

Exam Econ 4415 International Trade - Fall 2023

November 2023

1. **12.5 POINTS.** Consider a neoclassical economy facing a change from autarky to free trade. Explain and illustrate graphically which industries would become exporters and which importers, why would be that the case, what would happen with goods' prices and welfare.

Answer: The candidate should explain the theory of comparative advantage, its sources and how prices change when going from autarky to free trade. The candidate should plot the production possibility frontier, utility indifference curve, production and consumption point, expenditure line before and after opening to trade.

2. **20 POINTS.** Based on the factor proportion theory, explain and illustrate graphically what you would expect to happen to a small open economy (e.g. production, prices) in the short term and long term in the following independent scenarios

- (a) Active workforce reduces

Answer: the candidate should refer to Ricardo-Viner model for the short term and the Rybczynski theorem of the Heckscher Ohlin model for the long term.

In the short term wages goes up (in both industries, as labor is mobile across industries), returns to capital go down, production in both industries reduces, capital is fixed in each industry. Goods' prices do not change as they are set internationally. The candidate should draw the bathtub diagram before and after the change in labor.

In the long term capital moves away from the labor intensive industry towards the capital intensive. The decrease in labor endowment reduces output

in the industry that is labor intensive and increase in the industry that is capital intensive. The reduction in the labor intensive industry is more than proportional to the reduction in labor endowment. As long as both goods are produced and factor intensity reversals do not occur, wages and return to capital remain constant. Goods prices do not change as they are set internationally. The candidate should do a graphical representation with allocation of capital and labor across industries.

(b) International price of a good that is being produced increases

Answer: the candidate should refer to Ricardo-Viner model for the short term and the Stolper Samuelson theorem of the Heckscher Ohlin model for the long term. Let's say price of good 1 goes up, while price of good 2 remains constant.

In the short term wages go up, but the percent increase is smaller than the percent increase in the price of the good. Given that labor is mobile, labor reallocates from industry 2 to industry 1 until wage in both industries equalize. Returns to capital in industry 1 increase, and by more than the change in price of good 1. Returns to capital in industry 2 reduce. Given that there is more labor in industry 1 and less in industry 2, output in industry 1 increases, while in industry 2 decreases. Candidate should draw bathtub plot before and after the change in the price.

In the long run capital moves across industries until capital returns equalize across industries, but will be different to before the change in the price of good 1. In the long run capital moves from industry 2 to industry 1. Let's assume industry 1 is labor intensive. The increase in price of good 1 increases wages by more (in percentage terms) than the increase in price of good 1, while returns to capital reduce. Hence, real return to wage increases (as wage increases by more than the increase in price of good 1) while real return to capital decreases. Output in industry 1 increases, while output in industry 2 decreases.

3. 10 POINTS. Explain the following:

(a) Forces of agglomeration

(b) Advantages that a larger market provides to consumers. Provide intuition from a world behaved as in an monopolistic competition model with love for variety, homogeneous firms and autarky.

Answer: The candidate should 1. explain forces of agglomeration, 2. explain gains from market size in a monopolistic competition model.

4. **12.5 POINTS.** Explain the main ingredients, assumptions and results of Melitz (2003) "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity". Provide graphical illustrations. Include predictions on firm entry, exit, sales, price index, productivity, gains from trade.

Answer: the candidate should refer to the Melitz (2003) "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity". The candidate should give a preview of the model. When reducing trade barriers, when can split firms in three brackets of productivity distribution: low productivity firms exit, medium productivity serve only domestic market and reduce sales, high productivity firms start exporting and increase sales. Price index decreases due to entry of high productivity foreign firms. Aggregate productivity increases as labor is reallocated from low productivity firms to high productivity firms. Gains from trade come from: 1. reallocation of labor from less productive to more productive firms, 2. increase in number of varieties available to consumers, 3. lower price index which is consequence of both more varieties and buying from more productive firms which set lower prices. The candidate should do graphical representations of the previous points.

5. **15 POINTS.** Explain the main ingredients, assumptions and results of Krugman and Venables (1995) "Globalization and the Inequality of Nations". Include predictions on how trade in intermediate goods affects real wages and the size and type of economic activity in each location as trade costs reduce.

The candidate should refer to Krugman and Venables (1995) "Globalization and the Inequality of Nations". The candidate should give a preview of the model and explain forward and backward linkages. The candidate should then explain that starting from high trade costs, a reduction in trade costs would first lead to a phase in which one location reduces its share of manufacturing industry while

the other location increases it. Then a further reduction in trade costs would lead to an increase in manufacturing share in that location that had a lower share. The candidate should explain what happens with real wages in each location as trade costs reduce.

6. **10 POINTS.** About trade costs between countries:

(a) Propose one method to measure (get an approximated value by observing data) trade costs. Specify which data you would need and how you would use it.

Answer: the candidate could propose multiple sources of measurement. For example, compare origin-destination-product export FOB price and import CIF prices, use data on tariff and non-tariff barriers, use distance or transport routes and the cost to transport each good. The candidate should explain how to use the data to measure the trade costs. The candidate could also highlight the importance of other trade costs that could be more difficult to measure directly, as the importance of differences in languages, corruption and other contractual frictions.

(b) Propose a method to estimate trade costs (recover trade costs based on theory). Specify which data you would need and the underlying assumptions to recover trade costs.

The candidate could refer to the gravity equation, and compare the observed trade flows with the trade flows that would happen in a imaginary world with zero trade costs. Differences the observed and imaginary world are due to trade costs. The candidate should highlight that to do so it would be necessary to have an estimate of the elasticity of trade flows to trade costs, and to have a measurement of internal trade flows.

Another alternative for estimation would be to exploit within-product price differentials across locations, assuming perfect arbitrage: differences in prices are only due to trade costs. In order to do so we need to assume goods are homogeneous such that price differences do not reflect quality differences, and we need to assume perfect competition such that price differences are not consequence of other market imperfections as e.g. market power. Hence, the set of goods to be used in such estimation should be those that satisfy those assumptions. If we observe that location i is exporting a good k to location j ,

then we can recover trade costs as $\ln(p_j^k) - \ln(p_i^k) = \ln\tau_{ij}^k$.

7. **20 POINTS.** Derive the gravity equation presented below (equation (1)) and explain how each of its components affects trade flows

$$X_{ij} = \frac{Y_i Y_j}{Y_W} \left(\frac{\tau_{ij}}{P_i P_j} \right)^{1-\sigma} \quad (1)$$

Where $X_{ij} = p_{ij}q_{ij}$ is the value of trade flows from location i to location j , with price p_{ij} and quantity q_{ij} . The trade cost τ_{ij} is an iceberg trade costs between location i and j , and $\tau_{ij} = \tau_{ji}$. The nominal income of region i is Y_i , and $Y_W = \sum_i Y_i$ is the world income. P_i is the price index of region i . Assume preferences for goods are homothetic and identical across locations, each location produces one variety, locations are small and take other region's price as given. Then, $p_{ij} = p_i \tau_{ij}$. Assume that the equilibrium is unique (hint: the remoteness index $\Omega_i = (\sum_j \theta_j (\frac{\tau_{ij}}{P_j})^{1-\sigma})^{\frac{1}{1-\sigma}}$ of location i will be equal to the price index P_i of location i , where θ_j is the share of location j in world income).

Take q_{ij} the demand of location j for the variety of location i as given (you do not need to derive it):

$$q_{ij} = \left(\frac{p_{ij}}{P_j} \right)^{-\sigma} \frac{E_j}{P_j}$$

where $P_j = \left[\sum_i p_{ij}^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$ is the price index in location j , σ is the elasticity of substitutions across varieties (common across all locations) and E_j is the total nominal expenditure of location j .

Answer: The candidate should take as given the equations provided and continue from there. See below.

$$X_{ij} = p_{ij}q_{ij} = \left(\frac{p_{ij}}{P_j} \right)^{1-\sigma} E_j = \left(\frac{\tau_{ij} p_i}{P_j} \right)^{1-\sigma} E_j$$

Using $\sum_j X_{ij} = Y_i$, the candidate should show that

$$p_i^{1-\sigma} = \frac{Y_i}{Y_W} \frac{1}{\sum_j \theta_j (\frac{\tau_{ij}}{P_j})^{1-\sigma}}, \quad (2)$$

where $\theta_j = Y_j/Y_W$ is country j 's share in world income.

Then the candidate should show

$$X_{ij} = \frac{Y_i Y_j}{Y_W} \left(\frac{\tau_{ij}}{\Omega_i P_j} \right)^{1-\sigma}, \quad (3)$$

where $\Omega_i = (\sum_j \theta_j (\frac{\tau_{ij}}{P_j})^{1-\sigma})^{\frac{1}{1-\sigma}}$.

Next the candidate should show that we can write P_j as

$$P_j = \left(\sum_i \left(\frac{\tau_{ij}}{\Omega_i} \right)^{1-\sigma} \theta_i \right)^{\frac{1}{1-\sigma}}. \quad (4)$$

With a unique equilibrium and symmetric trade costs ($\tau_{ij} = \tau_{ji}, \forall i, j$), then we obtain

$$P_j = \left(\sum_i \left(\frac{\tau_{ij}}{P_i} \right)^{1-\sigma} \frac{Y_i}{Y_W} \right)^{\frac{1}{1-\sigma}}. \quad (5)$$

Last, replace Ω_i by P_i to obtain the gravity equation

$$X_{ij} = \frac{Y_i Y_j}{Y_W} \left(\frac{\tau_{ij}}{P_i P_j} \right)^{1-\sigma}$$

The candidate should explain how each of the components of the gravity equation affects trade flows X_{ij} .