

**International Field Exam - Second Sitting**

**August 2024**

Answer three sets of questions, corresponding to the courses you took.

1. Consider the Armington model from Anderson and van Wincoop (2003), “Gravity with Gravitas: A Solution to the Border Puzzle,” AER. studied in class. There are  $N$  countries. In country  $n$  there are  $L_n$  workers who produce  $z_n$  units of output each. Preferences in country  $n$  are:

$$C_n = a_n \left[ \sum_{i=1}^N \alpha_i^{1/\sigma} C_{ni}^{(\sigma-1)/\sigma} \right]^{\sigma/(\sigma-1)}$$

where  $C_{ni}$  is a country  $n$  resident’s consumption of imports from  $i$ . Iceberg trade costs from  $i$  to  $n$  are  $\tau_{ni}$ . Answer the following questions both using intuition and relevant equations to justify your answer.

- (a) Define an equilibrium. Is it unique? (You do not have to provide a proof, but a discussion of why you think the equilibrium may or not be unique based on results from the literature).
  - (b) Define, both formally and intuitively, the “multilateral resistance” term.
  - (c) How do the gains from trade of country  $n$ , defined as the ratio in real income between an equilibrium under free trade and under autarky in country  $n$ , depend on the parameter  $\alpha_i$  for  $i \neq n$ .
  - (d) Describe the data that would be needed to implement counterfactuals in relative changes in this model.
2. Starting from the assumptions of the previous model, assume now that workers are perfectly mobile across countries. Moreover,  $a_n = A_n L_n^\beta$ 
    - (a) Define an equilibrium. Is it unique? (You do not have to provide a proof, but a discussion of why you think the equilibrium may or not be unique based on results from the literature).
    - (b) Set up a social planner’s problem.
    - (c) Is the equilibrium efficient? If not, how can efficiency be restored? (Rely on equations as much you need to make your point).
    - (d) Suppose now that  $\beta = 0$  but there is a non-tradeable sector, such as housing. Under which conditions will the equilibrium be efficient? (No need to use equations).
  3. Reading checks (use just one or two sentences for each question)
    - (a) What is the method used by Donaldson (AER 2018), “Railroads of the Raj,” to assess the validity of the Eaton and Kortum model?
    - (b) What is the method use by Ahlfeldt, Redding, Sturm, and Wolf (ECMA 2015), “The economics of Density: Evidence from the Berlin Wall,” to assess the role of agglomeration spillovers in driving the impact of the Berlin Wall?

# Questions from Ariel Burstein

## Exchange-rate pass-through and distribution costs.

Consider an imported good  $i$  with CES demand given by

$$c_i = p_i^{-\sigma} P^\sigma Q,$$

where  $p_i$  is the *retail* price,  $P$  and  $Q$  are the aggregate consumption price and quantity in the buyer's country, and  $\sigma$  is the demand elasticity.

Consumers purchase good  $i$  from *retailers*, who have the technology

$$c_i = \left[ (1 - \bar{a})^{\frac{1}{\phi}} y_i^{\frac{\phi-1}{\phi}} + \bar{a}^{\frac{1}{\phi}} d_i^{\frac{\phi-1}{\phi}} \right]^{\frac{\phi}{\phi-1}}.$$

That is, to deliver  $c_i$  units of good  $i$  to consumers, retailers combine  $y_i$  units of the physical good and  $d_i$  units of distribution services. The parameter  $\phi$  is the elasticity of substitution between the physical good and distribution services. We assume that  $\phi \leq 1$ . As  $\phi \rightarrow 0$ , retailers combine the physical good and distribution services at fixed proportions (e.g. a pair of imported shoes requires a fixed amount of shelf-space and labor services). The parameter  $\bar{a}$  determines the importance of distribution costs in the final retail cost. When  $\bar{a} = 0$ , the model simplifies to the model without distribution services.

Good  $i$  is produced by a foreign firm using foreign labor  $l_i$  according to the CRS production function

$$y_i = z_i l_i.$$

Note that the distribution service requirement  $\bar{a}$  does not vary with productivity  $z_i$ .

The market structure is as follows. There is single foreign producer (monopoly) of good  $i$  with marginal cost  $e/z_i$ , where  $e$  is the home-per-foreign currency exchange rate, and we have normalized the foreign wage to 1. The exporter sells the good to retailers at the *import price* (in home currency)  $\bar{p}_i$ . Retailers are perfectly competitive. They purchase good  $i$  from producers at a price  $\bar{p}_i$ , pay  $p_d$  per unit of distribution services they hire, and sell the good at the retail price  $p_i$  equal to the retailer's marginal cost. Denote the share of distribution costs in the retail price of good  $i$  by

$$s_i^d = \frac{p_d d_i}{p_i c_i}.$$

There are 6 parts to this question. Parts (i)-(ii) give one point each and parts (iii)-(vi) give 2 points each.

1. (1 point) Provide an expression for the elasticity of retail price with respect to the import price,  $\frac{\partial \log p_i}{\partial \log \bar{p}_i}$ , in terms of  $s_i^d$ .
2. (1 point) Provide an expression for the elasticity of demand with respect to changes in the producer price,  $\varepsilon_i = -\frac{\partial \log c_i}{\partial \log \bar{p}_i}$ .

3. (2 points) Provide an expression (or a system of equations) to calculate the profit maximizing import price  $\bar{p}_i$ . How does the exporter markup,  $\bar{p}_i/(e/z_i)$  vary across firms with different productivity  $z_i$ ?
4. (2 points) Consider a small change in the nominal exchange rate and assume that the distribution price  $p_d$  remain constant. Calculate the degree of exchange-rate pass-through into import prices, defined as

$$\rho_i = \frac{\partial \log \bar{p}_i}{\partial \log e}.$$

5. (2 points) Under what conditions can the model generate incomplete pass-through ( $\rho_i < 1$ )? Provide intuition for your answer.
6. (2 points) How does pass-through vary across firms with different productivity  $z_i$ ? Can the model reproduce the empirical fact that pass-through is decreasing in firm size?

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## Questions from Jonathan Vogel

Consider a specific factors model with three goods, indexed by  $j = 1, 2, 3$  with exogenous prices  $p_j > 0$ . There is one factor of production that is mobile across goods. It is in fixed supply, with supply equal to one unit. In addition, there is a separate fixed factor employed in each good  $j = 1, 2, 3$ . Let  $f_j(v)$  denote the output of good  $j$  if  $v$  units of the mobile factor is employed in good  $j$ . Suppose that  $f'_j(v) > 0$  and  $f''_j(v) < 0$  for all  $j$ . Also suppose that  $\lim_{v \rightarrow 0} f'_j(v) = \infty$  for all  $j$ , so that all goods are produced in any equilibrium (you can take the result that all goods are produced in positive quantities in any equilibrium as given).

**Question 1 – Characterization:** Write the equations that characterize the equilibrium allocation of the mobile factor across goods, denoting by  $v_j$  the allocation of the mobile factor to good  $j$ , and the equilibrium returns to the fixed factor, denoting by  $\pi_j$  the rents earned by the fixed factor in good  $j$ .

**Question 2 – Comparative statics:** Starting from an equilibrium, what is the impact of an increase in  $p_1$  on the allocation of the mobile factor across goods (the sign of the derivative of  $v_1$ ,  $v_2$ , and  $v_3$  with respect to  $p_1$ ) and the rents earned by each fixed factor (the sign of the derivative of  $\pi_1$ ,  $\pi_2$ , and  $\pi_3$  with respect to  $p_1$ )?