ECO 442: Quantitative Trade Models

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Semester Overview

Goal of course is to be able to solve models to answer policy questions in trade

What does Quantitative in Quantitative Trade Models mean?

- We want numbers and predictions that can be compared to data
- Predictions will be generated by economics models featuring optimizing agents (not OLS)

Semester Overview

Goal of course is to be able to solve models to answer policy questions in trade

Plan to Achieve Goal

- Briefly review the graphical models covered in lower division trade courses
- Contrast the above with fully specified general equilibrium models
- Generalize the models and discuss how to calibrate the model parameters with data

Ongoing Themes

- Learn to solve models computationally (we will use R)
- Evaluate model predictions to identify where our models succeed and fall short

Why do Countries Trade?

Ricardian: Countries have different technologies for producing goods. Comparative advantage.

Heckscher-Ohlin: Countries have same technology for producing goods, but different factor endowments which are used in the production of the goods.

Armington: Countries have different goods, and consumers like to consume foreign goods.

Monopolistic Competition: Countries have firms which produce differentiated varieties of a good. Consumers like to consumer different varieties.

Increasing Returns: Cheaper to produce a good all in a single place, so countries should specialize and trade.

Road Map

Start with Ricardian Model

1. Basic intuition
2. Simple framework with 2 countries and 2 goods
3. Expand to multiple countries and multiple goods
4. Formalize in a general equilibrium model where prices respond to production decisions

Mixed-in: Discuss policy implications of the model & empirical evidence

Ricardian Model Intuition

Ricardian model relies on concepts of **opportunity cost** and **comparative advantage**

Opportunity cost of producing a good is the loss of what you could have produced instead (foregone opportunities)

- Typically refers to the best alternative, as alternatives beyond that irrelevant

Comparative advantage is what you are relatively better at producing (lower opportunity cost)

- Basic intuition is that specializing in your comparative advantage and trading is better than producing everything yourself

Opportunity Cost

Same idea as in principles of micro: cost of a hamburger is $5, *opportunity cost* of the hamburger is the burrito you could have bought instead.

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Example: In the US, you can produce 5 pineapples with the same resources it takes to produce 100 apples. In Mexico, you can produce 20 pineapples with the same resources it takes to produce 100 apples.

- Opportunity cost of producing 1 apple is: 1/20 pineapple in US, 1/5 pineapple in Mexico
- Opportunity cost of producing 1 pineapple is: 20 apples in US, 5 apples in Mexico

Opportunity cost of producing apples is cheaper in the US since give up less pineapples.

Comparative Advantage

- A country has a comparative advantage in a good if the opportunity cost of producing that good is lower than in other countries

- The US has a comparative advantage in producing apples and Mexico has a comparative advantage in producing pineapples

- Suppose both countries initially produce both products. If each country produces less of the good they do not have a comparative advantage in, they can consume more of each good

	Δ(Apples Produced)	Δ(Pineapples Produced)
United States	+100	-5
Mexico	-50	+10
Total	**+50**	**+5**

Simple 2x2 Ricardian Model

Assumptions

- Two countries (H=Home and F=Foreign), Two goods (i,j=1,2)
- Single factor of production: Labor
- Countries differ in their labor costs to produce each good
- Linear production technology, fixed labor supply
- Perfect competition: Marginal Revenue (value of good produced) = Marginal Cost (wages)
- Small-open economies (production does not effect world prices or demand)

Unit Labor Requirements

Linear production technology ⇒ constant unit labor requirement

- Constant returns to scale (Marginal Cost = Average Cost)

Notation:

- a_1^H is the unit requirement for good 1 in the Home country, and a_2^H be for good 2
- a_1^F is the unit requirement for good 1 in the Foreign country, and a_2^F be for good 2

Say country has high labor productivity in a good if it has a low unit labor requirement

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Example: Suppose $a_1^H = 1, a_2^H = 3$ and $a_1^F = 2, a_2^F = 4$

- It takes 1 unit (hour) of labor to produce 1 unit of good 1 in Home country
- It takes 4 units (hours) of labor to produce 1 unit of good 2 in Foreign country

Labor Supply and Production

Labor supply in Home indicated by L^H. (L^F for Foreign)

- Indicates the total number of hours available to work in a country (constant, no leisure)

Production of good 1 in home country given by Q_1^H, and Q_2^H for good 2

- Total labor used by Home in production of good 1 equals $a_1^H Q_1^H$

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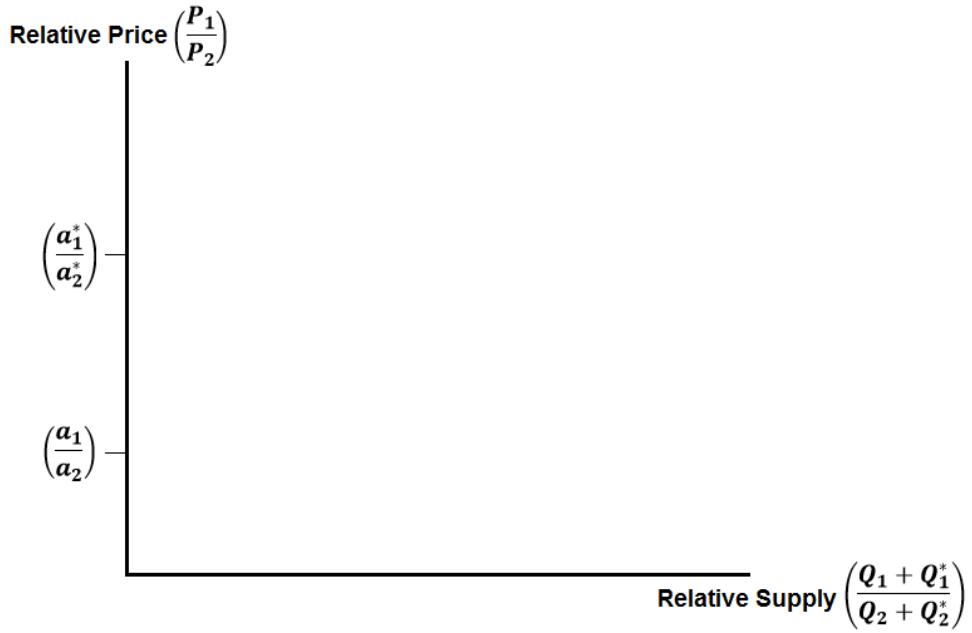
Production Possibility Frontier for Home given by

$$a_1^H Q_1^H + a_2^H Q_2^H \leq L^H$$

- LHS is labor used in production, RHS is labor supply. Will hold with equality in equilibrium.

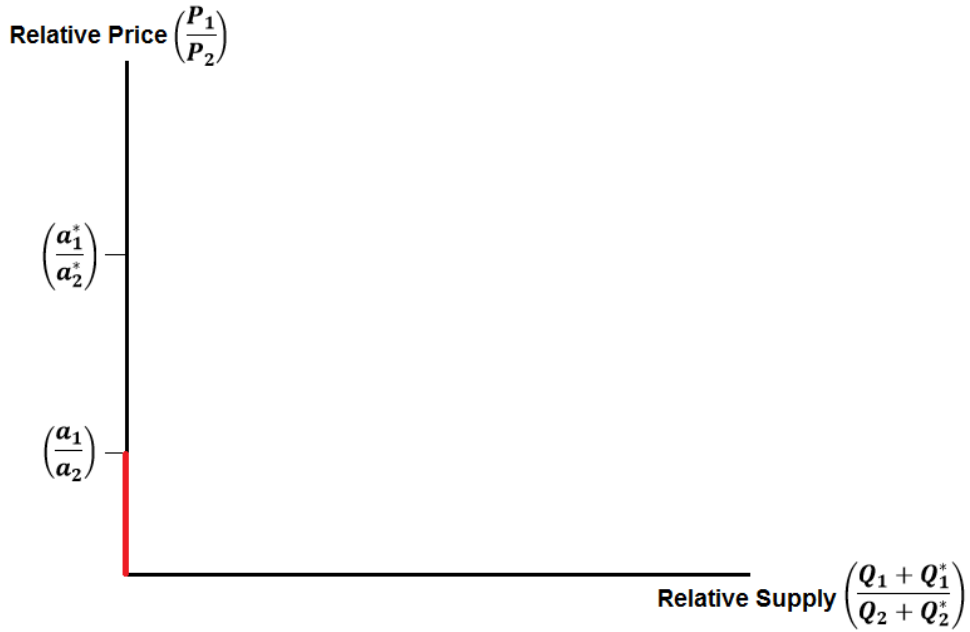
Constructing Relative Supply Graph



Notation Update for Graph:
no star = H, * = F
$(Q_1 = Q_1^H; Q_1^* = Q_1^F)$

Assume $\left(\frac{a_1}{a_2}\right) < \left(\frac{a_1^*}{a_2^*}\right)$. Therefore Home has comparative advantage in good 1
(Good 1 has lower opportunity cost in terms of good 2 in Home compared to Foreign).

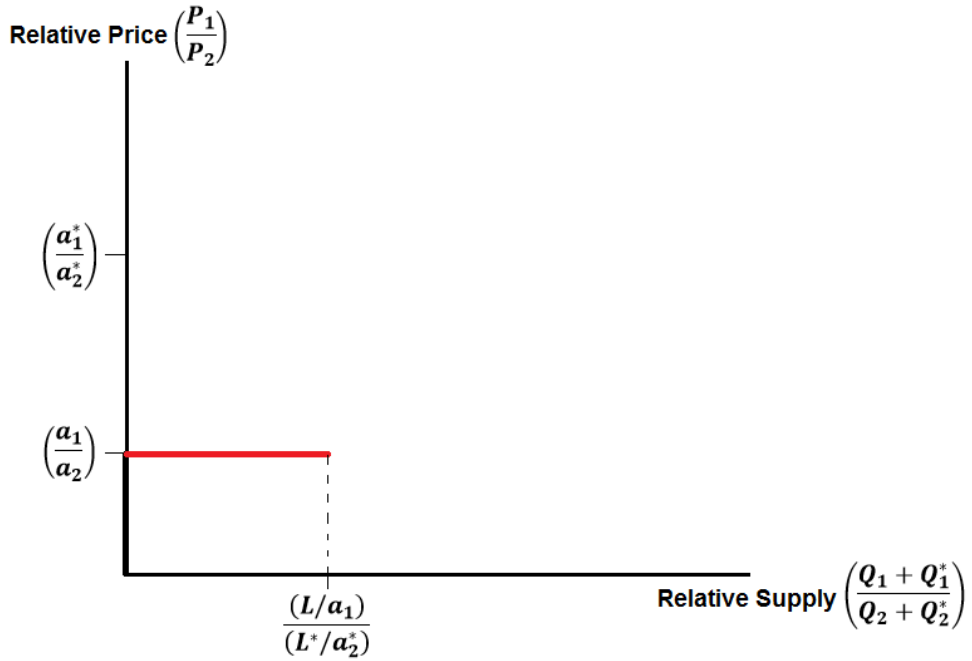
Constructing Relative Supply Graph



Case 1: $\left(\frac{P_1}{P_2}\right) < \left(\frac{a_1}{a_2}\right) < \left(\frac{a_1^*}{a_2^*}\right)$ ⇒ Neither country will produce good 1

RS= $\left(\frac{0+0}{Q_2+Q_2^*}\right) = 0$, where $Q_2 = \frac{L}{a_2}$ and $Q_2^* = \frac{L^*}{a_2^*}$

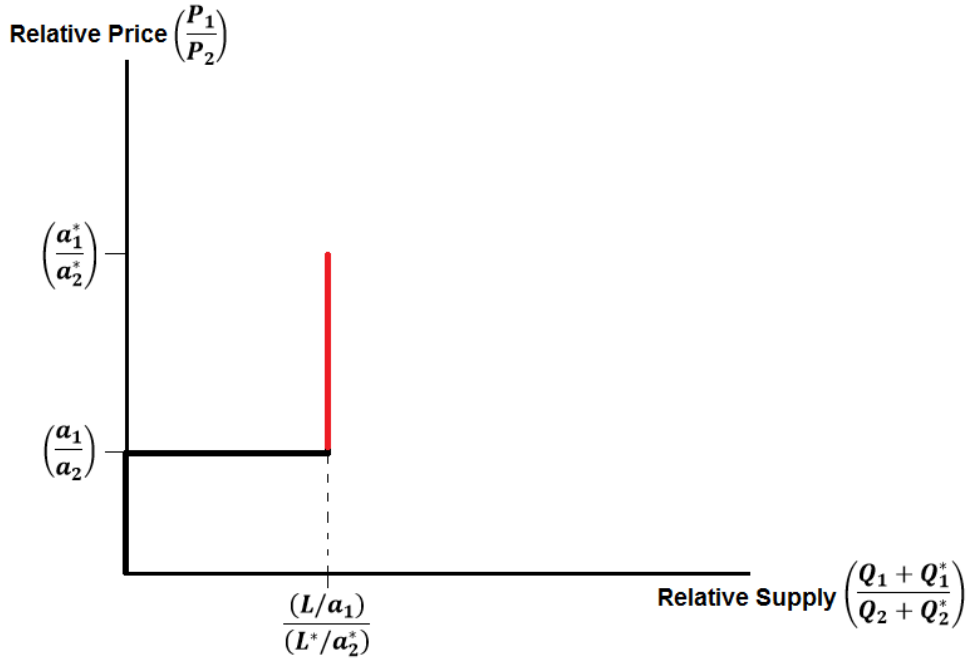
Constructing Relative Supply Graph



Case 2: $\left(\frac{P_1}{P_2}\right) = \left(\frac{a_1}{a_2}\right) < \left(\frac{a_1^*}{a_2^*}\right)$ ⇒ Home indifferent between producing good 1 and 2

RS= $\left(\frac{Q_1+0}{Q_2+Q_2^*}\right)$, where $Q_1 \in \left[0, \frac{L}{a_1}\right]$; $Q_2 = \frac{L-a_1Q_1}{a_2}$ and $Q_2^* = \frac{L^*}{a_2^*}$

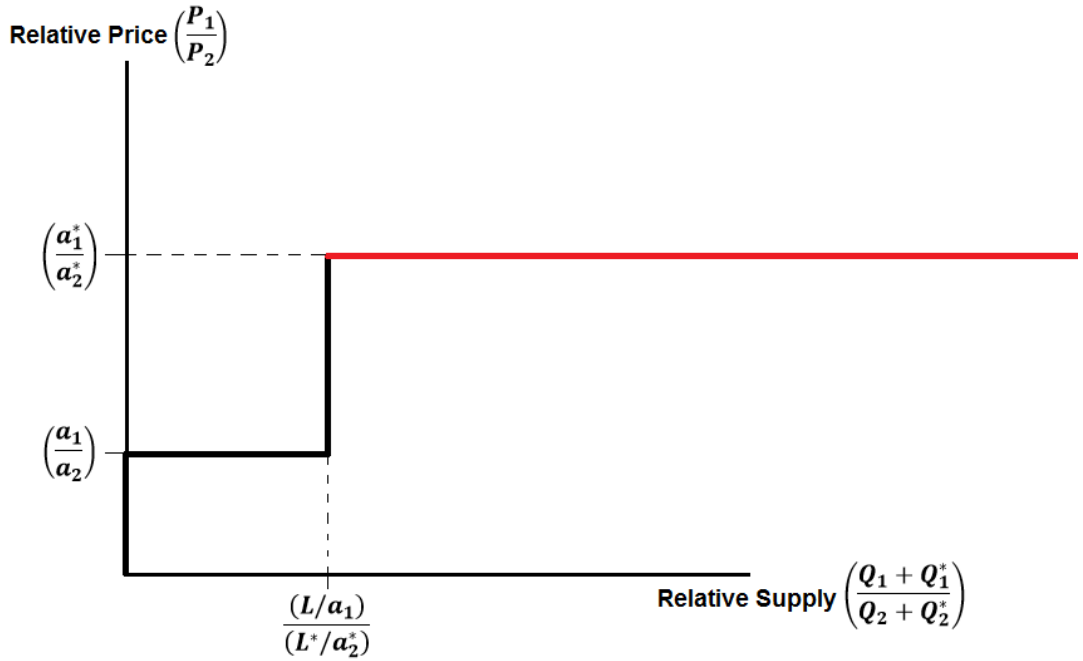
Constructing Relative Supply Graph



Case 3: $\left(\frac{a_1}{a_2}\right) < \left(\frac{P_1}{P_2}\right) < \left(\frac{a_1^*}{a_2^*}\right)$ ⇒ Home produces only good 1. Foreign produces only good 2.

RS= $\left(\frac{Q_1+0}{0+Q_2^*}\right)$, where $Q_1 = \frac{L}{a_1}$ and $Q_2^* = \frac{L^*}{a_2^*}$

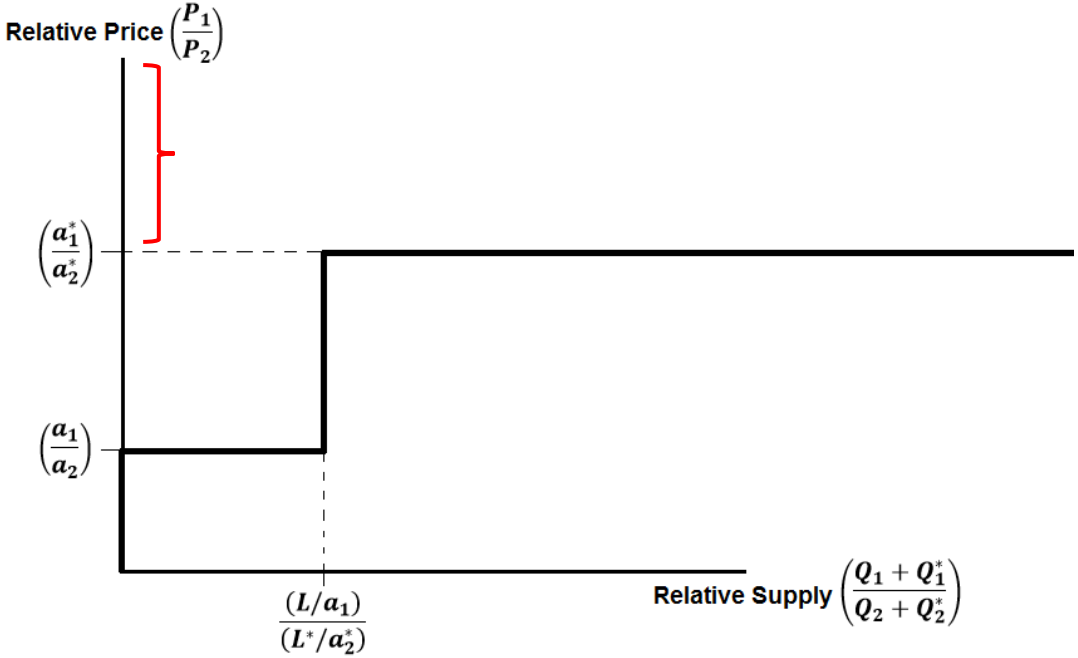
Constructing Relative Supply Graph



Case 4: $\left(\frac{a_1}{a_2}\right) < \left(\frac{a_1^*}{a_2^*}\right) = \left(\frac{P_1}{P_2}\right) \Rightarrow$ Foreign indifferent between producing good 1 and good 2.

RS= $\left(\frac{Q_1+0}{Q_1^*+Q_2^*}\right)$, where $Q_1 = \frac{L}{a_1}$ and $Q_2 \in \left[0, \frac{L^*}{a_2^*}\right]$; $Q_1 = \frac{L^* - a_2^* Q_2^*}{a_1^*}$

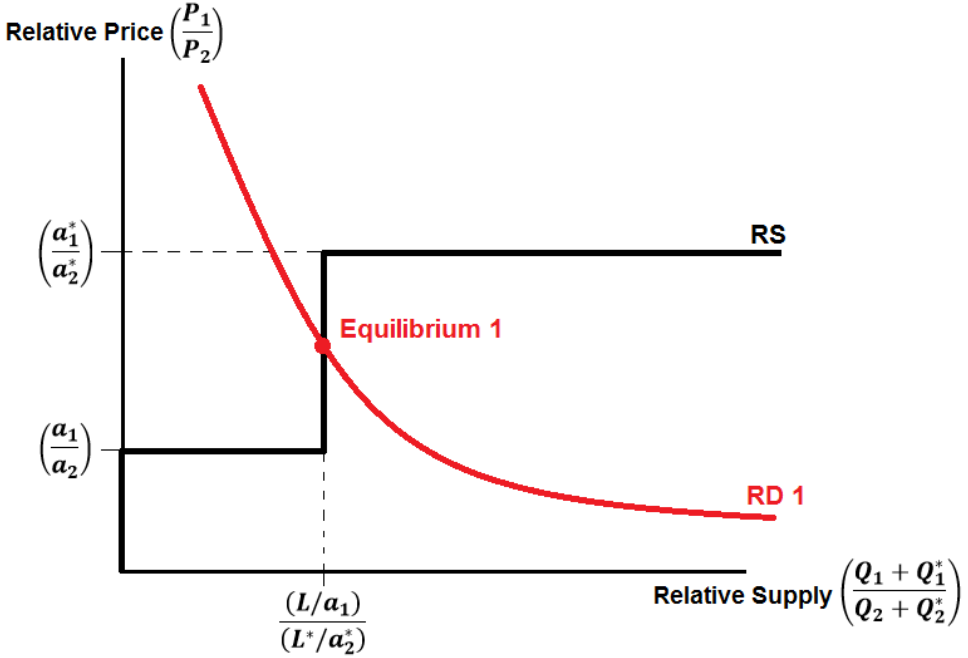
Constructing Relative Supply Graph



Case 5: $\left(\frac{a_1}{a_2}\right) < \left(\frac{a_1^*}{a_2^*}\right) < \left(\frac{P_1}{P_2}\right) \Rightarrow$ Neither country will produce good 2

RS= $\left(\frac{Q_1+Q_2}{0+0}\right) = \infty$, where $Q_1 = \frac{L}{a_1}$ and $Q_1^* = \frac{L^*}{a_1^*}$

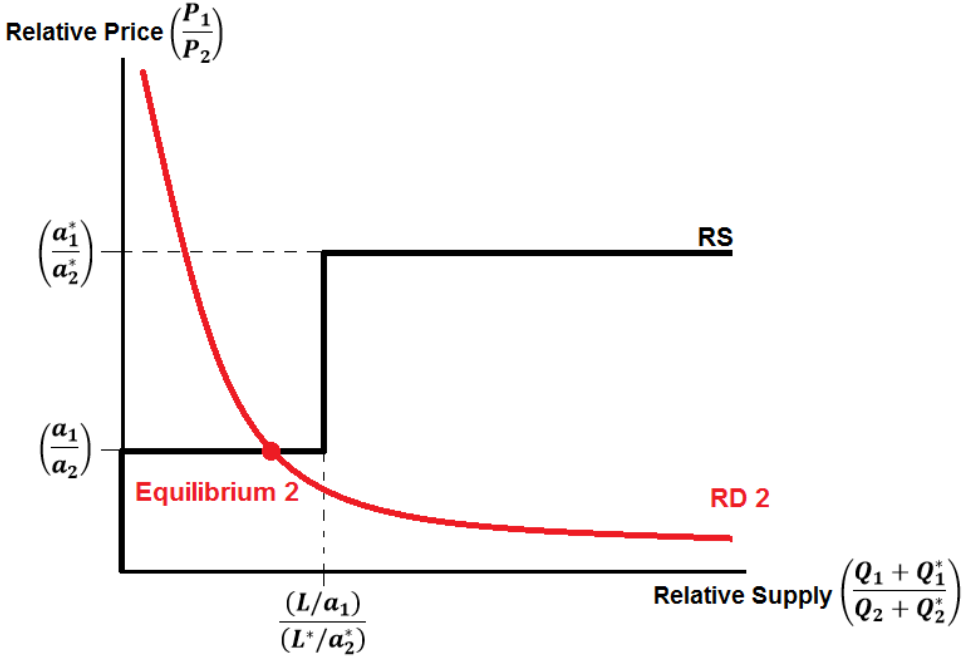
Finding Equilibrium using Relative Demand



Find equilibrium prices where RD = RS. Happens at the point Equilibrium 1.

Therefore $\left(\frac{a_1}{a_2}\right) < \left(\frac{P_1}{P_2}\right) < \left(\frac{a_1^*}{a_2^*}\right)$ ⇒ Home produces only good 1. Foreign produces only good 2.

Finding Equilibrium using Relative Demand



Different RD curves will give different Equilibriums. New RD curve intersects RS at Equilibrium 2

$\Rightarrow \left(\frac{P_1}{P_2}\right) = \left(\frac{a_1}{a_2}\right) < \left(\frac{a_1^*}{a_2^*}\right)$ $\Rightarrow$ Home indifferent & produces both goods. Foreign produces only good 2.