::Solutions::

Fall 2017: Exam 2

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.* No partial credit will be awarded for stating TRUE or FALSE without explanation.

1. (10 pts.) Consider the two country model of vertical FDI that we developed in class. When the cost of trading the final good is zero ($\tau = 0$), the firm will choose either complete fragmentation or exporting as its production structure.

> TRUE. When there are no cost to trading the final good, the firm will **completely fragment** if the cost of trading the intermediate good is low, or **export** if the cost of trading the intermediate good is high.

2. (10 pts.) A multinational opening a labor-intensive production facility will have a larger negative impact on local firms when the labor supply is inelastic.

> TRUE. If labor supply is inelastic, the multinational will increase wages significantly when it hires workers. This will drive up the cost of labor for other firms.

3. (10 pts.) Good y is produced using inputs a and b. The production function is Leontief; the associated cost function for one unit of good y is $c(p_a, p_b) = 5p_a + 7p_b$, where p_a is the price of input a and p_b is the price of input b. The cost minimizing way to produce one unit of good y is to use 5 units of a and 14 units of b.

> FALSE. The Leontief production function associated with this cost function is
>
> $$y = \min\left\{\frac{a}{5}, \frac{b}{7}\right\}$$
>
> so the cost minimizing bundle is $a = 5, b = 7$.

4. (10 pts.) The Umbrella Pharmaceutical Corporation is planning to build a laboratory complex in the United States near the Raccoon Forest. The laboratory will hire local labor and import chemical supplies from Europe. The anti-viral drugs produced in the laboratory will be shipped all over the world. The project will likely have strong backwards linkages in the United States.

> FALSE. If chemicals are the main input to production, and those chemicals are not sourced locally, the backward linkages are likely to be weak.

5. In its 10-K filing, General Motors lists "economic tensions between governments and changes in international trade and investment policies" as a risk factor, and specifically calls out the U.S.-Mexico trade relationship.

   a. (4 pts.) With respect to the United States and Mexico, what kind of policy change is GM worried about?

> GM is worried that trade policy ("renegotiating NAFTA") will change in ways that make it more expensive to ship goods between the United States and Mexico.

   b. (6 pts.) Explain how GM's multinational structure makes it particularly vulnerable to this kind of risk.

> GM's manufacturing operations rely on foreign affiliates (for vertical FDI motives) to produce different parts of cars and trucks. These parts are shipped around the world to be assembled into finished automobiles. Increasing the cost of moving goods between countries could dramatically raise the cost of production for GM.

6. Black and Decker power tools are made in two stages. First, skilled and unskilled labor produce the electrical components for the tools. Second, skilled and unskilled labor assemble the components into the finished tools. The production functions for electrical components (e) and assembly (a) are

$$e = \min\left\{\frac{\ell_s}{5}, \frac{\ell_u}{1}\right\}$$

$$a = \min\left\{\frac{\ell_s}{3}, \frac{\ell_u}{5}\right\},$$

where ℓ_s are the number of skilled labor units used and ℓ_u are the number of unskilled labor units used. A unit of hand tools requires one unit of electrical components and one unit of assembly. In the United States, wages are $w_s^U = 25$ and $w_u^U = 8$ and in Mexico they are $w_s^M = 40$ and $w_u^M = 4$.

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

a. (10 pts.) The trade costs for shipping electrical components to another country is $\tau_e = 0.1$. The cost of trading the finished tools is $\tau = 0.05$. What is the optimal firm structure? Explain your answer.

B&D chooses exporting: design and assembly occurs in the US.

US HFDI, Export, and P.F

$$C^U = (5 * 25 + 1 * 8) + (3 * 25 + 5 * 8) = 248$$

US C.F.

$$C^U = [(5 * 25 + 1 * 8) * 1.1 + (3 * 40 + 5 * 4)] * 1.05 = 300.615$$

MX HFDI

$$C^M = (5 * 40 + 1 * 4) + (3 * 40 + 5 * 4) = 344$$

MX Export

$$C^M = 248 * 1.05 = 260.4$$

MX C.F., P.F.

$$C^M = (5 * 25 + 1 * 8) * 1.1 + (3 * 40 + 5 * 4) = 286.3$$

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b. (6 pts.) As part of NAFTA's renegation, Mexico imposes a tariff of 15 percent on imported power tools, bringing the cost of shipping tools to $\tau = 0.20$. What is the optimal firm structure? Explain your answer.

> Changes from part a.:
> US C.F.
> $$C^U = [(5 * 25 + 1 * 8) * 1.1 + (3 * 40 + 5 * 4)]1.2 = 343.56$$
>
> MX Export
> $$C^M = 248 * 1.2 = 297.6$$
>
> The firm will now choose partial fragmentation, producing electronic components only in the United States and assembling power tools in each country for the local market.

c. (3 pts.) How has the renegotiation of NAFTA changed Black and Decker's demand for skilled and unskilled labor?

> B&W no longer assembles tools for the Mexican market, so its assembly operations in the United States will shrink. This will decrease the firm's demand for both skilled and unskilled labor in the United States, with the decrease in unskilled labor being larger.
>
> In Mexico, B&W opens an assembly plant, so it will increase its demand for skilled and unskilled labor in Mexico, with the increase in unskilled labor being larger.
>
> Bonus answer [worth 0 bonus points]: The cost of producing tools for the Mexican market has gone up. We haven't modeled demand, but if we did, the demand for tools in Mexico would likely fall. This would lead to a global reduction in labor, in addition to the effects listed above.

7. Consider the vertical FDI model we developed in class. Let $\theta_{au} = 5$, $\theta_{as} = 1$, $\theta_{bu} = 1$, $\theta_{bs} = 10$, $w_u^1 = 10$, $w_s^1 = 20$, $w_u^2 = 2$, and $w_s^2 = 30$. The model can be summarized in the figure below.
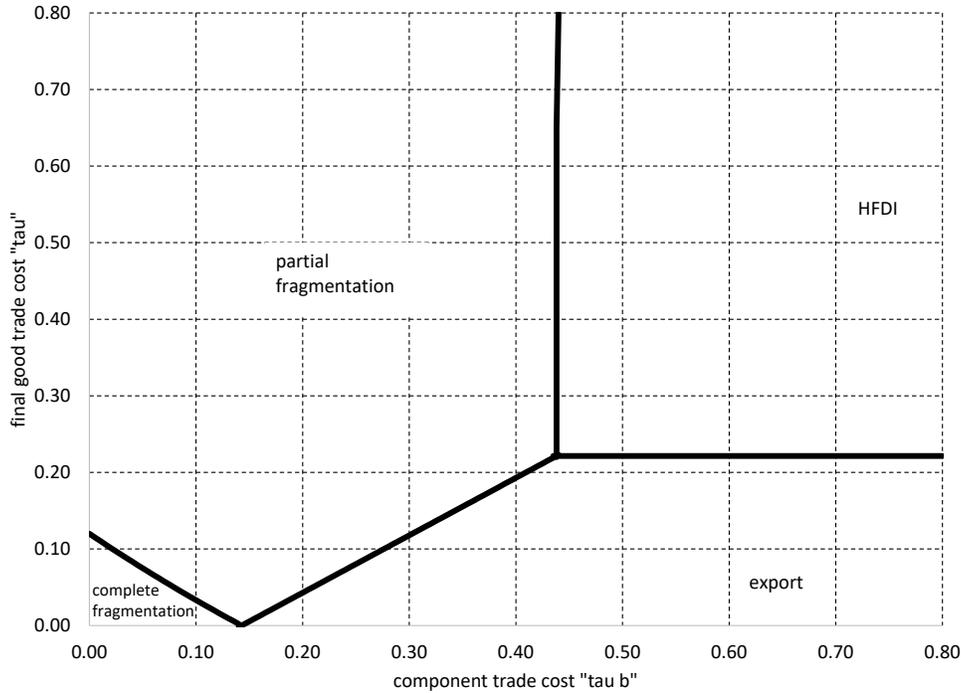
a. (3 pts.) What country exports which products when $\tau = 0.1$ and $\tau_b = 0.5$? Is there FDI in country 2?

> Country 1 exports the final good and country 2 exports nothing. There is no FDI in country 2.

b. (3 pts.) What country exports which products when $\tau = 0.1$ and $\tau_b = 0.15$? Is there FDI in country 2?

> Country 1 exports components and country 2 exports nothing. There is FDI in country 2 — an assembly plant.

c. (4 pts.) Provide intuition for why the firm's structure changes as τ_b falls from 0.5 to 0.15.

> The firm would like to take produce assembly in country 2 because unskilled wages are
> low there. When it is expensive to ship components, the cost of shipping outweighs the
> benefit from lower production costs. As the cost of shipping falls, the benefit from lower
> production costs outweighs the cost and the firm transfers some assembly production to
> country 2.

8. Consider a model in which two countries compete for an FDI project. If located in country 1, it
   will generate variable profits of $100 million for the firm, but the firm must make a $105 million
   investment to create the project. If located in country 2, it will generate variable profits of $95
   million for the firm, but the firm must make a $105 million investment to create the project.
   If the project is placed in country 1, the country receives $20 million worth of spillovers and if
   the project is placed in country 2, the country receives $20 million worth of spillovers. Each
   country is allowed to make a take-it-or-leave it subsidy offer to the multinational. Let η, the
   smallest increment a country can make, be $0.01 million.

   a. (3 pts.) What subsidy does country 1 offer it is the only country making a subsidy offer to
      the firm? What is the after-subsidy benefit in country 1?

   > Offer subsidy of 5.01, and receive after-subsidy benefit of 14.99.

b. (3 pts.) What subsidy does country 2 offer it is the only country making a subsidy offer to the firm? What is the after-subsidy benefit in country 2?

> Offer subsidy of 10.01, and receive after-subsidy benefit of 9.99.

c. (6 pts.) Suppose the two countries both make sealed subsidy offers to the firm. If the firm's after-subsidy profit for locating the project in each country is the same, the firm will randomly choose a country to locate the project. What subsidies do the two countries choose? Explain your reasoning.

> The best country 2 can do is to offer $s_2 = 20$, which earns the firm $\pi_2 = -10 + 20 = 10$ in profit. Country 2 gives away its entire benefit, $\beta_2 = 20 - 20 = 0$.
>
> Country 1 offers $s_1 = 15.01$ which earns the firm $\pi_1 = -5 + 15.01 = 10.01$ which makes the firm choose country 1. Country 1 has an after-subsidy benefit of $\beta_1 = 20 - 15.01 = 4.99$.

d. (4 pts.) What is the outcome of competition: Where does the firm locate? What profit does the firm earn? What is the after-subsidy benefit of the winning country? How does the after-subsidy benefit compare to that when the country did not compete with another country for the project.

> The firm chooses country 1 to locate the project, and earns a profit of 10.01. Country 1 has a benefit of 4.99 compared to 14.99 when it did not compete with country 2.

e. (5 pts.) Is the outcome of this game socially optimal, in the sense that it created the largest joint surplus possible? Explain your answer.

> The joint surplus if the project is located in country 1 is -5+20 = 15; if located in country 2, the joint surplus is -10+20=10.
>
> Since project will occur in country 1, the game **did generate the socially optimal outcome.** It generated a joint surplus of 15 rather than 10.

Extra Space

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