

## 1A. Extending Ricardo's CA to Many Goods

**Ricardo's Problem:** Too simplistic.

- The Ricardian theory with two goods convincingly shows which of the two goods a country will export.
- The theory is NOT practical. There are many industries.
- A country cannot simply export one good and import the rest, i.e., (n - 1) goods. If there are n commodities, a country is likely to export some and import the rest.
- The theory of CA does tell us that a country cannot import or export all goods when trade is balanced.

### How to Modify CA definition in the Two good world

Consider a world of two goods. Assume that the HC has a CA in good 1. Then

$$p_1 = a_{L1}w < p_1^* = a_{L1}^*w^*. \quad (1)$$

(which means “ autarky unit cost of good 1 is less than its foreign cost.”)

The HC does not have a CA in good 2. If good 2 were produced, its unit cost would be

$$p_2 = a_{L2}w > p_2^* = a_{L2}^*w^*. \quad (2)$$

(Domestic unit cost of good 2 is greater than its foreign cost).

● Implication: Impossible to force wage equalization in two countries, due to differences in labor productivities.

● Workers receive their value of marginal products in each industry in which the country has a CA.

### **(Choi) Definition**

● Why do we care whether one country uses fewer workers, or an input is used? Workers in different countries may have different productivities. We should only compare the unit costs of output, regardless of how it is made.

● Do not compare Autarky and Free Trade Prices

A comparison of autarky and free price of a good yields no hint as to whether the product will be exported. For instance, even if the price of a product is higher than under autarky, the country may import it, although it is less likely, because import and export decisions depend on not only its own price but also all other prices and income.

Let  $p_i^A$  denote the price of good  $i$  in autarky, and let  $P_i^*$  be the price of good  $i$  under free trade.

Consumption:  $x_i = x_i(p_1^*, p_2^*, \dots, p_n^*, I)$ .

Production:  $y_i = y_i(p_1^*, p_2^*, \dots, p_n^*)$ .

Import:

$$z_i = x_i(p_1^*, p_2^*, \dots, p_n^*, I) - y_i(p_1^*, p_2^*, \dots, p_n^*).$$

Choi

● One cannot determine whether a country exports a product by comparing autarky prices and free trade prices. Specifically, if  $p_1^A < p_1^*$  does not guarantee that the country will export good 1.

● Compare domestic unit costs and world prices. The country exports good 1 if

$$g_1^* = a_{L1}w + a_{K1}r < p_1^*,$$

i.e., if domestic unit production cost under free trade is less than that in the foreign country, provided that trade is balanced.

● HC has a CA in industry i if

$$p_i = a_{Li}w < p_i^* = a_{Li}w^*. \quad (3)$$

That is, domestic unit cost of good i is less than its foreign cost (if the HC has a CA in good in that industry), **again assuming trade is balanced**.

As we move from autarky to free trade, wages and output prices will change and deviate from their autarky values. Thus, in (3) we are dealing with output and wages (in general factor prices) under balanced free trade situation.

- The above inequality cannot hold for all industries, in which case the HC exports all goods, and hence trade will not be balanced.
- If trade is not balanced, the above definition needs to be modified. Both output prices and wages may be affected by trade imbalance. Thus, from the observed output prices and wages, the hypothetical output prices and wages under balanced trade condition must be recovered, which will then indicate true comparative advantages.
- When a country has a trade deficit (and the associated interest rate), it may not only import the product in which it has a comparative advantage but also other products in which it has a comparative disadvantage.
- The effect of trade deficit or surplus on prices and wages has not been investigated.

### Consistency with the old definition

If the HC has a CA (1) and the FC in 2, then

$$\frac{a_{L1}w}{a_{L1}^*w^*} < 1, \frac{a_{L2}^*w^*}{a_{L2}w} < 1,$$

Or

$$\frac{a_{L1}w}{a_{L1}^*w^*} < 1 < \frac{a_{L2}w}{a_{L2}^*w^*}, \quad (4)$$

Multiplying both sides by  $a_{L1}^*w^*/a_{L2}w$  we have, regardless of wage differential,

$$\frac{a_{L1}}{a_{L2}} < \frac{a_{L1}^*}{a_{L2}^*}. \quad (5)$$

Thus, the new definition is consistent with the traditional one.

● **Labor Immobility**  $\Rightarrow$  Wage disparity between industries.

● Assume: Domestic labor mobility.

If workers are not mobile between industries, workers may receive different wages in different export industries. For example, there is empirical evidence that workers in the export sector earn higher wages than those in the import competing sectors. However, if workers are mobile between sectors, wage equalization occurs in the domestic market).

## Ranking CA industries

Whither Labor?

● Since the domestic labor supply is limited, sometimes the country has to choose between two industries in which it has comparative advantages. Even in this case, the two industries can be ranked in terms of their comparative advantage. All industries can be ranked in terms of CA or price-cost ratio.

● Price to unit cost ratio of a good is  $\frac{p_i}{a_{Li}w} = \frac{p_i y_i}{wL_i}$ .

● It is more profitable to devote labor resources to industry 1 (and the country has a CA in that industry) if

$$\frac{p_1^*}{wa_{L1}} > \frac{p_2^*}{wa_{L2}}, \quad (6)$$

All industries can be ranked in terms of price-to-cost ratios,

$$\frac{p_1^*}{wa_{L1}} > \dots > \frac{p_k^*}{wa_{Lk}} \geq 1 > \frac{p_{k+1}^*}{wa_{Lk+1}} > \dots > \frac{p_n^*}{wa_{Ln}}, \quad (7)$$

A country exports every commodity whose price-unit cost ratio exceeds unity.

## Labor Demand

- Labor demand in a CA industry is determined by the world demand for the product.
- Workers move to the first industry with the highest price-to-cost ratio. World demand for workers in industry 1 is

$$L_1 = a_{L1}(x_1 + x_1^*).$$

- If  $L > L_1$  (domestic labor supply is not depleted), the remaining workers move to the next CA. When the demand for the second product is satisfied, any surplus labor can move to the next CA industry and so on.

## Labor Supply in the Neutral Industry

Suppose for some  $k$ , the price-cost ratio is unity. It does not have a CA nor comparative disadvantage. Assume that there is only one neutral industry. (If there are many such industries,  $k_1, k_2, \dots, k_m$ , then start with  $k_1$ . If there are laborers left, then move to  $k_2$ , and so on.)

- Industry  $k$  yields zero profits, regardless of its output. However, its supply is limited by

$$L_k \leq L - \sum_i^{k-1} L_i.$$

The HC specializes in, and export, the products of every CA **industry** (its domestic unit cost is less than the foreign cost).

## Many Factors

● Feenstra's Method (Continuum of Goods, and Many Factors without FPE)  $\Rightarrow$  See the next note.

**(Choi) Definition:** The HC has a CA in industry  $i$  if

$$p_i = a_{Li}w + a_{Ki}r < p_i^* = a_{Li}^*w^* + a_{Ki}^*r^*, \quad (8)$$

where  $p_i$  and  $p_i^*$  are domestic and foreign **unit cost or autarky prices** of good  $i$ .

(If there are other factors, include their costs also. Thus, an extension of the Ricardian model to many factor world is straightforward.)

## **No Factor Price Equalization (due to different technologies)**

● Factor prices  $(w,r)$  are determined in the factor markets. Once factor prices are determined, equilibrium price of a good is determined by the supply side of the country which has a CA in that industry.

● Specifically, for two countries A and B, equilibrium price of good  $i$  is  $p_i = \min[p_i^A, p_i^B]$ , and the country with a lower unit cost has a CA in that industry. That country has a horizontal supply curve, and the level depends on domestic factor prices.

● Equilibrium wage in a country is determined by the aggregate VMPL and the country's labor supply curve. Equilibrium rent for capital services are similarly determined in each country.