

Consider two small economies, Argentina and Peru. Assume each only has two industries, agriculture (Q_A) and mining (Q_M), and three factors of production: water (W), topsoil (T), and underground minerals (U). Water is used in both agriculture and mining, while topsoil is specific to agriculture and underground minerals are specific to mining. Assume the production functions for both industries exhibit constant returns to scale. Further assume that Argentina and Peru both have the same quantity of underground minerals and water, but Argentina has substantially more topsoil.

1. Explain why it is possible for an industry to have constant returns to scale and also have diminishing marginal products. Show how this affects the shape of the production function when one factor is variable.
2. Use the four quadrant diagram to show how to derive the PPF for one of the countries. Put Q_A on the horizontal axis of the PPF.
3. Show and compare the PPFs for both countries, and explain how the relative price P_A/P_M should differ between the two countries under autarky. Show and explain how free trade between the two should affect relative prices and production combinations. Then using the terms of trade as a Consumption Possibilities Frontier (CPF), show how specialization and trade makes it possible for both countries to consume more goods overall.
4. For Argentina, use an allocation graph for water to explain the initial autarky equilibrium in the water market. Then show and explain how free trade would affect the water market equilibrium, assuming both nominal output prices change (you may assume that the overall price level is unaffected). How is the nominal price of water (P_W) affected? What happens to the residual income of those who own the rights to topsoil? What happens to the residual income of those who own the underground mineral rights?

Economics 462
Quiz 2

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(This problem is adapted from Robert W. Crandall's 1984 article, "Import Quotas and the Automobile Industry: The Costs of Protectionism.")

Suppose that in 1983 the average free trade equilibrium price of an automobile was \$8,000, with U.S. manufacturers producing 8 million vehicles per year and U.S. consumers purchasing 12 million vehicles. Suppose that the U.S. government, responding to calls for protection against imports, now imposes a \$1,000 tariff (in reality, it was a VER, but we will leave that for another problem).

- a. Assume initially that the world price is unaffected by the U.S. tariff, and that both U.S. demand and supply are linear. Suppose that the tariff results in an increase in the consumers' price to \$9,000, a decrease in domestic quantity-demanded to 10 million, and an increase in domestic production to 9 million. Using partial equilibrium analysis, carefully graph the effect on the domestic automobile market. How much revenue does the tariff earn? Calculate the change in domestic consumer and producer surplus, and calculate the net change in total domestic surplus value. Assume that this tariff saved approximately 25,000 domestic jobs; how much did consumers pay per job saved per year?
- b. Suppose, instead, that the U.S. was a large world consumer of autos, and that the \$1000 tariff results in a decrease in the world price to \$7,500, a decrease in domestic quantity-demanded to only 11 million, and an increase in domestic production to only 8.5 million. Carefully graph the effect on the domestic automobile market. How much revenue would the tariff earn? Calculate the change in domestic consumer and producer surplus, and calculate the net change in total domestic surplus value.
- c. Now consider the effects of the U.S. tariff (in the second large-country case) on foreign exporting markets. Assume that at a price of \$8,000, foreign producers produced a total of 10 million autos, and when the price fell to \$7,500, foreign producers only produced 9.25 million autos. Assume every automobile that did not get exported to the U.S. was purchased by foreign consumers. Carefully graph the effect of the U.S. tariff on the foreign automobile market. Calculate the change in foreign consumer and producer surplus, and calculate the net change in both foreign surplus value and world (i.e., domestic and foreign) surplus value.

A small country can import a good at a world price of \$20. The domestic supply function is:

$$Q_S = 10 P$$

The domestic demand function is:

$$Q_D = 500 - 5 P$$

In addition, there is a positive production externality from technological spillovers and learning that producers cannot appropriate. Assume that each unit of production yields a marginal external social benefit of \$5.

- a) Using a supply and demand diagram, graph the free trade equilibrium for this small country, and show the effect of a \$10 tariff on price, quantity-supplied, and quantity-demanded.
- b) Calculate the distributional effects (changes in producer surplus, consumer surplus, the government budget, and the external social benefit) of a \$10 tariff on imports. Is the country better or worse off?
- c) Calculate the distributional effects (changes in producer surplus, consumer surplus, the government budget, and the external social benefit) of a \$10 domestic production subsidy instead. Relative to free trade, is the country better or worse off?
- d) What is the optimal policy, the tariff, the subsidy, or free trade without subsidies? If either the tariff or subsidy is best, what is the optimal amount? Explain. For extra credit, prove that your optimal policy is more efficient than either (b) or (c).

Consider a labor-abundant, less-developed country which produces two goods, urban manufacturing and rural agriculture. Manufacturing is capital-intensive, and agriculture is labor-intensive.

- a) Under the normal assumptions and free trade, what would be the expected patterns of trade? Using an appropriate diagram, show how the standard model of trade explains the allocation of labor and wage determination in the two sectors, and compare how free trade and import substitution affect the relative prices of the two goods and labor allocation between the two sectors.
- b) Assume that the marginal product of labor in agriculture is zero, so there is surplus labor, and traditional sharing arrangements lead to a subsistence wage for everyone in rural areas. Graph the Lewis model of labor allocation. Why does this model suggest that import substitution might be the best trade policy for economic development?
- c) Assume that there is no surplus labor, but workers in urban areas have significantly more political power, and as a result receive a much higher income from policies of urban bias. Graph the Harris-Todaro model of labor allocation. Why might import substitution in this case be a bad policy? What other policies might be more likely to lead to economic development?

Bonus: In (c) above, suppose that the urban wage was twice the rural wage. What would the simple Harris-Todaro model predict would be the urban unemployment rate? What would be the rural unemployment rate?