



::Solutions::

Practice Final Exam

Do not open this exam until instructed to do so.

- You have 110 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.) Legal services, compared to a patent for a production process, are less likely to be licensed to an unrelated firm.

TRUE. The assets in the legal services company are wrapped up in the company's workers. It would be very difficult to transfer that knowledge to another firm. A patent is simpler to transfer.

2. (10 pts.) When firms cannot write enforceable contracts, and have to bargain ex post over the proceeds from production, joint profit is maximized, but the division of the profit is not.

FALSE. Consider the hold-up model we developed in class. Bargaining shrinks the size of the joint surplus. By distorting the firm's incentives to invest in the relationship, the firms do not produce enough, and the joint profit is smaller than in the case when firms can write enforceable contracts.

3. (10 pts.) The production function for good y is $y = Am^\alpha$. If good y sells for p_y and good m costs the firm p_m to procure, the firm uses $m = [p_m/(\alpha p_y A)]^{1/(\alpha-1)}$ if it maximizes its profit.

TRUE. The profit function is

$$\pi = p_y Am^\alpha - p_m m$$

the first-order condition is

$$\alpha p_y Am^{\alpha-1} - p_m = 0$$

which, when solved yields,

$$m = \left(\frac{p_m}{\alpha p_y A} \right)^{\frac{1}{\alpha-1}} \text{ or } \left(\frac{\alpha p_y A}{p_m} \right)^{\frac{1}{1-\alpha}}$$

4. (10 pts.) A British multinational earned \$200 in the United States and \$400 in the United Kingdom. The corporate tax rate in the United States is 40 percent and the corporate tax rate in the United Kingdom is 25 percent. The U.K. government offers its multinationals a foreign tax credit. The total tax owed to the U.K. government is \$100.

TRUE. The tax credit is $C = 0.25 * 200 = 50$. The tax owed to the U.K. government is

$$T^{UK} = 0.25 * (600) - 50 = 100$$

5. Bessemer technologies owns a patent for producing a particular steel alloy. When one unit of inputs m are used in production, the technology produces revenues R . If Bessemer produces the inputs, it pays γp_m to do so.

Bessemer could license the patent to a firm in France. If it does, it pays T in each period to transfer the patent and f to provide technical support. In return, Bessemer receives license payments L_t and L_{t+1} . In period $t + 1$ the licensee has learned how to create the alloy. If it chooses to produce without the Bessemer patent, it pays f^S to support its technology.

Use the two-period licensing model that we developed in class to answer the following questions. Assume that $R = 6$, $\gamma = 1.4$, $f = 1.1$, $f^S = 1.6$, $T = 0.2$, $r = 0.03$, and $p_m = 1$.

- a. (6 pts.) What profit does Bessemer earn if it produces m for its own use? Assume Bessemer has access to financial instruments that pay return $r = 0.03$.

$$\pi_F^I = (6 - 1 * 1.4 - 1.1) + \frac{6 - 1 * 1.4 - 1.1}{1.03} = 6.90$$

- b. (8 pts.) Suppose Bessemer licenses the technology to a French firm that has access to financial instruments that pay return $r^S = 0.03$. There were several firms bidding for the patent, so Bessemer is able to demand a license agreement that results in $\pi_S = 0$ for the licensee. What are the license payments?

The second period payment is

$$L_{t+1} = 1.60$$

the first period payment is

$$L_t = (6 - 1) + \frac{6 - 1 - 1.6}{1.03} = 8.3$$

- c. (3 pts.) Should the firm license to the French company? Why?

$$\pi_F = (8.3 - 0.2 - 1.1) + \frac{1.6 - 1.1 - 0.2}{1.03} = 7.29$$

Profit from licensing is higher, so the firm should license the technology.

- d. (8 pts.) Bessemer is offered a second opportunity to license its technology, this time to a firm in Argentina. The interest rate in Argentina is $r^S = 0.2$. Compute the license payments.

The second period payment is still

$$L_{t+1} = 1.60$$

the first period payment is

$$L_t = (6 - 1) + \frac{6 - 1 - 1.6}{1.2} = 7.8$$

- e. (5 pts.) Explain the economic intuition behind the difference in the license payments from the French firm and the Argentinean firm.

The Argentinean firm makes smaller license payments because it discounts the future profits more than the French firm. Since the future profits are worth less to the Argentinean firm, it will not pay as much as the French firm to license the technology.

- f. (3 pts.) Should the firm license to the Argentinean company? Why?

$$\pi_F = (7.8 - 0.2 - 1.1) + \frac{1.6 - 1.1 - 0.2}{1.03} = 6.82$$

The firm should not license the technology to the Argentinean company. It could earn a larger profit by producing the intermediate good itself.

6. Consider a final good firm that owns the final good technology $q = Am^\alpha$. The final good sells for price p . If the final good firm chooses to make the intermediate good m , it pays a fixed cost f^I and it costs $p_m\gamma$ per unit. A specialized supplier can produce the intermediate good for price p_m per unit. Due to enforcement problems, the two firms cannot write a contract that governs the price and quantity of m . Use the outsourcing/hold-up model that we developed in class to answer the following questions.
- a. (8 pts.) If $\alpha = 0.5$, $A = 0.4$, $p_m = 1.1$, $p = 1.5$, $\beta = 0.7$, $\gamma = 1.3$, and $f^I = 0.25$, what are the profits of the final good firm if it produces the intermediate good in-house?

Production levels are

$$m = 0.044, q = 0.084$$

profits are

$$\pi_F^I = 1.5 * 0.084 - 1.1 * 1.3 * 0.044 - 0.25 = -0.187$$

- b. (8 pts.) If $\alpha = 0.5$, $A = 0.4$, $p_m = 1.1$, $p = 1.5$, $\beta = 0.7$, $\gamma = 1.3$, and $f^I = 0.25$, what are the profits of the final good firm if it outsources to the supplier firm and the two firms bargain after production of the intermediate good?

Assume that the supplier has bargaining power β and the final good firm has bargaining power $1 - \beta$.

Production levels are

$$m = 0.036, q = 0.076$$

profits are

$$\pi_F^I = (1.5 * 0.076) * 0.3 = 0.034$$

- c. (5 pts.) Would the firm be more, or less, likely to integrate if A increased? Explain your answer.

The firm will be more likely to integrate as A increases. Increasing A increases the size of the profit the firm earns which creates a stronger incentive to get m production correct. The larger profit makes it more likely that the final good firm can earn enough operating profit to cover the fixed cost involved with integration.

7. (6 pts.) The corporate tax rate in Mexico is 25 percent and the corporate tax rate in Peru is 18 percent. A multinational firm ships an intermediate good from its headquarters in Mexico to its affiliate in Peru. The intermediate good is assembled into a finished product which is sold in Peru. The intermediate good price is a transfer price: The good was “sold” from one unit of the firm to another. Would the firm like to set the transfer price relatively high or low? Explain your answer.

The firm would like to earn its profit in the low tax country, Peru. In this case, it would like to set the transfer price low, so the profit in Mexico is low and the profit in Peru is high.

Cumulative Mini-exam

The next two questions are short answer questions. Your answers should be no more than six or seven sentences.

8. (10 pts.) What kind of foreign direct investment is complementary to international trade? By complementary, we mean more FDI leads to more international trade. Explain your answer.

Vertical FDI — spreading the production process out across countries — leads to more trade. In this case, firms produce parts of their product in different countries in order to minimize the production cost. More goods get traded (component parts from one country are exported to assembly plants in another country; final goods are exported to other countries) as the firm spreads its production process over more countries through FDI.

9. (10 pts.) Multinational firms are larger and more productive than their domestic counterparts. Provide an explanation for this fact. You may want to use a model we have developed in class to frame your answer.

Our heterogeneous-firm model of horizontal FDI can explain this fact. Firms differ by their productivity — more productive firms are larger (they sell more) and earn larger profits. When foreign direct investment involves paying a fixed cost, only larger and more productive firms can cover the fixed cost and become multinational firms. Less productive (and smaller) firms would not earn enough profit in the foreign market to cover the fixed cost, so they only sell in the domestic market.

[Aside: Economists describe this mechanism as *self-selection*. More productive firms choose to be multinationals, less productive firms choose to only sell in their home market.]

10. Should a firm export or build a foreign affiliate to serve a foreign market? In this question, we will use the two-country, heterogenous-firm model to study the firm's decision. A firm in the United States would like to serve two foreign markets: Canada and France.

In the two countries, expenditures are $E_C = E_F = 500$; the elasticities of demand are $\epsilon_C = \epsilon_F = 4$; and wages are $w_C = w_F = 1.6$. The ad valorem trade costs are $\tau_C = 0.02$ and $\tau_F = 0.15$. The wage in the United States is $w_U = 1.6$; the fixed cost of exporting is $f^e = 0.75$ and the fixed cost of producing is $f^p = 8$. The firm's productivity is $\varphi = 2$.

- a. (5 pts.) Should the firm export or use a foreign affiliate to sell to Canada? Show your work.

Profit if exporting:

$$\pi^e = \frac{E_C}{\epsilon_C} \left(\frac{\epsilon_C}{\epsilon_C - 1} \frac{w_U}{\varphi} (1 + \tau_C) \right)^{1 - \epsilon_C} - w_U f^e$$

$$\pi^e = \frac{500}{4} \left(\frac{4}{4 - 1} \frac{1.6}{2} (1.02) \right)^{1 - 4} - 1.6 * 0.75 = 95.9$$

Profit if using a foreign affiliate:

$$\pi^m = \frac{E_C}{\epsilon_C} \left(\frac{\epsilon_C}{\epsilon_C - 1} \frac{w_C}{\varphi} \right)^{1 - \epsilon_C} - w_C f^p$$

$$\pi^m = \frac{500}{4} \left(\frac{4}{4 - 1} \frac{1.6}{2} \right)^{1 - 4} - 1.6 * 8 = 90.2$$

The firm should export to Canada.

- b. (5 pts.) Should the firm export or use a foreign affiliate to sell to France? Show your work.

Profit if exporting:

$$\pi^e = \frac{E_C}{\epsilon_C} \left(\frac{\epsilon_C}{\epsilon_C - 1} \frac{w_U}{\varphi} (1 + \tau_C) \right)^{1 - \epsilon_C} - w_U f^e$$

$$\pi^e = \frac{500}{4} \left(\frac{4}{4 - 1} \frac{1.6}{2} (1.15) \right)^{1 - 4} - 1.6 * 0.75 = 66.5.$$

Profit if using a foreign affiliate in France is the same as the profit in Canada because the country's wages, elasticities, and market sizes are identical. The profit is 90.2.

The firm should use a foreign affiliate to serve France.

- c. (10 pts.) What is the “proximity-concentration tradeoff?” Explain its role in a firm’s choice over how to serve a foreign market. You may want to use your answers from parts a. and b. in your answer.

The proximity-concentration tradeoff describes the costs and benefits of multinational production to serve a foreign markets.

“Proximity” to the foreign country is the benefit: If the firm produces in the foreign country, it does not have to pay the costs of shipping the goods there.

Losing “concentration” of production is the cost: If the firm produces in the foreign country, it replicates the costs of production. If concentrating production is important (increasing returns to scale/large fixed costs) then replication can be costly.

Trade costs are low enough to Canada that it is not worth paying f^p to produce there. “Concentration” prevails. The higher trade costs to France make it worth paying f^p to avoid paying τ_C on the shipments to France. “Proximity” prevails.

Extra Space

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