Written Resit Exam for the M.Sc. in Economics Winter 2015–16

Advanced International Trade

3–hour closed–book exam

February 18 2016

SUGGESTED ANSWERS

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. That is, if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by 'eksamen på dansk' in brackets, you must write your exam paper in Danish.

This document consists of 6 pages in total.

Problem 1:

Consider a small Heckscher-Ohlin economy producing two tradable goods using workers L and capital K. Let industry 1 be labor-intensive $\left(\frac{L_1}{L} > \frac{K_1}{K}\right)$, and let a_{fj} denote the required input of f to produce one unit of good $j = \{1, 2\}$.

1. Write up the full-employment conditions.

   Suggested answer:

   $$a_{L1}y_1 + a_{L2}y_2 = L$$
   $$a_{K1}y_1 + a_{K2}y_2 = K$$

2. Suppose immigration increases the size of the labor force $(\hat{L} > 0)$ but immigrants do not bring any capital $(\hat{K} = 0)$. What happens to production of the two goods?

   Suggested answer:

   $$a_{L1}dy_1 + a_{L2}dy_2 = dL$$
   $$a_{K1}dy_1 + a_{K2}dy_2 = dK$$

   $$\frac{a_{L1}y_1}{L}\frac{dy_1}{y_1} + \frac{a_{L2}y_2}{L}\frac{dy_2}{y_2} = \frac{dL}{L}$$
   $$\frac{a_{K1}y_1}{K}\frac{dy_1}{y_1} + \frac{a_{K2}y_2}{K}\frac{dy_2}{y_2} = \frac{dK}{K}$$

   $$\lambda_{L1}\hat{y}_1 + \lambda_{L2}\hat{y}_2 = \hat{L}$$
   $$\lambda_{K1}\hat{y}_1 + \lambda_{K2}\hat{y}_2 = \hat{K} = 0$$

   Solve for $\hat{y}_1$ and $\hat{y}_2$ to get

   $$\hat{y}_1 = \frac{\lambda_{K2}}{\lambda_{K2} - \lambda_{L2}}\hat{L} > 0$$
   $$\hat{y}_2 = \frac{\lambda_{K1}}{\lambda_{K1} - \lambda_{L1}}\hat{L} < 0$$

   We assumed that industry 1 was labor intensive such that $\lambda_{K2} > \lambda_{L2}$ and $\lambda_{K1} < \lambda_{L1}$. Hence, an increase in the labor force will increase output in the labor-intensive industy and decrease output in the other industry. This is the Rybczynski Theorem.

3. What would happen if immigrants bring capital with them in the same proportion as natives have capital $(\hat{L} = \hat{K} > 0)$?

   Suggested answer:
   Each input and so each industry would be scaled up by the same factor. Hence, the economy would grow proportional to immigration.

Problem 2:

Consider an economy with one monopolistically competitive industry. In this industry, each firm produces one unique variety of a differentiated product. There are N varieties available in the economy and each of the L consumers has the following utility function:

$$U = \sum_{n=1}^{N} c_n^{\theta}, \quad 0 < \theta < 1 \tag{1}$$

where c_n denotes the quantity consumed of good n.

Aggregate demand, d_n is defined as:

$$d_n = Lc_n = p_n^{1/(\theta-1)} \frac{wL}{P} \tag{2}$$

where $P = \sum_{m=1}^{N} p_m^{\frac{\theta}{\theta-1}}$ denotes an aggregate price index. The economy is assumed to be large in the sense that each firm takes P as exogeneously given.

Firms require $l_n = \alpha + \beta x_n$ workers to produce x_n units of output. Each consumer is endowed with one unit of labor which is inelastically supplied to the economy at wage, w. In equilibrium, supply must meet demand (that is, $x_n = d_n$).

1. Write down an expression for a firm's profits. Show that the firm's optimal price is $p_n = \theta^{-1}\beta w \; \forall n = 1, ..., N$. Why do firms set the same price for their products in this economy? Why do firms set a lower price for higher values of θ?

   Suggested answer:
   Profits are given by:

   $$\pi_n = p_n Lc_n - w(\alpha + \beta Lc_n)$$

   FOC:

   $$\frac{\partial \pi_n}{\partial p_n} = Lc_n + p_n Lc_n' - w\beta Lc_n' = 0$$

   $$\implies p_n = w\beta - c_n/c_n'$$

   From (2) it follows that:

   $$c_n/c_n' = \frac{p_n^{1/(\theta-1)} \frac{w}{P}}{(1/(\theta-1))p_n^{1/(\theta-1)-1} \frac{w}{P}}$$

   $$= (\theta - 1)\frac{p_n^{1/(\theta-1)}}{p_n^{(2-\theta)/(\theta-1)}}$$

   $$= (\theta - 1)p_n$$

   Inserting this in the FOC above:

   $$p_n = w\beta - (\theta - 1)p_n \Leftrightarrow p_n = \theta^{-1}w\beta = p$$

All firms set the same price, as the optimal price is a function of parameters that are common to everyone. A higher value of θ implies that demand becomes more elastic. This explains why firms set lower prices in a monopolistically competetive environment. Another interpretation is that preferences show more love of variety when θ is larger. Therefore, consumers demand lower prices for each variety.

2. Firms enter the economy whenever profits are positive. In equilibrium, profits must be zero due to free entry. Write down the zero–profit condition. Show that the output of each firm is:

$$x_n = \frac{\theta}{1 - \theta}\frac{\alpha}{\beta} \tag{3}$$

Suggested answer:
Zero–profits imply that

$$\pi_n = 0 \Leftrightarrow (p_n - w\beta)x_n = w\alpha$$

Insert optimal price:

$$(\theta^{-1}w\beta - w\beta)x_n = w\alpha$$

$$\implies x_n = \frac{1}{\theta^{-1} - 1}\frac{\alpha}{\beta} = \frac{1}{\frac{1-\theta}{\theta}}\frac{\alpha}{\beta} = \frac{\theta}{1 - \theta}\frac{\alpha}{\beta} \tag{4}$$

3. All workers are employed in production. Write down an expression for N using the full–employment condition. How does the number of firms, N, depend on θ?

Suggested answer:
Full employment requires:

$$L = \sum_{n=1}^{N} l_n = \sum_{n=1}^{N}(\alpha + \beta x_n) = N(\alpha + \beta x_n)$$

Inserting expression for output:

$$L = N\left(\alpha + \beta\frac{\theta}{1 - \theta}\frac{\alpha}{\beta}\right)$$

$$\implies N = \frac{L}{\alpha(1 + \frac{\theta}{1-\theta})} = \frac{(1 - \theta)L}{\alpha} \tag{5}$$

A higher value of θ implies that firms set lower prices and increase their output. Since output is expanding, the number of firms has to go down in equilibrium.

4. Suppose the economy opens up to trade with another country. Assume the two countries are identical in terms of preferences, technology and endowments. What happens to production and the number of firms in the home economy once it opens up to international trade? Are there gains from trade? How do the gains from trade compare to the results in Krugman (1979)?

Suggested answer:
Equation 4 continues to hold. That is, production is unchanged as the home economy opens up to trade. The number of varieties produced are therefore also unchanged, cf. equation 5. Consumers are, however, better off. The real wage does not change, but in the open economy, consumers enjoy a wider range of products through imports of foreign varieties. In Krugman (1979), there are gains from trade due to an increase in product variety and efficiency gains (due to increases in production). In this model, only the first source of gains is present.

5. The economy has so far been characterized by love–of–variety preferences, increasing returns to scale technology and firms setting prices as a constant markup over marginal cost. Following Melitz (2003), assume now that firms are heterogeneous in terms of productivity, φ_i. Discuss why some firms export and others do not on the basis of the figure below. Note that you are not required to derive any statements formally in your answer.
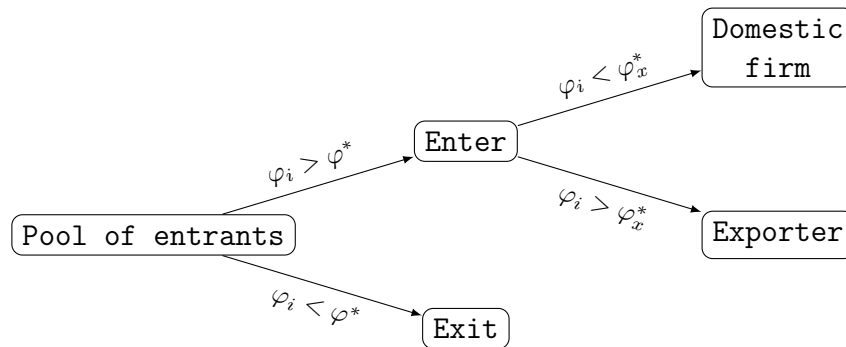
Suggested answer:
In Melitz (2003), there is a large pool of potential new firms. After paying a fixed entry cost, each firm draws a productivity parameter φ from a distribution. To be active in the market, a firm must have a productivity parameter high enough to cover the per-period overhead cost. There exists a cutoff productivity, φ^*, such that those firms with $\varphi_i > \varphi^*$ enter the market (and those below it cease to exist). This selection is illustrated in the figure. In the open economy, firms may also export their good to foreign markets. To do so, they must pay a fixed cost of exporting as well as iceberg trade costs. Because of these additional costs, only the most productive firms export.

6. Suppose the economy from the previous question opens up to trade with another country. Assume the two countries are identical. What happens to production and the number of firms in the home economy, as it transitions from a closed economy to an open economy? Are there gains from trade? How do the gains from trade compare to the situation with homogeneous firms?

Suggested answer:
As the economy opens up to trade, two selection processes occur. First, the least productive firms are forced to exit (since wages and the cost of production go up). At the same time, only the most productive firms will undertake exporting. Overall,

the number of firms decreases in the economy. An implication is that market shares and profits are reallocated towards the more productive firms. As such, some firms reduce their production, while other increase it. Overall, trade leads to an aggregate productivity gain. There are gains from trade due to an increase in product variety and an aggregate productivity increase. The latter effect is an additional source of gains compared to the analysis with homogeneous firms.

Problem 3:

Answer True or False to each of the statements below. Briefly explain your answer.

1. In Dornbusch, Fischer and Samuelson (1977), countries gain from international trade because product variety increases.

   Suggested answer: False. Countries gain from being able to buy the same goods produced more cheaply in other countries.

2. The Gravity Equation can only be derived from models with complete specialization across countries.

   Suggested answer: False. Eaton and Kortum (2002) derive the Gravity Equation in a Ricardian trade model with geographic barriers. Because of iceberg trade costs, production is incompletely specialized in this model (but the Gravity Equation still holds).

3. Offshoring the production of some intermediates previously produced by domestic low-skilled workers makes domestic workers worse off.

   Suggested answer:
   False. The total effect on wages of low-skilled workers is theoretically ambiguous. The productivity effect is positive while the substitution effect is negative. The substitution effect is determined by a relative-price effect and a labor-supply effect in Grossman and Rossi-Hansberg (2008) — both are negative for low-skilled/those workers whose tasks are being offshored. Complementary factors (e.g. high skilled workers) gain.

4. The overall openness to trade of the exporting and the importing country affect the bilateral trade flow, controlling for the bilateral trade cost.

   Suggested answer:
   True. Andersen and van Wincoop (2003) show that the multilateral resistance terms (capturing overall accessibility to trade of an economy) affect bilateral trade. Omitting them lead to bias in simple gravity equations such as McCallum (1995).

5. The intensive margin of exports is the (average) price at which goods are being exported.

   Suggested answer:
   False. The intensive margin of exports is the total value of the shipments within a product cateogy, i.e. it is price times quantity. The extensive margin is the number of product categories being shipped.