ECON 460: Graduate International Trade
Problem Set #3
Spring 2014, Professor Treb Allen
Due: Wednesday May 14 at the beginning of class

1. *Estimating the gravity coefficient.* Download the bilateral trade data (which is in a Stata format) from the class website. First, let us estimate the gravity equation using a number of different methods.

   (a) The traditional gravity estimator. Estimate:

   $$\ln X_{ij} = \beta \ln dist_{ij} + \ln Y_i + \ln Y_j + \varepsilon_{ij},$$

   where $dist_{ij}$ is the (straight-line) distance between country i and j.

      i. What is the estimated coefficient β?
      ii. How does this coefficient change if you allow the coefficient on the origin and destination incomes to differ?

   (b) The fixed effects estimator. Estimate:

   $$\ln X_{ij} = \beta \ln dist_{ij} + \ln \gamma_i + \ln \delta_j + \varepsilon_{ij}$$

      i. What is the estimated coefficient β?
      ii. How does this estimated coefficient differ from the estimate in part (a)? Provide the intuition for this change. (Hint: the answer will depend on the correlation between the omitted variables and the bilateral distance).
      iii. What is the correlation between the (de-meaned) origin income and the (de-meaned) estimated origin fixed effects?

   (c) The ratio gravity estimator. Estimate:

   $$\ln\left(\frac{X_{ij}}{X_{jj}}\right) = \beta \ln dist_{ij} + \ln \gamma_i - \ln \gamma_j$$

   [Hint: use the income to construct $\{X_{ii}\}$].

      i. What is the estimated coefficient β?

   (d) The general equilibrium gravity estimator. Estimate:

   $$\ln X_{ij} = \beta \ln dist_{ij} + \ln \gamma_i + \ln \gamma_j$$

      i. What is the estimated coefficient β?
      ii. What is the correlation between the origin fixed effects estimated in parts (b), (c), and (d)?

2. *Is trade balanced?*

   (a) For each country, regress its (log) total imports on its (log) total exports. Can we reject that the coefficient is one? What is the R^2?

   (b) Using the estimated origin country coefficients from the fixed effects gravity estimation, calculate:

   $$\hat{d}_j \equiv \frac{Y_j}{\sum_{i \in S} \hat{K}_{ij} \hat{\gamma}_i}.$$

   We saw in the lecture notes that balanced trade implies that $\hat{d}_j = \hat{\delta}_j$ (the destination fixed effect). Can we statistically reject that $\hat{d}_j = \hat{\delta}_j$ and, if so, what is the p-value?

(c) Estimate the following regression using dummy variables:

$$\ln X_{ij} = \beta \ln dist_{ij} + \ln \gamma_i + \ln \gamma_j + \ln \tilde{\delta}_j,$$

i.e. for each country include a dummy variable equal to one if either that country is the origin or destination and for each country include an additional dummy variable equal to one if the destination is that country. Can we statistically reject that$\hat{\tilde{\delta}}_j = 0$ and, if so, what is the p-value?

3. *Calibration.* Let us consider the Armington model. The goal of this problem is to calibrate the model so that it exactly matches the observed trade flow data.

(a) First, use the labor market clearing condition $w_i L_i = Y_i$ to calculate the (observed) equilibrium wage in every country.

(b) We now need to make some assumptions. First, let us assume that the average productivity across the entire world is one, i.e. $\frac{1}{N}\sum_{i=1}^{N} A_i = 1$. Second, let us assume that $\tau_{ii} = 1$ in all countries (i.e. there are no internal trade costs). [Why can't τ_{ii} and A_i be separately identified?] Finally, suppose that $\sigma = 5$.

(c) Now, guess an initial distribution of A_i across countries (e.g. $A_i = 1$ everywhere).

(d) With the guess of A_i, solve for the bilateral trade costs $\{\tau_{ij}\}$ using the observed wages and the expression for $\frac{X_{ij}}{X_{jj}}$.

(e) Given the $\{\tau_{ij}\}$ that you have found, calculate what the equilibrium wages must be in each country (hopefully you can use the program you wrote for problem set #2).

(f) Compare these equilibrium wages to the wages that you observe in the data. Based on how they compare, update your guess about $\{A_i\}$.

(g) Repeat steps (d)-(f) until you find a set of $\{A_i\}$ and $\{\tau_{ij}\}$ that exactly match the trade data and are consistent with the model.

(h) What is the correlation of τ_{ij} and τ_{ji}?

(i) What is the correlation between the calibrated origin and destination fixed effects and those estimated in question 1(b)?

4. *Counterfactuals.*

(a) Using your calibrated results from the previous question, suppose that the United States unilaterally reduced its importing tariffs by 10% (i.e. $\{\tau_{i,US}\}_{i \neq US}$ declined by 10%). Calculate the equilibrium wages and price index for all countries in the new equilibrium. How much did the welfare change in the U.S.?

(b) Compare this answer to the answer implies by the ACR formula $\hat{W}_j = \left(\hat{\lambda}_{jj}\right)^{\frac{1}{1-\sigma}}$.

(c) Now instead of using the calibrated results, calculate the change in the wages and market shares directly using the DEK procedure and apply the ACR formula to determine the welfare change in the U.S. Do you get the same result?