

PROBLEM 1

1.1 *Trade benefits the factor that is specific to the importing sector.*

False. According to the specific factors model opening up to trade will reduce the relative price of the good in the import sector, and the specific factor in the sector whose relative price falls will lose.

1.2 *The Heckscher Ohlin model fails empirical tests when it is used to predict factor trade.*

True. The Leontief Paradox, "The tests on Global Data" by Bowen, Leamer and Sveikaukas and "The Case of the Missing Trade" by Treffer all fail to provide empirical support for the predictions of the Heckscher Ohlin model. However, a less restrictive version of the model (relaxing the assumptions about common technologies across countries, countries produce the same set of goods and costless trade equalizes goods prices) fits the predicted patterns for the factor content of trade quite well.

1.3 *In a model of reciprocal dumping, there will be a negative effect of trade on welfare if transport costs are high.*

True. The Brander and Krugman (1983) article shows that welfare falls when transport costs are reduced from the trade prohibitive level. This is because at that level the loss from transporting the homogenous good two ways across the border is large relative to the pro-competitive effect, which reduces prices and increases consumer surplus.

1.4 *A number of Asian economies have shown rapid economic growth over recent decades. The reason for the success of these economies is trade liberalization.*

False. Trade liberalization may have played a role in the growth takeoff in Asia, but several other factors, such as industrial policy, deregulation and accumulation of production factors, also may explain a part. In particular, Alwyn Young found evidence that factor accumulation played a fundamental role in the growth experiences of Hong Kong, Singapore, South Korea and Taiwan.

1.5 *Imperfect competition gives governments incentives to subsidize exports, but these policies are jointly suboptimal.*

True. Strategic policies are beggar-thy-neighbor policies, that increase domestic welfare at the expense of other countries' welfare as profits are shifted away from other countries (Brander and Spencer 1985). These policies therefore risk a trade war that leaves everyone worse off.

PROBLEM 2

A final good, y_m , is produced in a perfectly competitive industry from two intermediate inputs, y_1 and y_2 , using a concave production function which is homogenous of degree one in the inputs. The intermediate inputs are produced using unskilled labor, L_i , skilled labor, H_i , and capital, K_i ($i = 1, 2$) with concave production functions that are homogenous of degree one. The first intermediate input, y_1 , is relatively unskilled labor intensive, while the second intermediate input, y_2 , is relatively intensive in skilled labor. The unskilled labor intensive input may be imported from abroad while the skilled labor intensive input may be exported. Trade in the inputs is balanced such that $px_1 + x_2 = 0$, where $x_1 < 0$ is imports of the first input, $x_2 > 0$ is exports of the second input, and p is the price of the first input. The price of the second input is set to one. The total factor usage in the industry is $L_1 + L_2 = L_m$, $H_1 + H_2 = H_m$, and $K_1 + K_2 = K_m$.

Question 2.1: Illustrate graphically by using the production possibility frontier between the two inputs, y_1 and y_2 , how the optimal output of the industry is found in three different cases: 1) There is no trade in intermediate inputs, 2) Trade in intermediate inputs is possible at the price p , and 3) Trade in intermediate inputs is possible at a lower price $p' < p$. Explain how output of the industry changes as the price of the intermediate input falls.

The situation is illustrated in Figure 6.3 in Feenstra and Hanson (2003). Without trade the industry produces inputs from which the final good is produced, i.e., where the isoquant is tangent to the production possibility frontier. If trade is allowed at the relative price p , output of the final good rises because the industry can move to a higher lying isoquant which is tangent to the budget line with slope p . If the relative price falls, industry output rises further because a higher lying isoquant can be reached with the flatter budget line. This is achieved because the industry shifts production towards the skilled-labor intensive activity allowing it to import (offshore) the unskilled labor intensive input.

The corresponding cost functions for each input in the industry are functions of factor prices and output, $C_i(w, q, r, Y_i)$, $i = 1, 2$, where w is the wage rate of unskilled labor, q is the wage rate of skilled labor, r is the rental rate of capital, and Y_i is the output of input i . The cost functions are homogenous of degree one in Y_i .

Question 2.2: Explain how the zero-profit conditions for the two inputs can be written $p = c_1(w, q, r)$ and $1 = c_2(w, q, r)$, where c_1 and c_2 are unit-cost functions (Hint: use that $C_i(w, q, r, Y_i) = Y_i c_i(w, q, r)$).

Since the cost functions are homogenous of degree one in output they can be written $C_i(w, q, r, kY_i) = kC_i(w, q, r, Y_i)$, where $k > 0$ and $i = 1, 2$. Setting $k = 1/Y_i$, we get that $C_i(w, q, r, Y_i) = Y_i c_i(w, q, r)$, where $c_i(w, q, r)$ is the unit cost function. The zero profit condition is $P_i Y_i = C_i(w, q, r, Y_i) = Y_i c_i(w, q, r)$, so that $P_i = c_i(w, q, r)$, or $p = c_1(w, q, r)$ and $1 = c_2(w, q, r)$.

Question 2.3: Show that the relationships between the percentage change in factor prices and the percentage change prices of intermediate inputs are given by the equations $\hat{p} = \theta_{1L}\hat{w} + \theta_{1H}\hat{q} + \theta_{1K}\hat{r}$ and $0 = \theta_{2L}\hat{w} + \theta_{2H}\hat{q} + \theta_{2K}\hat{r}$, where θ_{ij} is the cost-share of factor j in activity i , with $\theta_{iL} + \theta_{iH} + \theta_{iK} = 1$, for $i = 1, 2$ (Hint: Totally differentiate the zero profit conditions from question 2.2).

By totally differentiating the zero profit condition for input 1, we get

$$\begin{aligned} dp &= \frac{\partial c_1}{\partial w} dw + \frac{\partial c_1}{\partial q} dq + \frac{\partial c_1}{\partial r} dr \\ &= L_1 dw + H_1 dq + K_1 dr, \end{aligned}$$

where the last step uses Shepard's lemma to get optimal unit factor demands. Then we have

$$\begin{aligned} \frac{dp}{p} &= \hat{p} = \frac{wL_1}{p} \frac{dw}{w} + \frac{qH_1}{p} \frac{dq}{q} + \frac{rK_1}{p} \frac{dr}{r} \\ &= \frac{wL_1}{c_1} \hat{w} + \frac{qH_1}{c_1} \hat{q} + \frac{rK_1}{c_1} \hat{r} \\ &= \theta_{1L}\hat{w} + \theta_{1H}\hat{q} + \theta_{1K}\hat{r}, \end{aligned}$$

where we have used that $p = c_1 = wL_1 + qH_1 + rK_1$. The same exercise can be applied for input 2 to get $0 = \theta_{2L}\hat{w} + \theta_{2H}\hat{q} + \theta_{2K}\hat{r}$.

Question 2.4: Assume that $\theta_{1K} = \theta_{2K}$, i.e., the cost shares of capital are identical in the production of the two inputs and that the import price of the unskilled intensive intermediate input falls ($\hat{p} < 0$). Use the equations in 2.3 to show that $\hat{w} < \hat{q}$. Provide an interpretation for this finding.

With equal cost shares we can subtract the two equations from each other to get

$$\begin{aligned}\hat{p} &= (\theta_{1L} - \theta_{2L})\hat{w} + (\theta_{1H} - \theta_{2H})\hat{q} \\ &= (\theta_{1L} - \theta_{2L})(\hat{w} - \hat{q})\end{aligned}$$

or

$$\hat{w} - \hat{q} = \frac{\hat{p}}{\theta_{1L} - \theta_{2L}},$$

which is negative because the first input is intensive in unskilled labor ($\theta_{1L} > \theta_{2L}$). Thus as the unskilled intensive input becomes cheaper, the industry imports more of the input, which indirectly hurts the unskilled domestic workers through lower relative wages.

Question 2.5: *Assume now instead that $\theta_{1K} > \theta_{2K}$, $\hat{p} = 0$, and $\hat{r} > 0$ and show that this will also imply $\hat{w} < \hat{q}$. Provide an interpretation for this finding.*

With the stated assumptions we have two equations with two unknowns, \hat{w} and \hat{q} :

$$\begin{aligned}0 &= \theta_{1L}\hat{w} + \theta_{1H}\hat{q} + \theta_{1K}\hat{r} \\ 0 &= \theta_{2L}\hat{w} + \theta_{2H}\hat{q} + \theta_{2K}\hat{r}\end{aligned}$$

Solving for \hat{w} and \hat{q} we get

$$\hat{q} = \frac{\theta_{2L}\theta_{1K} - \theta_{2K}\theta_{1L}}{\theta_{2H}\theta_{1L} - \theta_{2L}\theta_{1H}}\hat{r}$$

and

$$\hat{w} = \frac{\theta_{2K}\theta_{1H} - \theta_{1K}\theta_{2H}}{\theta_{2H}\theta_{1L} - \theta_{2L}\theta_{1H}}\hat{r}$$

so that

$$\hat{w} - \hat{q} = \frac{\theta_{2K} - \theta_{1K}}{\theta_{2H}\theta_{1L} - \theta_{2L}\theta_{1H}}\hat{r},$$

which is negative because $\theta_{1K} > \theta_{2K}$, $\theta_{2H} > \theta_{1H}$ and $\theta_{1L} > \theta_{2L}$. The situation can arise if capital leaves the country as a result of higher return to capital ($\hat{r} > 0$). Input 1 uses both unskilled labor and capital intensively, so when capital leaves it is then unskilled labor that suffers.

Question 2.6: *Discuss the empirical evidence for the results obtained in 2.4 and 2.5.*

The relative wage of unskilled workers declined between 1980 and 2000 in many countries. At the same time technological change (e.g. computers) and trade in final goods

increased. Most economists have found that trade in final goods was not an important explanation because of three reasons: i) the magnitude of trade was still low for many countries in that period, ii) only small changes in relative import prices, and iii) employment changes within instead of between industries. These findings suggested that it could not be a trade story because they are inconsistent with traditional trade theory. Instead technological change was found to be the more important explanation. However, Feenstra and Hanson (2003) pointed out that all three findings would be consistent with increases in imports of intermediate inputs (or offshoring), which could either happen due to lower prices of inputs or due to vertical foreign direct investments. Using industry level data Feenstra and Hanson show that offshoring explains roughly as much as technological change. There is also more recent studies using Danish firm and worker data that find a rising wage gap between high- and low-skilled workers as a consequence of offshoring.