

Tutorial 2 – Trade and inequalities

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1 Heterogeneous firms, unemployment, and wage inequalities

This exercise is based on Egger & Kreickmeier (2009, *International economic review*) article “Firm heterogeneity and the labor market effects of trade liberalization”, an open-access version being available [here](#).

1. According to Egger & Kreickmeier (2009), why is it necessary to introduce market frictions to study heterogeneous wages among similar workers?
2. Let's denote Y the total output produced, and $q(v)$ the quantity of input $v \in V$ used to produce it. We assume that the production function takes the following CES form:

$$Y = \left(M^{-(1-\rho)} \int_{v \in V} q(v)^\rho dv \right)^{\frac{1}{\rho}} \quad (1)$$

with M a constant representing the mass of available inputs and $0 < \rho < 1$. Show that if all inputs are used in the same quantity q , then we have $Y = Mq$.

3. Let's define Y as the numéraire (i.e. it is sold at price $P=1$). Show that to maximize profits, the final good producer uses the following quantity of inputs:

$$q(v) = \frac{Y}{M} p(v)^{\frac{1}{\rho-1}} \quad (2)$$

4. We assume intermediate good producers differ in terms of productivity ϕ , and that their production costs also depend on the effort of their workers ϵ . Thus, producing $q(\phi)$ units of intermediate good requires $l(\phi) = \frac{q(\phi)}{\epsilon\phi}$ units of labor paid at a wage $w(\phi)$. Let's also assume that in order to produce, intermediate good producers all have to pay the same fixed cost f . Show that, taking into account the demand function of the final good producer, the intermediate good producer will charge the price:

$$p(\phi) = \frac{w(\phi)}{\rho\phi\epsilon} \quad (3)$$

5. Following Akerlof & Yellen (1990), let's assume that workers condition their level of effort to the wage they receive. In particular, workers will be assumed to provide a full effort $\epsilon = 1$ if their wage exceeds their perceived “fair wage” \hat{w} . Otherwise, their effort level is: $\min(\frac{w}{\hat{w}}, 1)$. We also denote \bar{w} the average wage of employed workers and U the unemployment rate. Comment on the following equation determining workers perceived fair wage:

$$\hat{w}(\phi) = \phi^\theta \left((1 - U) \bar{w} \right)^{1-\theta} ; \quad \theta \in [0; 1] \quad (4)$$

6. As explained by Egger & Kreickmeier, we can assume that in equilibrium firms will pay the fair wage, i.e. $\hat{w}(\phi) = w(\phi)$. Show that all firms pay the same wage when $\theta = 0$, and that all producers have the same marginal production cost when $\theta = 1$.
7. Since in equilibrium $\epsilon = 1$, show that intermediate good producers' profits are:

$$\pi(\phi) = (1 - \rho) \frac{Y}{M} \left(\frac{w(\phi)}{\rho\phi} \right)^{\frac{\rho}{\rho-1}} - f \quad (5)$$

8. Using the fair-wage equation, show that the wage, price, and output ratios between two firms with productivity parameters ϕ_1 and ϕ_2 are:

$$\frac{w(\phi_1)}{w(\phi_2)} = \left(\frac{\phi_1}{\phi_2} \right)^\theta ; \quad \frac{p(\phi_1)}{p(\phi_2)} = \left(\frac{\phi_1}{\phi_2} \right)^{\theta-1} ; \quad \frac{q(\phi_1)}{q(\phi_2)} = \left(\frac{\phi_1}{\phi_2} \right)^{\frac{\theta-1}{\rho-1}} \quad (6)$$

9. Discuss the role of θ on the price and output differential.
10. Show that more productive firms employ more workers if and only if $\frac{\theta-\rho}{\rho-1} > 0$. Interpret this result.
11. One can show that the equilibrium employment rate in this economy is:

$$1 - U = \rho^{\frac{\theta}{1-\theta}} \left(\frac{k}{k-\zeta} \right)^{\frac{\theta}{\zeta}} \frac{k-\zeta}{k-\zeta+\theta} \quad (7)$$

with k and ζ two constant parameters. For which value of θ is there full employment? Interpret.

12. If we denote ϕ^* the productivity parameter of the least productive firm active on the market, then one can also show that:

$$\frac{\bar{w}}{w(\phi^*)} = \frac{k-\zeta+\theta}{k-\zeta} \quad (8)$$

Interpret this measure and the role of θ on income inequality.

13. Assume now that a country opens to trade with $n - 1$ other countries. Trade "iceberg" costs between countries are denoted $\tau > 1$. If we define $\Gamma = \frac{1+n\tau^{-\frac{k+\theta}{1-\theta}}}{1+n\tau^{-\frac{k}{1-\theta}}}$, then we can show that after trade liberalization:

$$1 - U = \Gamma \rho^{\frac{\theta}{1-\theta}} \left(\frac{k}{k-\zeta} \right)^{\frac{\theta}{\zeta}} \frac{k-\zeta}{k-\zeta+\theta} \quad (9)$$

and

$$\frac{\bar{w}}{w(\phi^*)} = \frac{1}{\Gamma} \frac{k-\zeta+\theta}{k-\zeta} \quad (10)$$

Discuss how τ and θ affect equilibrium unemployment and wage inequalities when the country opens to trade.

2 Exposure to international trade and workers' earnings in the US

This exercise is based on Autor, Dorn, Hanson & Song (2014, *Quarterly Journal of Economics*) article "Trade adjustment: worker-level evidence", available [here](#).

1. Autor et al (2014) provide stylized facts over the growth of Chinese exports, and the fall of the US manufacturing sector between 1991 and 2007. What are the main take-away?
2. Figure II of the paper plots for 397 sectors the growth experienced in import penetration from China, as a function of the share of production workers. Comment this figure. What does it tell us about China's comparative advantage relative to the US?
3. The baseline model estimated in the paper is the following:

$$\tilde{E}_{ij\tau} = \beta_0 + \beta_1 \Delta IP_{j\tau} + \beta_2 IP_{j,91} + X'_{ij,0} \beta_3 + Z'_{j,0} \beta_4 + e_{ij\tau} \quad (11)$$

with $\tilde{E}_{ij\tau}$ the cumulative earnings over the period 1992 to 2007 of worker i employed in industry j in 1991, IP_j the import penetration in industry j , $X'_{ij,0}$ individual-specific controls and $Z'_{j,0}$ sector-specific controls. In the paper, import penetration is measured as being the increase in Chinese imports to the US. If this regression is simply estimated with OLS, what are the potential risks for the identification of β_1 ?

4. Table IX presents the effect of import exposure on cumulative earnings for three income groups (bottom, middle, top terciles). Focusing on the first column, what do the results suggest?