Public Affairs 856
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University of Wisconsin-Madison

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Problem Set 2 Answers

Due in Lecture on Monday, February 28th.

1. Heckscher-Ohlin Model of Trade.

Consider the following 2×2×2 Hecksher-Ohlin model (2 countries = home, foreign, 2 goods = natural gas, automobiles, 2 factors of production = land, capital),

On the diagram below, the endowment of Home is marked $(K/T)^H$ (by the way, this is sometimes called a "Johnson Diagram", after Harry Johnson; refer to *Factor Proportions and Factor Price Equalization: An Integrated Approach*). The PPF for the same country is also shown below.

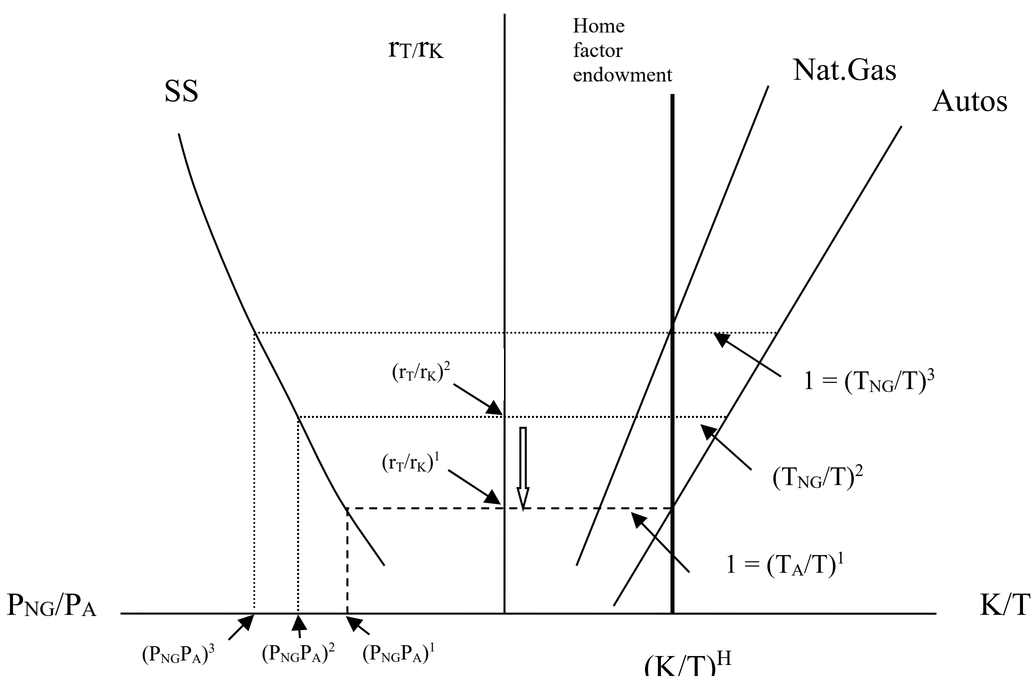


Figure 1: "Johnson Diagram"

Where K is capital, T is land, r_T is the rental rate for land, and r_T is the rental rate for capital.

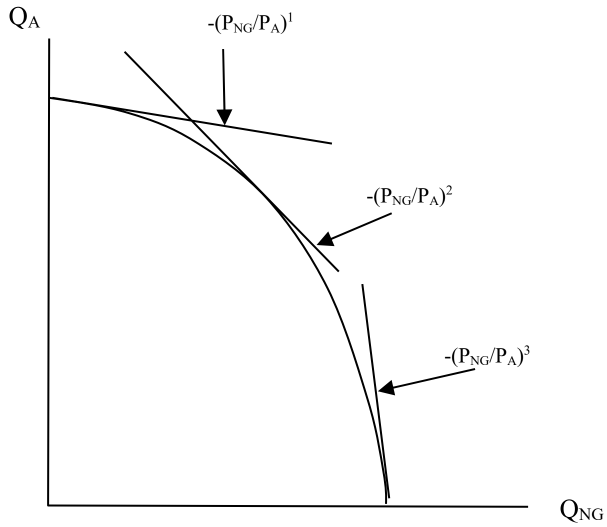


Figure 2: PPF for Home

a. What are the factor ratios in use in the Natural Gas and Automobile industry for the price ratio $(P_{NG}/P_A)^3$? What about $(P_{NG}/P_A)^2$?

$(T_{NG}/T)^3 = 1$ and $(T_{NG}/T)^2$, $(T_{NG}/T)^2$, respectively, indicated above.
(Alternatively, if you wrote for factor ratios as being the $(K/T)^H$ for $(P_{NG}/P_A)^3$, and the like, I would count that as a correct answer, as I was not specific what a factor ratio was).

b. What happens to the relative returns to factors as the price ratio changes from $(P_{NG}/P_A)^2$ to $(P_{NG}/P_A)^1$? Can you explain this result intuitively?

(rT/rK) falls from $(rT/rK)^2$ to $(rT/rK)^1$. As P_{NG} falls relative to P_A, natural gas production falls. This draws away factors from natural gas, which uses land intensively, so land rents must fall.

c. At $(P_{NG}/P_A)^1$ what are the factor ratios used in each industry? [Hint: Mark this ratio on the Johnson Diagram] Can you explain why the factors in Home can be fully employed at this relative price of commodities?

$(T_A/T)^1 = (T/T) = 1$, i.e., all labor is employed in auto production, as is all land. Production is specialized. All factors can be employed because the factor intensity in automobiles becomes exactly the same as Home relative factor endowment through the adjustment of the land rental to capital rental ratio.

Assume Home and Foreign are endowed with factor ratios of $(K/T)^H$ and $(K/T)^*$.

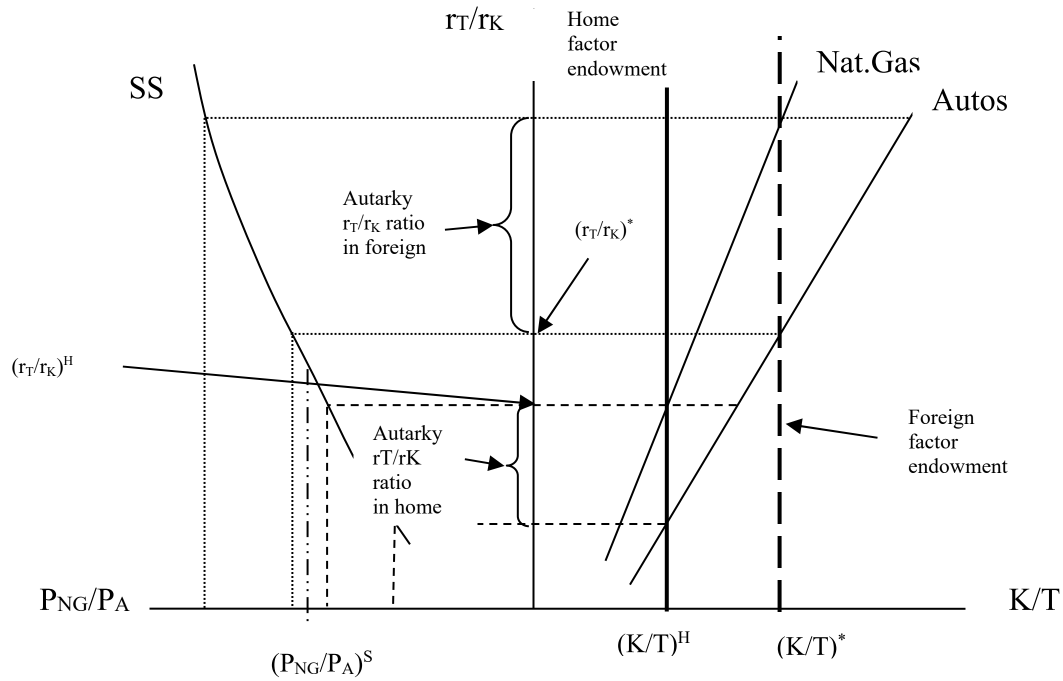


Figure 3: "Johnson Diagram" with Foreign Endowment

d. Which country has more capital per unit of land (T)? Foreign.

e. Which country has the lower price of Natural Gas in autarky? (Assume both goods are produced.) Home.

f. Draw in some autarky price ratios in figure 3. Where must the world price ratio fall? What world price ratio supports specialization in both countries? $(P_{NG}/P_A)^S$

g. Is there a world price ratio where neither country specializes in production of one good? What happens to relative factor returns in both countries when trade occurs? Why?

Relative factor returns converge, but do not equalize exactly (they stop at $(r_T/r_K)^H$ for home, $(r_T/r_K)^*$ for foreign). This occurs because both countries tend to export the good which uses intensively the factor in which they are abundant in. That is Natural Gas in home (uses land intensively, so r_T rises relative to r_K) and Autos in foreign (uses capital intensively so r_K rises relative to r_T).

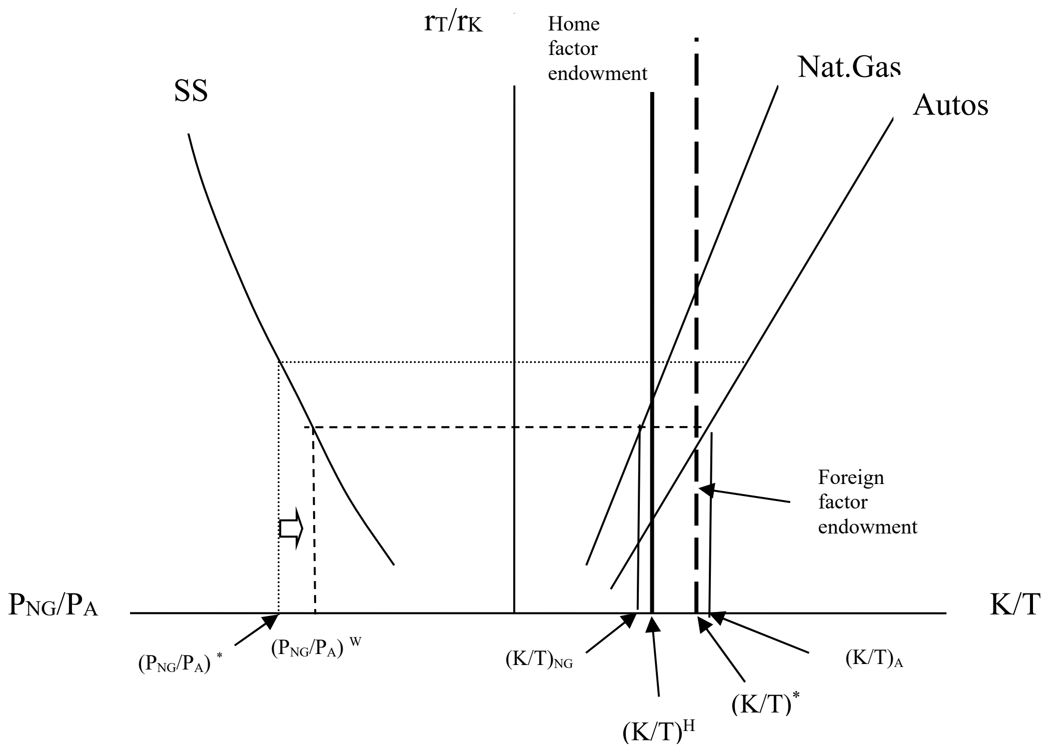


Figure 4: "Johnson Diagram" with Alternate Foreign Endowment

Consider the pair of trading countries Home and Foreign (the endowment line is positioned differently now). Let $(P_{NG}/P_A)^W$ be the equilibrium world price of the commodities.

h. What are the factor ratios in Natural Gas and Automobiles industries in Foreign? In Home?

Factor ratios in Natural Gas and Autoos are the same in both countries.

What are the relative returns to factors in Foreign and Home?

Relative returns in home and foreign are the same: $(r_T/r_K)^W$.

i. What country produces relatively more Natural Gas, and why?

Home produces more Natural Gas, because Natural Gas production is land intensive and home is land abundant.

j. If consumption preferences are identical in both countries, which one will export Natural Gas?

Home exports Natural Gas.

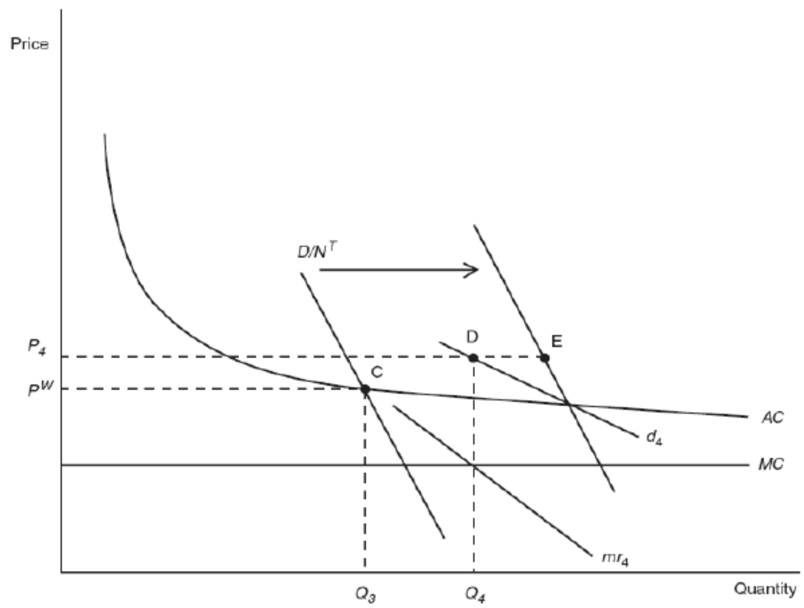
k. If $(P_{NG}/P_A)^*$ is the autarky commodity price ratio in Foreign, which group of factor owners in Foreign will oppose the introduction of trade?

Land will oppose since foreign is land scarce.

2. Starting from the long-run trade equilibrium in the monopolistic competition model, as illustrated in Figure 6-7, consider what happens when industry demand, D, increases. For instance, suppose that this is the market for cars and lower gasoline prices generate higher demand D.

a. Redraw Figure 6-7 for the home market and show the shift in the D/NT curve and the new short-run equilibrium.

The increase in demand shifts the D/N^A curve to the right, dragging along the curves d_3, and mr_3. Each firm produces Q_4 at a price of P_4 attempting to earn monopoly profits at point D, and when all firms do so they move along the new D/N^T curve to point E.



b. From the new short run equilibrium, is there exit or entry from the market, and why?

In the short-run with trade, monopoly profits are positive because price exceeds average cost. As a result, firms enter the industry and N^T increases.

c. Describe where the new long-run equilibrium occurs, and explain what has happened to the number of firms, and the prices they charge.

In the long-run with trade, firm entry shifts D/N^T and d_4 to the left and makes d_4 more elastic until it is tangent to the average cost curve. At that point, monopoly profits are zero and firms no longer enter the industry. Relative to the short-run equilibrium in (1.2), the number of firms increases and price decreases.

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