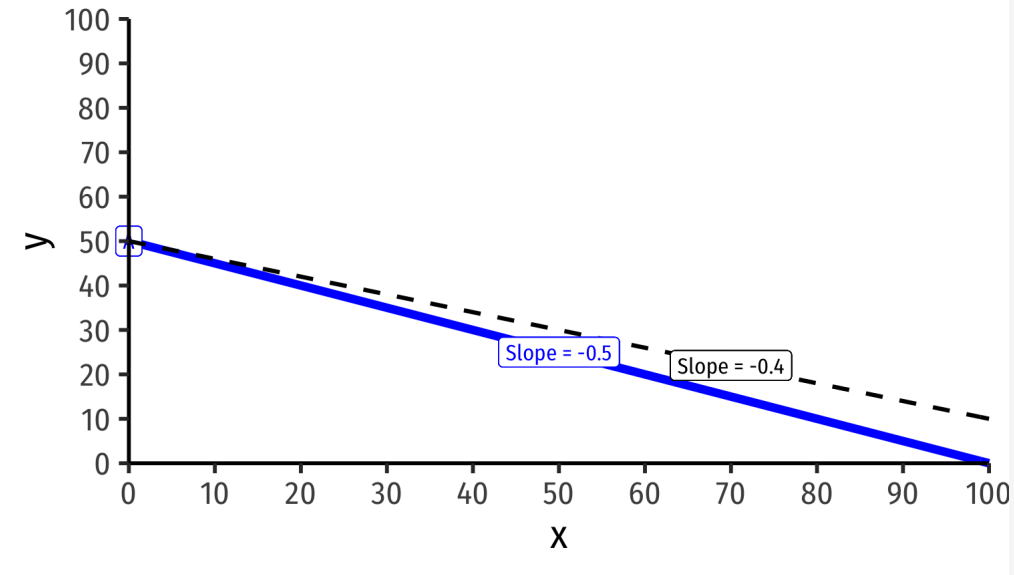
$$0.25y < p_x < 0.5y$$

$$2x < p_y < 4x$$

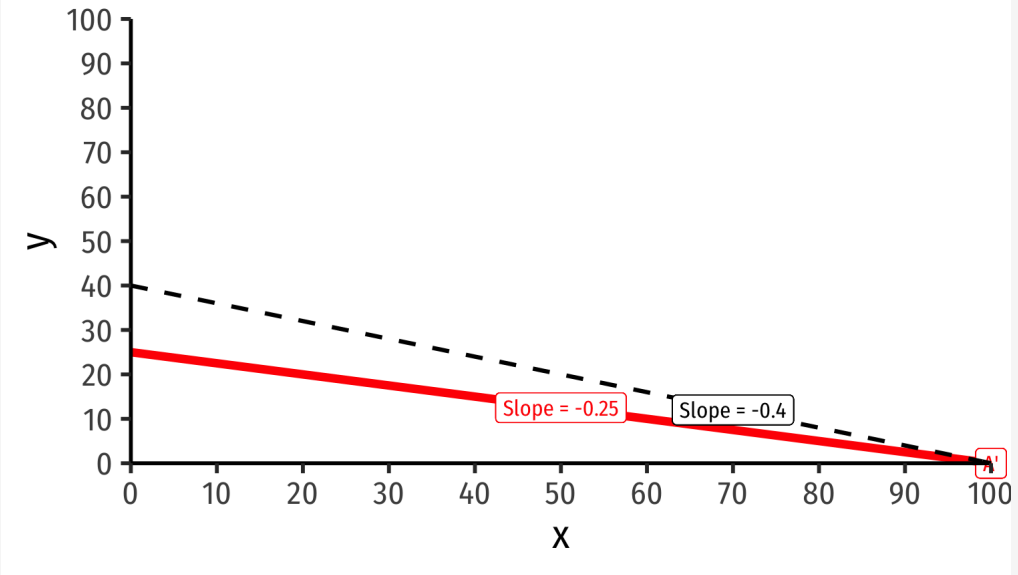
- **Suppose the world relative price of x settles to** $\frac{p_x^\star}{p_y^\star} = 0.4y$

International Trade Equilibrium: World Relative Prices

Home



Foreign

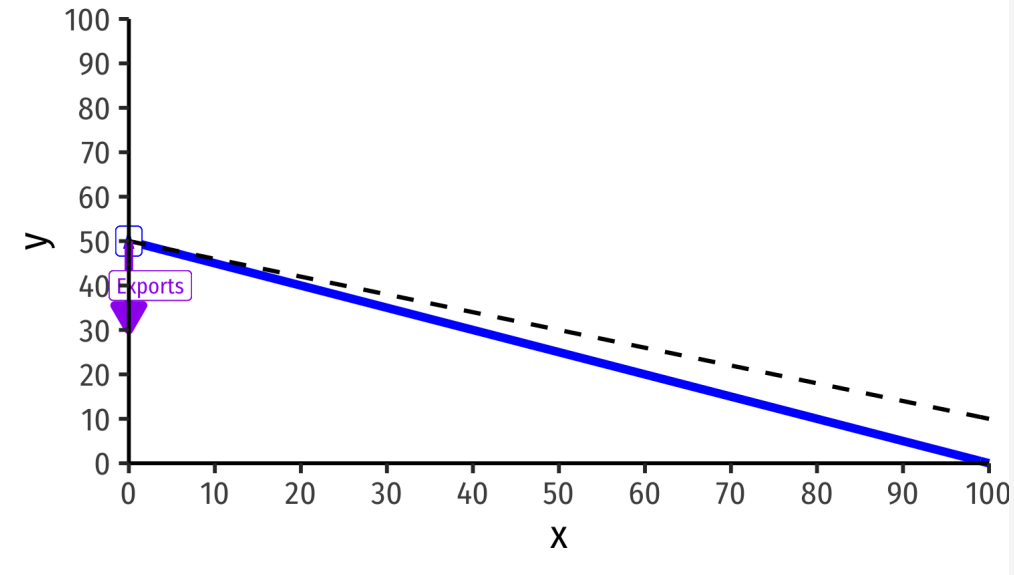


World relative price of x: $\frac{p_x^\star}{p_y^\star} = 0.4y$

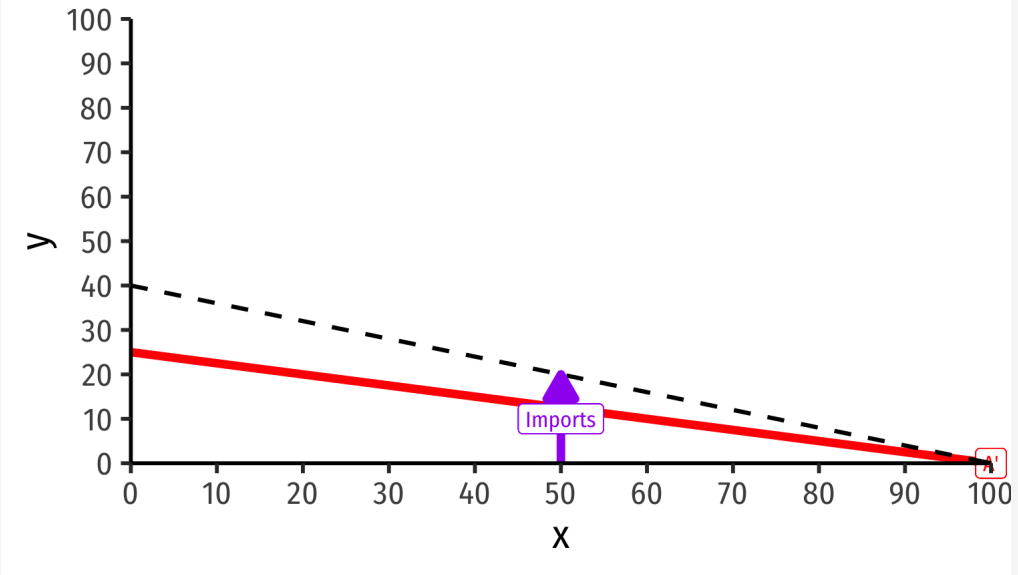
Both countries face same **international exchange rate** with slope $= -0.4$

International Trade Equilibrium: “Trade Triangles”

Home



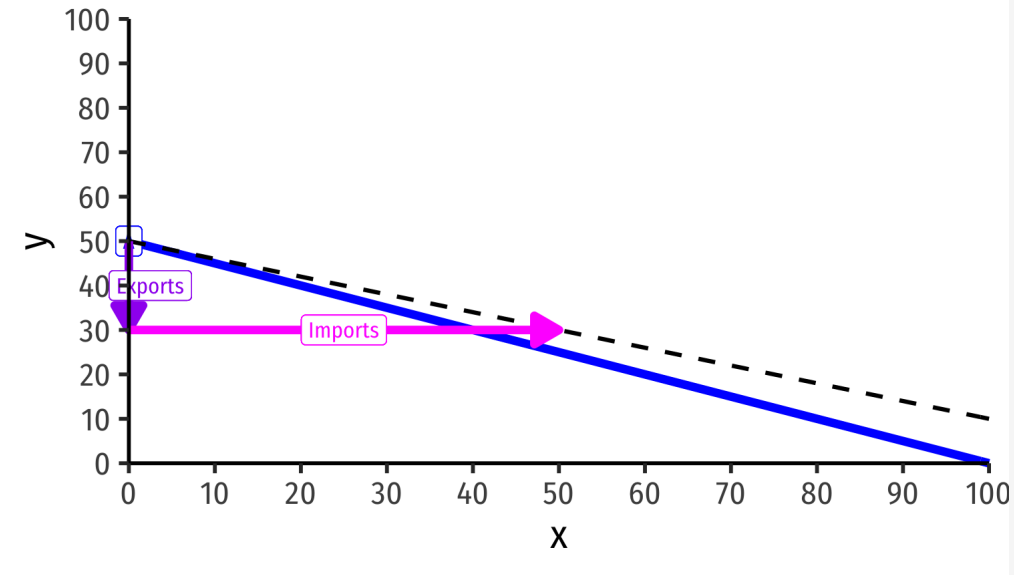
Foreign



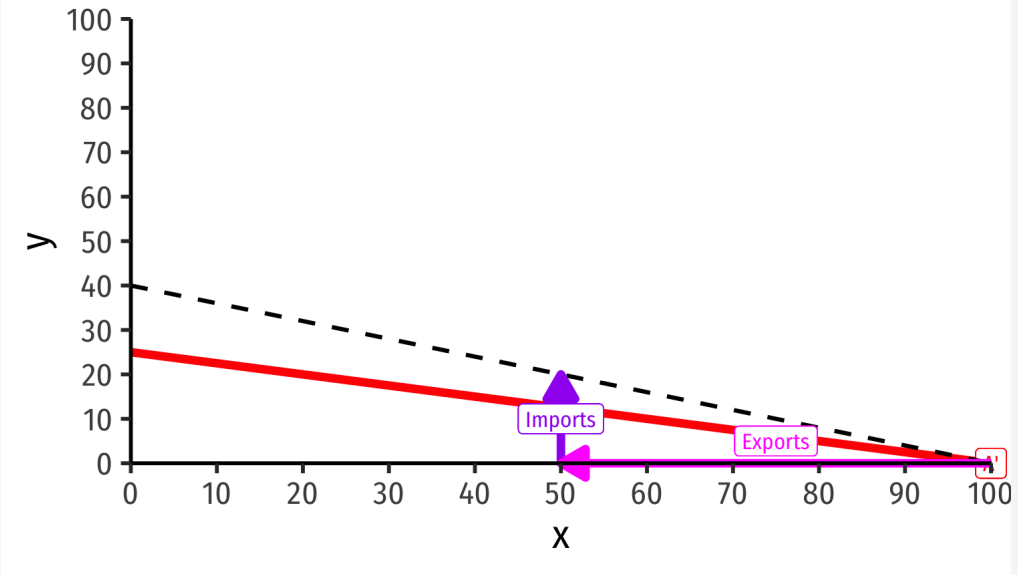
Home exports 20y to Foreign

International Trade Equilibrium: “Trade Triangles”

Home



Foreign

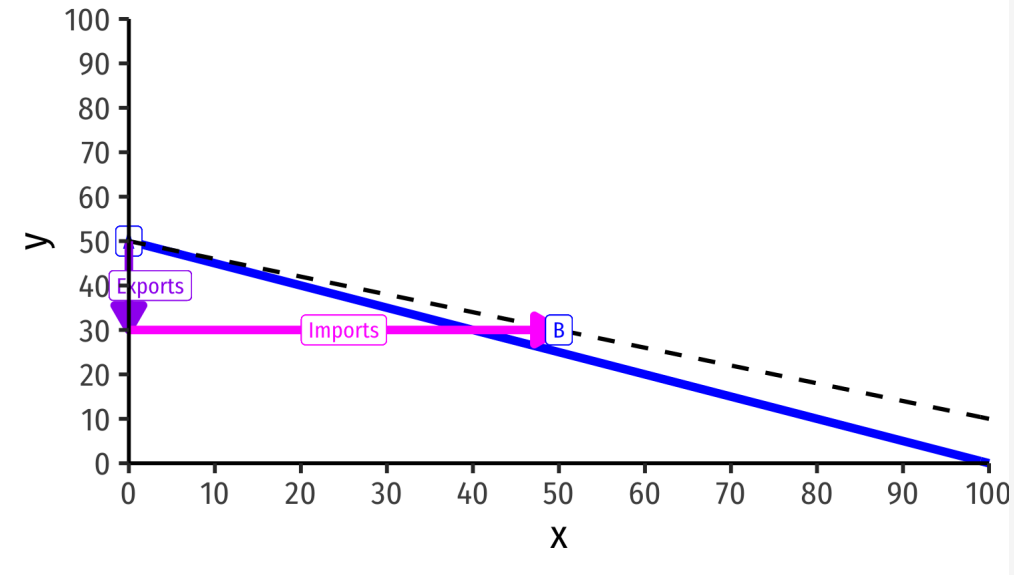


Home exports 20y to Foreign

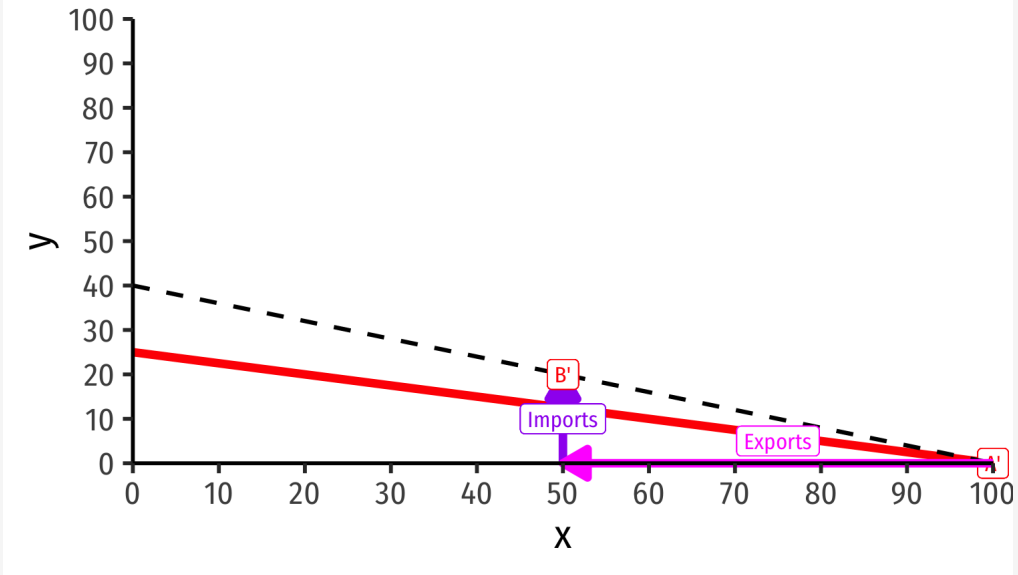
Foreign exports 50x to Home

International Trade Equilibrium: “Trade Triangles”

Home



Foreign



Trade along **world exchange rate** (world relative prices) from specialization points (A and A') to consumption points (B and B') beyond PPFs!

Another Example: You Try!

Example: Suppose the following facts to set up:

- Home has 100 Laborers
  - Requires 5 workers to make wheat
  - Requires 10 workers to make cars
- Foreign has 200 Laborers
  - Requires 2 workers to make wheat
  - Requires 8 workers to make cars

1. For each country, find the equation of the PPF and graph it.
2. Which country has an *absolute* advantage in producing wheat and cars?
3. Which country has an *comparative* advantage in producing wheat and cars?
4. What will the range of possible terms of trade be?