International Trade core course
Master in Economics, 2nd year
Université Paris-Saclay

1 Short Question [20%]

Answer *either* question a. or b., not both.

a Give a brief summary of the Arkolakis, Costinot and Rodríguez-Clare (2012) result and the Melitz-Redding critique. Explain why the usefulness of alternative trade models depends on whether welfare evaluation occurs ex ante or ex post.

b Give a brief statement of the Heckscher-Ohlin-Vanek theorem. Discuss 1 or 2 empirical papers providing evidence against the HOV prediction. Which assumptions of the HOV model should be amended to improve its empirical performance?

2 Problem: Comparative Advantage and Firm Selection [80%]

Consider a variant of the Melitz model, with 2 countries $c = H, F$, 2 sectors $i = 1, 2$ and 2 factors $v = K, L$. Factors do not move across borders but move freely across sectors. Their prices are set on competitive markets, with ρ_c and w_c respectively denoting the (equilibrium) price of capital K and labor L, in country c. Factor endowments are inelastic, with country H abundant in factor K, i.e. $\frac{\bar{K}_H}{\bar{L}_H} > \frac{\bar{K}_F}{\bar{L}_F}$.

Both countries have the same preferences, represented by the utility function

$$U(C_{1c}, C_{2c}) = C_{1c}^{\alpha_1} C_{2c}^{\alpha_2} \qquad \text{with } C_{ic} \equiv \left[\int_{\omega \in \Omega_{ic}} (q_{ic}(\omega))^{\frac{\sigma-1}{\sigma}} d\omega\right]^{\frac{\sigma}{\sigma-1}}, i = 1, 2, \quad c = H, F$$

where α_i is the share of sector i in nominal consumption (and $\alpha_1 + \alpha_2 = 1$) and $\sigma > 1$ is the elasticity of substitution between varieties of the same sector. Ω_{ic} is the (endogenous) set of varieties of good i consumed in country c.

The technology of production is similar across countries, but heterogeneous across sectors. The total cost of producing q units of a variety in sector i and country c is:

$$\Gamma_{ic}(\varphi, q) = \left(f + \frac{q}{\varphi}\right) \rho_c^{\beta_i} w_c^{1-\beta_i}$$

where $0 < \beta_2 < \beta_1 < 1$ and f is the fixed production cost. $\varphi > 0$ is firm-specific productivity, which is drawn from a common distribution $g(\varphi)$ with positive support and continuous cumulative distribution $G(\varphi)$.

The environment displays monopolistic competition. As a consequence, domestic prices, domestic revenues and domestic profits respectively equal:

$$\begin{aligned}
p_{ic}^d(\varphi) &= \frac{\sigma}{\sigma-1} \frac{\rho_c^{\beta_i} w_c^{1-\beta_i}}{\varphi} \\
r_{ic}^d(\varphi) &= \left(\frac{p_{ic}^d(\varphi)}{P_{ic}}\right)^{1-\sigma} \alpha_i R_c \qquad\qquad i = 1, 2, \quad c = H, F \\
\pi_{ic}^d(\varphi) &= \frac{r_{ic}^d(\varphi)}{\sigma} - f \rho_c^{\beta_i} w_c^{1-\beta_i}
\end{aligned}$$

where $P_{ic} = \left[\int_{\omega\in\Omega_{ic}}(p_{ic}(\omega))^{1-\sigma}d\omega\right]^{\frac{1}{1-\sigma}}$ is the country-sector-specific price index and $R_c \equiv \rho_c\bar{K}_c + w_c\bar{L}_c$ the national nominal revenue.

The timing of the model is the same as in Melitz (2003). Entry is free, but entrants must pay a one-time entry cost $f^e\rho_c^{\beta_i}w_c^{1-\beta_i}$ before discovering their productivity. Once they discover their productivity, they can either exit immediately or produce over an infinite horizon at their (constant) productivity. At each period, firms face a probability δ of being hit by an exogenous "death" shock, which is independent across firms.

1. Comment on the assumptions. To what extent do they differ from the seminal Melitz framework?

2. Autarky equilibrium.

   (a) Write down the Zero Cutoff Profit (ZCP) condition; express the cutoff productivity level φ^*_{ic} below which firms immediately exit the market, as a function of the model's parameters, the equilibrium factor prices ρ_c and w_c, the sectoral price index P_{ic} and the national income R_c.

   (b) Compute the ex-ante expected value of entry and write down the Free Entry Condition (FE). *Hint*: it is useful to define $\tilde{\varphi_{ic}}(\varphi^*_{ic}) \equiv \left[\frac{1}{1-G(\varphi^*_{ic})}\int_{\varphi^*_{ic}}^{\infty}\varphi^{\sigma-1}g(\varphi)d\varphi\right]^{\frac{1}{\sigma-1}}$

   (c) Combining both equations, show that

   $$\frac{f}{\delta}\left[\int_{\varphi^*_{ic}}^{+\infty}\left[\left(\frac{\varphi}{\varphi^*_{ic}}\right)^{\sigma-1} - 1\right]dG(\varphi)\right] = f^e$$

   Comment. Why is the productivity cut-off independent of factor prices? How does the selection of firms into production differ across sectors and countries?

3. Free trade equilibrium. Suppose there are no variable and fixed trade costs.

   (a) Discuss the export behavior of firms. What does it imply in terms of relative sectoral prices $(P_{ic}/P_{ic'})$?

   (b) How do countries specialize? Is there always Factor Price Equalization?

4. Costly trade equilibrium. Consider a variable trade iceberg cost $\tau > 1$ and a fixed trade cost $f^x\rho_c^{\beta_i}w_c^{1-\beta_i}$. Assume $(\tau)^{\sigma-1}f^x > f$. In equilibrium, the export price, export revenues and export profits write as follows:

   $$p^x_{ic}(\varphi) = \frac{\sigma}{\sigma-1}\frac{\rho_c^{\beta_i}w_c^{1-\beta_i}}{\varphi}\tau$$
   $$r^x_{ic}(\varphi) = \left(\frac{p^x_{ic}(\varphi)}{P_{ic'}}\right)^{1-\sigma}\alpha_i R_{c'}$$
   $$\pi^x_{ic}(\varphi) = \frac{r^x_{ic}(\varphi)}{\sigma} - f^x\rho_c^{\beta_i}w_c^{1-\beta_i}$$

   where $i = 1, 2$, $c = H, F$ and $c' \neq c$.

   (a) Let us define φ^{x*}_{ic} the productivity cut-off above which firms from sector i in country c find it profitable to export to country c'. Using the two equations defining φ^*_{ic} and φ^{x*}_{ic}, show that, in the costly trade equilibrium:

   $$\varphi^{x*}_{ic} = \varphi^*_{ic}\tau\frac{P_{ic}}{P_{ic'}}\left(\frac{R_c}{R_{c'}}\frac{f^x}{f}\right)^{\frac{1}{\sigma-1}}$$

Comment (we will focus on the case when $\tau \frac{P_{ic}}{P_{ic'}} \left(\frac{R_c}{R_{c'}} \frac{f^x}{f}\right)^{\frac{1}{\sigma-1}} > 1, \ \forall i, c$ which is consistent with empirical evidence).

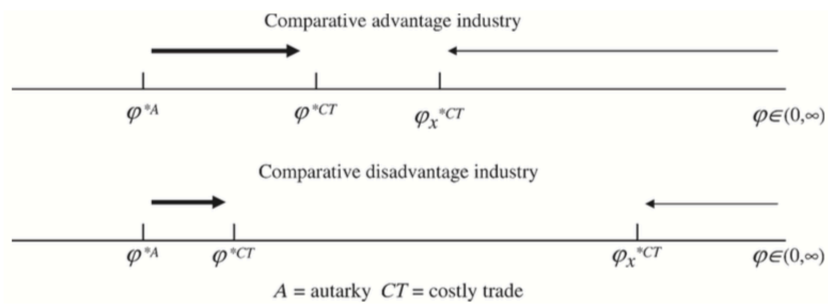
(b) In a free entry equilibrium where both sectors produce, one can show that

$$\frac{f}{\delta}\left[\int_{\varphi_{ic}^*}^{+\infty}\left[\left(\frac{\varphi}{\varphi_{ic}^*}\right)^{\sigma-1}-1\right]dG(\varphi)\right]+\frac{f^x}{\delta}\left[\int_{\varphi_{ic}^{x*}}^{+\infty}\left[\left(\frac{\varphi}{\varphi_{ic}^{x*}}\right)^{\sigma-1}-1\right]dG(\varphi)\right]=f^e$$

How does the domestic cutoff φ_{ic}^* compare with that of autarky?

(c) The equilibrium of the model is obtained using the above equilibrium conditions, together with the goods and labour markets equilibria. Figure 1 illustrates the changes in the equilibrium production and export thresholds, in autarky and in the costly trade equilibrium, in both sectors.

Figure 1: From autarky to costly trade: differential movements of the productivity cut-offs across industries



Comment on the results. Use question (4a) to relate export propensity and factor reallocation to comparative advantage.

5. Empirical evidence

(a) Table 1 provides summary statistics on the labor intensity and the propensity to export in the French Pharmaceutical and Textile industries. Comment on these empirical results in relation with the predictions of the model.

(b) Table 2 provides summary statistics on the heterogeneity of labor intensities, within sectors across firms. The third line reports the coefficient estimated when regressing the firm-specific labor intensity on a dummy equal to one if the firm exports. Comment on these results. How do they suggest the model should be amended?

Table 1: Summary statistics on labor intensity and export propensity in two French industries

	Textile	Pharmaceutical	$\frac{\text{Textile}}{\text{Pharmaceutical}}$
Mean labor intensity (Mean $1-\beta_i$)	.26	.18	1.44
Export Probability	.52	.67	.78
Export Proba to the Czech Republic	.10	.15	.67
Export Proba to Algeria	.04	.15	.27
Export Proba to Morocco	.14	.21	.67
Export Proba to Greece	.11	.22	.50
Export Proba to Hungary	.07	.13	.54
Export Proba to Austria	.15	.16	.94
Export Proba to Belgium	.33	.37	.89
Export Proba to Germany	.28	.32	.88
Export Proba to the UK	.23	.28	.82
Export Proba to Denmark	.11	.15	.73

Source: French customs, firm-level export data. The mean labor intensity is computed as the average across all firms in the industry of the ratio of each firm's wage bill over her total sales. The export probability is computed as the number of exporters over the total number of active firms in the industry. Using the notations of the model, this corresponds to $\frac{1-G(\varphi_{ic}^{x*})}{1-G(\varphi_{ic}^{*})}$, where c is France and i is either textile or pharmaceuticals. The second panel reports export probabilities to labor abundant countries while the third panel reports export probabilities to capital abundant countries.

Table 2: Summary statistics on the heterogeneity of labor intensities in two French industries

	Textile	Pharmaceutical	$\frac{\text{Textile}}{\text{Pharmaceutical}}$
Mean labor intensity (Mean $1-\beta_i$)	.26	.18	1.44
Standard deviation (StDev $1-\beta_i$)	.004	.005	0.80
Exporter Labor Intensity Premium	$-.105^{***}$	$-.034^{***}$	3.09

Source: French customs. The exporter labor intensity premium is obtained by regressing $1-\beta_i$ on a dummy equal to one if the firm exports. The standard deviations reflect the within-sector heterogeneity of firms in terms of labor intensity. In the whole population of French firms, more than 80% of the heterogeneity in labor intensities is within, rather than across, sectors.