::Solutions::

Practice Exam 2

Updated 11/1 to correct typo in solution to 5d.

Do not open this exam until instructed to do so.

- You have 75 minutes to complete this exam
- You may use a calculator; you may **not** use any other device (cell phone, etc.)
- You may consult one page of notes (both sides); you may not use books, notebooks, etc.
- Show your work

I will not lie, cheat, or steal to gain an academic advantage, nor will I tolerate those who do.

_____

Signature

_____

Printed Name

True/False-Explain. Respond to the following statements by *explaining why they are true or false.* For each statement, a complete and correct explanation is worth 10 points. No partial credit will be awarded for stating TRUE or FALSE without explanation.

1. (10 pts.) Vertical foreign direct investment and international trade are complementary.

   TRUE. When firms fragment production across borders, intermediate parts and/or final goods are shipped between the countries. The more vertical FDI there is in a country, the more that country is trading.

   [In contrast, horizontal FDI and trade are substitutes.]

2. (10 pts.) Export platform FDI is not likely to generate many productivity spillovers through forward linkages.

   TRUE. Since most of the foreign affiliate's output will not be sold in the host country, the forward linkages are likely to be weak, and not conducive to productivity spillovers.

3. (10 pts.) Goods x and y are produced using electricity (e) and labor (ℓ). The production function for good x is $x = \min\{\frac{\ell}{2}, \frac{e}{3}\}$. The production function for good y is $y = \min\{\frac{\ell}{1}, \frac{e}{3}\}$. Good y is labor-intensive.

FALSE. Good x is labor intensive: It requires two units of labor for every three units of electricity, while good y requires only 1 unit of labor for every three units of electricity.

4. (10 pts.) The government should never subsidize inward foreign direct investment.

FALSE. Governments may want to subsidize inward FDI when the investment will bring positive spillovers (or externalities) to the country. These spillovers need to be determined on a case-by-case basis, and the subsidy should be commensurate with the strength of the spillover.

5. Integrated oil and gas companies, like ExxonMobil, use extraction services (e) and refining services (r) to first produce crude oil (o) which is then refined into gasoline (g). The price of refining services is p_r and the price of extraction services is p_e. Consider two countries, the United States and Mexico. In the United States, $p_r^U = 1$ and $p_e^U = 4$. In Mexico, $p_r^M = 5$ and $p_e^M = 2$. The production functions for oil and gasoline are

$$o = \min\left\{\frac{e}{10}, \frac{r}{1}\right\}$$
$$g = \min\left\{\frac{e}{1}, \frac{r}{3}\right\}.$$

Use the model of vertical FDI that we developed in class to answer the following questions.

a. (5 pts.) If there are no costs to trading oil and gasoline, which country produces oil and which produces gasoline? Explain your answer.

> The US would produce gasoline and Mexico would produce oil. Gasoline is refinery intensive, and refining is cheaper in the US, while oil production is extraction intensive, and extraction is cheaper in Mexico.

b. (3 pts.) Write out the formula for the cost of gasoline in the United States and in Mexico when ExxonMobil chooses to completely fragment its production. Let τ_o be the cost of trading crude oil and τ_g be the cost of trading gasoline.

$$c^U = \left(10p_e^M + p_r^M\right)(1+\tau_o) + \left(p_e^U + 3p_r^U\right)$$
$$c^M = \left[\left(10p_e^M + p_r^M\right)(1+\tau_o) + \left(p_e^U + 3p_r^U\right)\right](1+\tau_g)$$

c. (3 pts.) Write out the formula for the cost of gasoline in the United States and in Mexico when ExxonMobil chooses to partially fragment its production. Let τ_o be the cost of trading crude oil and τ_g be the cost of trading gasoline.

$$c^U = \left(10p_e^M + p_r^M\right)(1+\tau_o) + \left(p_e^U + 3p_r^U\right)$$
$$c^M = \left(10p_e^M + p_r^M\right) + \left(p_e^M + 3p_r^M\right)$$

d. (8 pts.) When the cost of shipping oil, τ_o, is 0.12 and the cost of shipping gasoline, τ_g, is 0.05, is partial fragmentation or complete fragmentation the optimal way to structure the firm? Explain your answer

Complete fragmentation

$$c^U = (10*2+1*5)(1.12) + (1*4+3*1) = 35$$
$$c^M = [(10*2+1*5)(1.12) + (1*4+3*1)](1.05) = 36.75$$

Partial fragmentation

$$c^U = (10*2+5)(1.12) + (1*4+3*1) = 35$$
$$c^M = (10*2+5) + (1*2+3*5) = 42$$

Complete fragmentation is optimal, because it yields the lowest price of gasoline in each country.

e. (3 pts.) To spur job creation in the oil drilling industry, the U.S. Congress bans crude oil imports into the United States. What is ExxonMobil's new gasoline cost in the United States?

$$c^U = \left(10p_e^U + p_r^U\right) + \left(p_e^U + 3p_r^U\right)$$
$$c^U = (10 * 4 + 1 * 1) + (1 * 4 + 3 * 1) = 48$$

f. (7 pts.) To offset the higher price of crude oil in the United States, Congress will subsidize exports of gasoline to Mexico. In our model, a subsidy is a negative value of τ_g. What value of τ_g makes the cost of U.S.-refined gasoline exported to Mexico equal to the cost of gasoline produced entirely in Mexico?

Gasoline produced entirely in Mexico costs 42 dollars (you computed this in part d.) and gasoline produced entirely in the US costs 48 dollars (you computed this in part e.).

$$48 \times (1 + \tau_g) = 42$$

So $\tau_g = -0.125$ equates the price of gasoline produced in the US with that in Mexico.

6. Your firm has been hired by the Cyrodiilian government to advise them on a potential investment by high-tech Canadian power generater TransAlta.

   The Canadian firm would like to build several hydroelectric generating plants using equipment imported from Germany. TransAlta expects to staff the generating plants with local workers, but is concerned that the low college enrollments in Imperial City might make it difficult to find enough skilled labor.

   The TransAlta investment would mainly serve the Imperial City market, with a population of 8 million people. The power generation market in Cyrodiil is currently dominated by three local firms. Due to a mix of strategic pricing and poor infrastructure, electricity prices in Cyrodiil are 15 percent higher than in neighboring Hammerfell.

   a. (3 pts.) Why is TransAlta investing in Cyrodiil?

   > TransAlta is investing for market access. Electricity cannot be easily traded. If TransAlta wants to compete for the electricity needs of the 8 million people in Imperial City, they will have to produce electricity in Cyrodiil.

   b. (15 pts.) How would the investment affect firms in Cyrodiil? You may want to use the evaluative framework we developed in class to organize your answer.

   > There are different ways to come at this question, but your answer should address factor market conditions, competition in the electricity markets, and the possibility of spillovers through forward and backward linkages.
   >
   > - Factor markets: TransAlta needs skilled labor, which appears scarce. The increased demand by TransAlta could drive up the wages of skilled workers, increasing the production costs for other firms in Imperial City that use skilled labor.
   > - Competition: Cyrodiilian electricity markets suffer from a lack of competition. Bringing in a high productivity generater from abroad would increase competition, leading to lower prices. This is good for consumers and firms in the area.
   > - Spillovers: To the extent that the improved electrical infrastructure delivers power more reliably and at lower costs, downstream firms are likely to benefit. Since almost every firm uses electricity (though to varying degrees) this is likely to provide a large benefit through forward linkages. Backwards linkages appear weak — the upstream equipment supplier is in Germany.

7. Consider two versions of the vertical FDI model we developed in class. In both models, let $\theta_{au} = 5$, $\theta_{as} = 1$, $\theta_{bu} = 1$, $\theta_{bs} = 10$, $w_u^1 = 10$, $w_s^1 = 20$, $w_u^2 = 2$. In one version of the model, $w_s^2 = 30$ and in the other version, $w_s^2 = 35$.

   We can characterize the optimal firm structure in each model using the figures below.

Figure 1

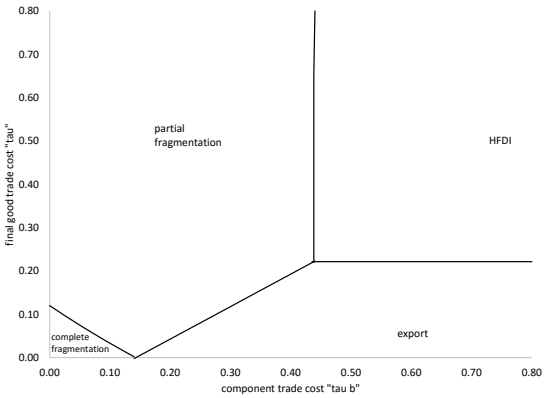
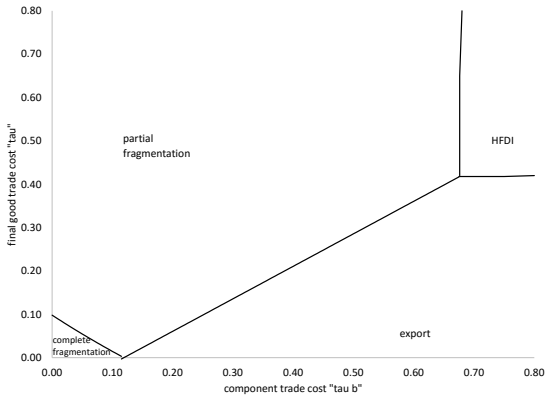


Figure 2



   a. (9 pts.) Which figure, 1 or 2, corresponds to the model in which $w_s^2 = 35$? Explain your answer.

   Figure 2 corresponds to the model in which $w_s^2 = 35$. The more expensive is skilled labor in country 2, the greater are the gains from fragmentation. When fragmentation is more valuable, it can be sustained for higher values of the trade cost. Comparing Figures 1 and 2, we see that partial fragmentation can be sustained in Figure 2 for much larger τ_b.

   You also could have argued this question by pointing out that HFDI in Figure 2 is much less common...

   [This is (intentionally) a difficult question.]

b. (2 pts.) Suppose, in the model represented by Figure 1, $\tau = 0.5$ and $\tau_b = 0.5$. What happens to inward FDI in country 2 when a trade agreement lowers tariffs to $\tau = 0.2$ and $\tau_b = 0.2$?

> The change in tariffs moves the firm from HFDI to partial fragmentation. The firm was investing in country 2 to do both component production and assembly. After the change in tariffs, the firm invests in country 2 only for assembly. Inward FDI will be smaller at the new tariff levels.

c. (2 pts.) Suppose, in the model represented by Figure 2, $\tau = 0.5$ and $\tau_b = 0.5$. What happens to inward FDI in country 2 when a trade agreement lowers tariffs to $\tau = 0.2$ and $\tau_b = 0.2$?

> In this case, the structure of the firm does not change, and neither does the level of FDI. The lower trade costs make the finished good cheaper in country 2, however.

Extra Space

Clearly label the question number, and leave a reference to this page near the question.