**International Field Exam**

**June 2024**

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

## Questions from Pablo Fajelbaum

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:

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

   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.

   (b) How does the iceberg trade cost of exporting from country $i$ to country $j$ affect the exports from country $i$ to country $k \neq j$?

   (c) How do the gains from trade, defined as the ratio in real income between an equilibrium under free trade and under autarky, depend in country $i$ on $\alpha_i$ and $z_i$?

2. Starting from the assumptions of the previous model, assume now that workers are perfectly mobile across countries.

   (a) Define an equilibrium.

   (b) Is the equilibrium unique? (You do not have to provide a proof, but a discussion of why you think the equilibrium may or not be unique).

   (c) Set up a social planner's problem. Is the equilibrium efficient? (Rely on equations as much you need to make your point).

   (d) Compare this framework to the one in Allen and Arkolakis (2014), "Trade and the Topography of the Spatial Economy," QJE.

      i. What key forces are different?

      ii. How do these forces affect your assessment of efficiency and uniqueness?

   (e) Repeat the previous analysis, but now comparing with the frameworks in Roback (1982) and Helpman (1998) studied in class.

3. What is the main conclusion in Dingel and Tintelnot (2023), "Spatial Economics for Granular Settings," regarding the use of "hat algebra" in spatial setups? Give one potential criticism of their main point.

**Questions from Jonathan Vogel**

Consider a Ricardian model with a continuum of goods, indexed by $z \in [0,1]$, and two countries indexed by $i = 1,2$, each endowed with $L_i$ units of labor. Constant unit labor requirements for country $i$ and good $z$ are given by

$$a_i(z) = \alpha e^{\beta_i z}$$

where $\beta_2 > \beta_1 > 0$. Countries have identical Cobb-Douglas preferences given by

$$U_i = \int_0^1 \ln c_i(z) dz$$

Normalize the wage in country 1 to one: $w_1 = 1$. And denote by $w$ the wage in country 2 (denominated in the wage of country 1, obviously). Consider an equilibrium in which country 1 transfers $T \geq 0$ units of its income (i.e., country 2 owns $T$ units of the labor in country 1), which denominated in its own wage, to country 2. I impose $T < L_1$ (the transfer is feasible).

**Question 1 – Existence + uniqueness:** Prove that a unique equilibrium exists given $T$.

**Question 2 – Easier comparative statics:** Starting from an equilibrium without transfers, $T = 0$, solve for how a small increase in $T$ affects

1. The cutoff good, $z^*$, at which the two countries' costs are equated

2. The relative wage of country 2 to country 1, defined above as $w$

**Question 3 – Harder comparative static** [Note – only answer this question after completing other parts of your exam]**:** Starting from an equilibrium without transfers, $T = 0$, solve for how a small increase in $T$ affects welfare in country 1.

# 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 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 $\phi \to 0$, 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

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

1. 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. 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. 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 $z_i$?

5. By equation (4), $\frac{\partial \log \mu_i}{\partial \log e}$ is more negative for firms with higher $s_i^d(\mu_i - 1)$. Since markups and the distribution share are increasing in $z_i$ if $\phi < 1$, this model can rationalize the fact that more productive (and larger) firms have lower pass-through.

Questions from Aaron Tornell.

Consider an economy with moral hazard in credit markets and government bailout guarantees. Concretely, consider a borrower with internal funds $w$ that borrows an ammount $b$ at time $t$ and promises to repay $b * [1+r]$ at time $t+1$. With probability $\alpha$ the borrower will have enough income at time $t+1$ to repay debt in full, while with probability $1-\alpha$ the borrower will have zero income and will default on the debt. Furthermore, if at time $t$ the borrower incurs a non-pecuniary cost $h[w+b]$, then at time $t+1$ she will be able to divert all repayment funds and pay nothing to the lender. Lenders are competitive, risk-neutral agents, and have an opportunity cost $r$.

**(a)** Assuming that the borrower will not divert funds and repay debt whenever she has positive income, at what interest rate would lenders be willing to lend to this borrower?

**(b)** Using the interest rate derived in (a) above, derive the borrowing constraint that a lender would impose at time $t$ to ensure the borrower does not divert funds and repays debt at time $t+1$ in the state in which she has positive income.

**(c)** Suppose there is a bailout guarantee that is triggered only if a critical mass of borrowers defaults, in which case the government repays lenders all their promised repayments. What would be the borrowing constraint in this case?

(d) What would be the answers to (c) if we assume instead that a bailout is granted anytime a single borrower defaults?

(e) Use the setup in (a)-(d) to describe an economy that exhibits currency mismatch and lending booms.