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International Trade – Fall 2019

Final Exam

Solutions

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Problem 1

Brexit - consequences for trade and income distribution

In June 2016 a majority of the British population voted to leave the EU. Three years later, negotiations are still ongoing. Discuss the consequences for UK production, international trade, welfare, and income distribution if the country chooses to exit the EU. Your discussion should be drawing on international trade theory, and you should elaborate on two scenarios:

a. A soft Brexit: a scenario in which the UK introduces immigration restrictions, but keeps preferential access to the EU single market for goods i.e. tariffs are zero between the UK and the EU for goods and services.

b. A hard Brexit: a scenario in which UK leaves the EU without a new trade deal, and trades under World Trade Organization (WTO) rules, and does not get any preferential access to the EU countries (the EU imposes positive tariffs on UK exports, and UK imposes positive tariffs on imports from EU).

   Answer: *The answer is pretty open; but the students are expected first to state the thought experiments of soft and hard Brexit. Soft Brexit is the case that trade remains free, but labor supply in Home country (the UK in this case). Hard Brexit means that the UK faces a positive tariff on its exports and levy a positive tariff on its imports. Then, for each thought experiment, the students are expected to use a theory to discuss the change of UK production, trade, welfare (real wage for each group), and nominal wage for each group. The students also need to specify whether they assume the UK is a large or small open economy, which affects the analysis of welfare. The precise answer depends on the*

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specific model student choose for the analysis. They should be rewarded if they (i) mention facts about skill composition of UK's immigration and emigration; (ii) UK's top import and export industries are largely overlapped (intra-industry trade dominants).

Note: this problem is based on the topic of the voluntary term paper of the course. The students are thus allowed to bring their term papers as support material. Those who did a careful job on their term papers should thus be rewarded accordingly.
Where in the curriculum: Lecture 3 slides on the Ricardo-Viner model, Lecture 3-4 on two-by-two Heckscher-Ohlin model, with the assumption that the UK is a small open economy suite the best for the analysis. But students can choose other models as long as they make a correct analysis and justify their choice of model(s).

Problem 2

a. Explain the notion optimal tariff.

Answer: *The optimal tariff is the tariff a country unilaterally chooses on its imports to maximize its welfare, which is the sum of consumer surplus, producer surplus, and tariff revenue. The optimal tariff theory argues that a country that is a large importer of a particular commodity can shift the economic burden of an import tariff from domestic consumers to foreign suppliers if the country is "large" enough to affect world price.*

b. Consider a specific product market in a small open economy. Explain and show graphically the impact of a tariff on consumers, producers and the total economy.

Answer: *[sketch] Use the left-panel graph showed in Lecture 7 slides, page 14 to explain. With an increase in tariff, consumer surplus decrease (areas $a + b + c + d$), producer surplus increase (areas a), total tariff revenue increases (area c). However the whole economy has dead weight loss (areas $b + d$).*

c. If the economy had been large rather than small, would this have affected the answer of question b.? Explain why and to what extent.

Answer: *[sketch] The answer will be affected, as if the economy is large, an increase in imported tariff will affect world prices.*

Use the left-panel graph showed in Lecture 7 slides, page 20 to explain. With an increase in tariff, consumer surplus decrease (areas $a + b + c + d$), producer surplus increase (areas a), total tariff revenue increases (area $c + e$). In this case, the economy as a whole gain or loss depends on the size of dead-weight loss (areas $b + d - e$), and the size of additional tariff gains (e). If area e is greater than $b + d$, the total economy will gain from the increase in import tariff.

Where in the curriculum: Lecture 7 slides on trade policy.

Problem 3

Consider a country H where each firm has monopoly power over a single variety x_j. A firm pays a fixed cost f and a variable cost b, so it hires labor according to

$$l_j = f + b x_j$$

Suppose the representative consumer has L_H units of labor for which he receives a wage w. The consumer has utility over N differentiated goods given by (note that $\sigma > 1$):
$$U = \left[\sum_{j=1}^{N} q_j^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

a. Write down the utility maximization problem of the consumer.

Answer: *The utility maximization problem of the consumer is given by:*

$$\max_{q_j} U = \left[\sum_{j=1}^{N} q_j^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

$$s.t. \quad \sum_{j=1}^{N} q_j p_j = w L_H$$

b. Solve the utility maximization problem yeilds the demand for each variety j:

$$q_j = \frac{p_j^{-\sigma}}{P^{1-\sigma}} w L_H,$$

where $P^{1-\sigma} = \sum_{k=1}^{N} p_k^{1-\sigma}$. How does the demand for variety j change with an increase in w, L_H, P, and p_j, respectively? What is the intuition for each of them?

Answer:

- *w or L_H increases, q_j increase, because of the representative consumer's total income for expenditure increases.*

- *p_j increase, meaning the variety gets more expensive; hence consumer reduces consumption on j; thus, q_j decreases.*

- *P increase, meaning the market gets less competitive (due to fewer varieties or price of other varieties become more expensive), hence condition on p_j does not change, the representative consumer will buy more variety j, q_j increases.*

c. Each firm chooese the optimal price to maximize its profit. A firm's optimization problem is given by:

$$\max_{p_j} \pi_j = p_j q_j - b q_j w - w f, \tag{1}$$

where q_j satisfies the demand function we derived before. Show that the optimal price for each variety is given by $p_j = \frac{\sigma b w}{\sigma - 1}$.

Answer: *Each firm produces one variety, and chooese the optimal price to*

maximize its profit. A firm's optimization problem is given by:

$$\max_{p_j} \pi_j = p_j q_j - b q_j w - w f \tag{2}$$

$$s.t. \quad q_j = \frac{p_j^{-\sigma}}{P^{1-\sigma}} w L_H.$$

Note that under monopolistic competition, firm behaves as if their behavior has no impact on aggregate economic variables, such as P and w. F.O.C. w.r.t. p_j

$$q_j + p_j \frac{\partial q_j}{\partial p_j} - b w \frac{\partial q_j}{\partial p_j} = 0$$

$$\rightarrow \quad p_j - b w = -q_j \left(\frac{\partial q_j}{\partial p_j}\right)^{-1}$$

Using the demand constraint $\quad q_j = \frac{p_j^{-\sigma}}{P^{1-\sigma}} w L_H$*, one can show that* $-q_j \left(\frac{\partial q_j}{\partial p_j}\right)^{-1} = \frac{p_j}{\sigma}$*. Therefore:*

$$p_j - b w = \frac{p_j}{\sigma} \quad \rightarrow \quad p_j = \frac{\sigma b w}{\sigma - 1}.$$

d. Suppose now firms differ in their variable production cost. Now they hire labor according to

$$l_j = f + b_j x_j,$$

i.e., the marginal cost of production b_j, now differs across firms. Write down the optimal price of firm j with variable cost b_j. How does the price a firm charge varies with its marginal cost of production? Comment briefly.

Answer:

$$p_j = \frac{\sigma b_j w}{\sigma - 1},$$

which is obvious based on subquestion c. Higher the marginal cost of production, the higher the price the firm charges. Because CES guaranteed the constant

markup, hence higher cost of a firm always translates to a higher price.

e. Given our setting when moving from autarky (no trade) to free trade (zero trade frictions), how do the number of firms at the Home change when they are identical? How do the number of firms at Home (i.e., Home production firm, not the number of firms sell at Home market, which consists of both Foreign and Home firms) change when they differ in b? What is the source(s) of grains from trade in each case, respectively?

Answer:

- *The number of firms Home has will remain unchanged when we move from autarky to free trade in Krugman case. The mass of firms will decrease in Melitz's case (because when open to trade, least productive firms exit, the average profitability of surviving firms increase. When then implies, given the labor market clearing condition which we went through in the seminar, the mass of firms must decrease).*

- *The gains from trade in Krugman case come from the love of variety. The gains from trade in Melitz's case is because of the love of variety as well as the within-industry selection, which leads to aggregate efficiency improvement.*

Where in the curriculum: Lecture 8 and 9's slides on Krugman model; Lecture 11's slides on trade and heterogeneity.

Problem 4

Head and Ries (1999) analyze the effects of tariffs based on a model of trade and imperfect competition, using the so-called gravity equation. To the left, you find their results.

Focus on the effect of Canadian Tariff and U.S. Tariff on log output per Canadian plant with all observations (first column, row 1-2). The tariffs are measured in fractional

terms. For instance, if the tariff is 50% on leather shoes, it is measured as 0.5 (not logged).

Table 3
Effects of tariffs on log output per plant (ln q)

| | Sample: | | | | |
	All	Imp. Com.	IC + Free	IC + Fixed	All
Canadian Tariff	1.134[a]	1.247[a]	0.279	3.824[a]	4.928[a]
	(0.368)	(0.411)	(0.455)	(0.925)	(1.135)
U.S. Tariff	−1.638[a]	−2.227[a]	−0.937	−5.632[a]	−6.371[a]
	(0.596)	(0.716)	(0.828)	(1.403)	(2.078)
Cdn. Tariff					−17.952[a]
× Turnover					(5.489)
U.S. Tariff					20.131[c]
× Turnover					(10.289)
1994	0.179[a]	0.172[a]	0.117[a]	0.301[a]	0.186[a]
	(0.020)	(0.022)	(0.025)	(0.040)	(0.021)
R^2 (within)	0.175	0.173	0.129	0.338	0.191
Root MSE	0.149	0.152	0.149	0.154	0.149
No. of Obs.	1828	1628	1183	445	1693

Note: Fixed industry year effects are not reported except for 1994 which approximates the percent change from 1988. Standard errors in parentheses. [a],[b],[c] indicate significance in a two-tail test at the 1, 5 and 10 percent levels.

a. Interpret the point estimates on Canadian Tariff (1.134) and U.S. Tariff (-1.638). Do the sign and magnitude make sense? Explain briefly.

   Answer:

   - *Interpretation: a one percentage point increase in Canadian Tariff increases the output per Canadian plant by 1.134%. A1 percentage point increase in the U.S. Tariff decreases the output per Canadian plant by 1.638%.*

   - *Sign makes sense. Canadian tariff increase means increased protection; the U.S. tariff increase means that it gets harder to sell to the U.S. market, hence demand drops; therefore, output drops as well. Size also makes sense; as in the gravity equation seminar, we learned that the estimated coefficient on trade costs is typically around 1.*

b. Following the previous question, does the aggregate impact of tariff reduction (Canadian Tariff+ U.S. Tariff reduction) on output per plant matches the prediction of Krugman model? Explain briefly.

Answer: *Yes. Because the net effect is close to zero (1.134-1.638). With the krugman model, firm size does not depend on trade costs.*

Where in the curriculum: Lecture 8 and 9's slides on Krugman model; Lecture 11's slides on trade and heterogeneity; Lecture 10 on Gravity Equation.