Solutions: Problem Set 5

Economics 27000

Levi Crews

March 8, 2021

Question 1

1. "For any specific tariff there is an equivalent ad-valorem tariff rate, regardless of the price."

   False. Let p denote the per-unit price of the good on which the tariff is imposed. Under a specific tariff t, the per-unit price faced by the importer is $p + t$. Under an ad-valorem tariff rate τ, the per-unit price faced by an importer is $(1 + \tau)p$. So given a specific tariff t^*, the equivalent ad-valorem tariff rate is
   $$\tau^* = \frac{t^*}{p},$$
   but this depends on p! In other words, given t^*, you can't select a τ^* that would be equivalent for every value of p. Specific and ad-valorem tariffs aren't interchangeable.

2. "If a firm shifts into more R&D-intensive industries, it will internalize more of its supply chain."

   Uncertain. Slide 50 of `8_Multinational_Production` suggests a positive correlation between R&D intensity and intrafirm imports (a measure of internalization), but correlation is not causation! It may be that costly technology transfer or contractual difficulties do lead this firm to internalize more of its supply chain, but potential endogeneity issues (reverse causality or omitted variable bias, for instance) preclude a causal interpretation of the regression depicted on slide 50.

3. "A decrease in the fixed overhead cost f_D from the Helpman, Melitz, & Yeaple (2004) model will lead to less firms exporting in equilibrium."

   True. See the figure on slide 31 of `8_Multinational_Production`. The line $\pi_I(\varphi)$ shifts up with the reduction in f_D, while the line $\pi_X(\varphi)$ does not change. It follows that the intersection between the two lines will occur at a lower value of φ than before, $(\varphi^I)^{\sigma-1}_{new} < (\varphi^I)^{\sigma-1}_{old}$, while the cutoff for exporting, $(\varphi^X)^{\sigma-1}$, does not change. Since exporters are those firms for which $\varphi \in [(\varphi^X)^{\sigma-1}, (\varphi^I)^{\sigma-1}_{new}]$, the number of exporters must drop. (Note: you could point out that there may be no firms with productivity in the interval $[(\varphi^I)^{\sigma-1}_{new}, (\varphi^I)^{\sigma-1}_{old}]$, in which case the number of exporters stays the same, but this is a particularly unusual case.)

Question 2

1. US has absolute and comparative advantage in cheeseburgers; Japan, in sushi.

2. There are 20 units of labor in each country. If all labor went to cheeseburgers, 30 in total could be produced. Likewise for sushi. The first 20 cheeseburgers would be made in the US at a cost of 1/2 roll of sushi each. The next 10 would be made in Japan at a cost of 2 rolls each. So the world PPF starts at $(0, 30)$, decreases with slope $-1/2$ to the point $(20, 20)$, then decreases with slope -2 to $(30, 0)$.

3. Consumers in both countries have identical Cobb-Douglas preferences:

$$U = D_c^{1/2} D_s^{1/2}.$$

It follows that the relative demand curve in $(D_c/D_s, P_c/P_s)$-space will be $P_c/P_s = D_s/D_c$ for both countries. The relative supply curve will be flat at relative price 1/2 until the relative quantity 1, then vertical until the relative price 2, after which it is horizontal again. Normalizing $P_c = 1$, we'll have complete specialization and $P_s = 1$. World production will be $(20, 20)$: the US will produce 20 cheeseburgers; Japan, 20 rolls of sushi. The representative consumer in each country will consume the bundle $(D_c, D_s) = (10, 10)$, which yields utility $U = 10$.

4. Now suppose that the US imposed an ad-valorem tariff of 50% on sushi but Japan did not impose any tariffs of its own. Either of the extreme scenarios in which the full incidence falls on the US or on Japan would still be consistent with a complete-specialization equilibrium wherein the US just makes cheeseburgers and Japan just makes sushi. So we just need to determine the actual tariff incidence. Normalize $P_c = 1$. Let P_s denote the price of sushi (in units of cheeseburgers) received by the Japanese producer. The demand functions of the US consumer will be

$$D_s = \frac{(1/2)(20P_c + 0.5P_sD_s)}{1.5P_s} \implies P_sD_s = 8$$
$$D_c = \frac{(1/2)(20P_c + 0.5P_sD_s)}{P_c} = 10 + 0.25P_sD_s = 12.$$

In Japan,

$$D_s^* = \frac{(1/2)20P_s}{P_s} = 10$$
$$D_c^* = \frac{(1/2)20P_s}{P_c} = 10P_s.$$

Market clearing requires $12 + 10P_s = 20$ and $10 + 8/P_s = 20$, so $P_s = 4/5$. US welfare is $U = 12^{1/2}10^{1/2} \approx 10.95$ and Japanese welfare is $U^* = 8^{1/2}10^{1/2} \approx 8.94$.

5. Now suppose instead that Japan imposed an ad-valorem tariff of 50% on cheeseburgers but the US did not impose any tariffs of its own. The answer is the same as in the previous question, just flip "the US" with "Japan" and "cheeseburgers" with "sushi".

6. Finally, suppose instead that the US imposed an ad-valorem tariff of 50% on sushi and Japan imposed an ad-valorem tariff of 50% on cheeseburgers. We can still assert that this will be an equilibrium with complete specialization. Let P_c denote the price of cheeseburgers received by the US producer; define P_s analogously with respect to Japan. Normalize $P_c = 1$. The demand functions of the US consumer will be

$$D_s = \frac{(1/2)(20P_c + 0.5P_sD_s)}{1.5P_s} \implies P_sD_s = 8$$
$$D_c = \frac{(1/2)(20P_c + 0.5P_sD_s)}{P_c} = 10 + 0.25P_sD_s = 12.$$

In Japan,

$$D_c^* = \frac{(1/2)(20P_s + 0.5P_cD_c^*)}{1.5P_c} \implies D_c^* = 8P_s$$
$$D_s^* = \frac{(1/2)(20P_s + 0.5P_cD_c^*)}{P_s} = 12.$$

Market clearing requires $12 + 8P_s = 20$, so $P_s = 1$. US welfare is $U = 12^{1/2}8^{1/2} \approx 9.8$ and Japanese welfare is $U^* = 8^{1/2}12^{1/2} \approx 9.8$.

7. Using our welfare calculations from the last four questions, we construct the following payoff matrix:

	Free	Protect
Free	10, 10	8.94, 10.95
Protect	10.95, 8.94	9.8, 9.8

where the US is the row player and Japan is the column player. The Nash equilibrium is (Protect, Protect).

Question 3

Recall that $B^D = 3$, $B^F = 5$, $\sigma = 2$, $\tau = 1.25$, $f_D = 3$, and $f_X = 8$.

1. We solve for φ such that $\pi_D(\varphi) = 0$:

$$0 = B^D\varphi^{\sigma-1} - f_D \implies \left(\varphi^D\right)^{\sigma-1} \equiv \frac{f_D}{B^D} = 1.$$

The slope of the profit line in $(\varphi^{\sigma-1}, \pi)$-space is $B^D = 3$.

2. We solve for φ such that $\pi_X(\varphi) = 0$:

$$0 = B^F\varphi^{\sigma-1}\tau^{1-\sigma} - f_X \implies \left(\varphi^X\right)^{\sigma-1} \equiv \frac{f_X}{B^F}\tau^{\sigma-1} = 2.$$

The slope of the profit line in $(\varphi^{\sigma-1}, \pi)$-space is $B^F\tau^{1-\sigma} = 5/1.25 = 4$.

3. We solve for φ such that $\pi_I(\varphi) = \pi_X(\varphi)$:

$$B^F \varphi^{\sigma-1} \tau^{1-\sigma} - f_X = B^F \varphi^{\sigma-1} - f_X - f_D \implies \left(\varphi^I\right)^{\sigma-1} \equiv \frac{f_D}{B^F(1-\tau^{1-\sigma})} = 3.$$

   The slope of the profit line in $(\varphi^{\sigma-1}, \pi)$-space is $B^F = 5$.

4. For each of (a)–(d), the answer is 1/4. This follows immediately from the three preceding questions.

5. Let's examine the three cutoff values. When τ increases, the line π_X pivots downward around its y-intercept, but no other lines change. Accordingly, ϕ^D stays the same, ϕ^X increases, and ϕ^I decreases. So the fraction of firms that don't produce stays at 1/4, the fraction that produce only for the domestic market increases, the fraction that export decreases, and the fraction that do FDI increases.