Linder's hypothesis and heterogeneity of consumer preferences

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Abstract

The paper considers a two country trade model of monopolistic competition that features the tastes heterogeneity of consumers both within and across countries. The incorporation of heterogeneity into a monopolistic competition setting is achieved by assuming different elasticities of substitution in the CES utility function for different consumers. The key question analyzed in the paper is how consumer heterogeneity and asymmetry in country size affect the share of intraindustry trade between the destination countries.

Introduction

This paper develops a general equilibrium model of trade featuring consumer taste heterogeneity to examine the behavior of the share of intraindustry trade. The motivation of the paper is triggered by the Linder's hypothesis (Linder, 1961) which claims that across-country taste diversity impedes the volume of trade. In accordance with Linder, the more similar demand structures of two countries the more intensive is the trade between them. Any across-country difference in tastes will hamper the trade intensity. Since preference structure is unobservable, Linder assumed additionally that the average income of consumers can be used as the most important factor determining demand composition. In such a case the per capita income becomes a proxy for the demand structure, making possible to test the hypothesis by comparing average incomes and trade flows between destination countries. The idea of ours is that the consistency of Linder's hypothesis can be examined directly by using a model of demand featuring consumers with heterogeneous tastes over the same set of varieties. Accounting for the heterogeneity in tastes is achieved by assuming different elasticities of substitution in the CES utility function for different consumers and different countries. This modelling strategy is similar to that applied to a closed economy case by Osharin et al. (2014), where an attempt is made to bring together consumers' differences in incomes and tastes within the unified framework.

Model

There are two different countries in the world economy – Home and Foreign – indexed by r and s ($r, s = H, F$). The mass of consumers residing in country r is L_r, so that $L = L_H + L_F$ is the total population of the world and $\theta = L_H / L$ is the exogenously given share of consumers in home country. The economy of country r involves only one manufacturing sector supplying a continuum of horizontally differentiated varieties; N_r is the set of varieties produced in this country. Unlike standard models of monopolistic competition, consumers are supposed to be heterogeneous in their tastes. They have CES preferences but perceive varieties as being more or less differentiated, which also means that different consumers are endowed with different love for variety towards the set of varieties produced in the economy. To reflect this idea, ω_r denotes an element of the country specific space of consumers Ω_r, and μ_r denotes its measure, describing the distribution of consumers' tastes. The preferences of consumer ω_r in country r can be represented by a parameter $\sigma_r(\omega_r) > 1$ which captures how this consumer perceives the differentiated varieties. The utility function of consumer ω_r in country r is represented by

$$U_r(\omega_r) = \left(\sum_s \int_{j \in \mathrm{N}_s} (x_j^{sr}(\omega_r))^{(\sigma_r(\omega_r)-1)/\sigma_r(\omega_r)} dj \right)^{\sigma_r(\omega_r)/(\sigma_r(\omega_r)-1)}, \tag{1}$$

where $x_j^{sr}(\cdot)$ stands for the individual consumption of varieties, produced in country s and consumed in country r.

Each consumer is also a worker who is endowed with one unit of labor in both countries. Let w_r be the basic wage rate in country r, determined endogenously, then the individual income of a consumer in country r will be equal to his/her wage: $y_r = w_r$. Shipments from country r to country s are subject to transportation costs $\tau_{rs} \geq 1$, satisfying the following condition: $\tau_{rs} = \begin{cases} 1, & r = s \\ \tau, & r \neq s \end{cases}$. Taking this into account, and assuming segmentation of the product markets, the budget constraint of consumer ω_r in country r becomes

$$\sum_s \int_{j \in \mathrm{N}_s} p_j^{sr} x_j^{sr}(\omega_r) dj = y_r , \tag{2}$$

where p_j^{sr} is the price of variety j produced in country s and sold in country r. Note that due to assumed market segmentation, $p_j^{sr} \neq \tau p_j^{ss}$ in general, meaning that firms are able to price discriminate between the countries.

Maximizing the utility function (1) subject to the budget constraint (2), the individual demand function of consumer ω_r in country r for variety j produced in country s is

$$x_j^{sr}(\omega_r) = \frac{y_r}{P_r(\omega_r)} (p_j^{sr})^{-\sigma_r(\omega_r)}, \tag{3}$$

where the price aggregate in country r equals to

$$P_r(\omega_r) = \sum_s \int_{j \in N_s} (p_j^{sr})^{1-\sigma_r(\omega_r)} dj . \tag{4}$$

Note that this price aggregate is dependent on the prices of varieties produced both in domestic and foreign countries.

The technology in our model is represented through the cost function, which is of the unique-factor type. Firms produce under increasing returns and share identical technology in both countries with $f > 0$ and $c > 0$ denoting the fixed and the marginal labor requirements needed to produce q_i^{rr} units of variety i in country r for domestic consumption and q_i^{rs} units of the same variety for consumption abroad. Taking this into account, the profit of firm i in country r is given by

$$\pi_i^r = \sum_s (p_i^{rs} - \tau_{rs} c w_r) q_i^{rs} - f w_r , \tag{5}$$

where q_i^{rs} is the market demand for varieties produced in country r and consumed in country s:

$$q_i^{rs} = \int_{\Omega_s} x_i^{rs}(\omega_s) d\mu_s = y_s \int_{\Omega_s} \frac{(p_i^{rs})^{-\sigma_s(\omega_s)}}{P_s(\omega_s)} d\mu_s . \tag{6}$$

The aggregation in (6) is performed over the space of consumers Ω_s with μ_s being a measure, given on this space, $L_s = \int_{\Omega_s} d\mu_s$. Unlike the individual demands, the market demands in our model are not isoelastic because taste parameters $\sigma_s(\cdot)$ vary across consumers and countries and depend upon consumer taste distribution.

In order to get the closed form solution of the model, we simplify our analysis by assuming identical firms and homogeneous taste distributions within each of the two countries. Applying the first-order condition to profits (5) and combining short-run price equilibrium with zero profit and balance of trade conditions gives rise to the following system of equations.

$$\begin{cases} p^{rs} = (\bar{\varepsilon}^{rs} / (\bar{\varepsilon}^{rs} - 1))\tau_{rs} c w_r \\ \sum_s (p^{rs} - \tau_{rs} c w_r) q^{rs} = f w_r \\ N_r p^{rs} q^{rs} = N_s p^{sr} q^{sr} \end{cases} \tag{7}$$

for any $r, s = H, F$. These set of equations represents the general equilibrium of the model. Using wage rate in the foreign country as a numeraire, one may convert (7) to a system of seven equations for seven unknowns p^{HH}, p^{HF}, p^{FH}, p^{FF}, N_H, N_F, and w_H. Observing further that elasticity coefficients $\bar{\varepsilon}^{rs}$ can be represented as the known functions of the price and mass of firm ratios, and denoting $p_{FH} / p_{HH} \equiv \xi$, $p_{HF} / p_{FF} \equiv \zeta$, $N_H / N_F \equiv \nu$, $w_H / w_F \equiv \varpi$, the system (7) is reduced to the following system of four equations for four unknowns ξ, ζ, ν, ϖ:

$$\begin{cases} \dfrac{1-\beta^{HH}(\nu,\xi)/\gamma^{HH}(\nu,\xi)}{1-(1-\beta^{HH}(\nu,\xi))/(1-\gamma^{HH}(\nu,\xi))}\varpi^{-1}\tau = \xi \\ \dfrac{1-\beta^{FF}(\nu,\zeta)/\gamma^{FF}(\nu,\zeta)}{1-(1-\beta^{FF}(\nu,\zeta))/(1-\gamma^{FF}(\nu,\zeta))}\varpi\tau = \zeta \\ \dfrac{\theta\left(\beta^{HH}(\nu,\xi)\right)^2/\gamma^{HH}(\nu,\xi) + (1-\theta)\varpi^{-1}\left((1-\beta^{FF}(\nu,\zeta)\right)^2/(1-\gamma^{FF}(\nu,\zeta))}{(1-\theta)\left(\beta^{FF}(\nu,\zeta)\right)^2/\gamma^{FF}(\nu,\zeta) + \theta\varpi\left(1-\beta^{HH}(\nu,\xi)\right)^2/(1-\gamma^{HH}(\nu,\xi))} = \nu \\ (1-\theta)(1-\beta^{FF}(\nu,\zeta)) = \varpi\theta(1-\beta^{HH}(\nu,\xi)) \end{cases}, \tag{8}$$

where $\beta^{HH}(\nu,\xi)$, $\beta^{FF}(\nu,\zeta)$, $\gamma^{HH}(\nu,\xi)$, $\gamma^{FF}(\nu,\zeta)$ can be written in standard and special functions (the expressions for betas are put in (10) below).

The system of equations (8) is highly non-linear and does not provide an explicit solution. Nevertheless, it can be resolved numerically at a given set of exogenous parameters of the model. Using the equilibrium values of ξ, ζ, ν, ϖ, resulting from (8), one can calculate all other equilibrium parameters of the model in each of the two countries. This can be done at different values of transportation costs τ, population shares θ, and parameters σ_{H1}, σ_{H2} and σ_{F1}, σ_{F2} representing the lower and upper bounds of the preference parameters in the homogeneous taste distribution of consumers in either of the two countries.

Results

In order to see how the heterogeneity in tastes of consumers and asymmetry in country size affect the share of intraindustry trade, this share was calculated as $S = V / Y$, where V is the volume of trade (equal to the sum of exports), and Y is the gross domestic product in the world economy. By doing so, the following expression was obtained:

$$S = \frac{\theta\varpi\beta^{FH}(\nu,\xi) + (1-\theta)\beta^{HF}(\nu,\zeta)}{1-\theta+\theta\varpi}. \qquad (9)$$

The functions $\beta^{FH}(\nu,\xi)$ and $\beta^{HF}(\nu,\zeta)$ appearing in (9) have the following representations:

$$\begin{cases} \beta^{FH}(\nu,\xi) \equiv 1-\beta^{HH}(\nu,\xi) \equiv 1-\dfrac{1}{\Delta\sigma_H \ln(\xi)}\ln\left(\dfrac{1+\nu\xi^{\sigma_{H2}-1}}{1+\nu\xi^{\sigma_{H1}-1}}\right) \\ \beta^{HF}(\nu,\zeta) \equiv 1-\beta^{FF}(\nu,\zeta) \equiv 1-\dfrac{1}{\Delta\sigma_F \ln(\zeta)}\ln\left(\dfrac{1+\nu^{-1}\zeta^{\sigma_{F2}-1}}{1+\nu^{-1}\zeta^{\sigma_{F1}-1}}\right) \end{cases}, \qquad (10)$$

where $\Delta\sigma_H = \sigma_{H2} - \sigma_{H1}$, $\Delta\sigma_F = \sigma_{F2} - \sigma_{F1}$ are the differences between the maximum and minimum values of sigma parameters in homogeneous taste distributions in home and foreign countries.

The analysis of (8) and (9) carried out both analytically and numerically, shows that (independently of trade costs) the share of intraindustry trade pics at its maximum (which amounts to 50% of the world's GDP) in the case of the two symmetric countries hosting identical consumers endowed with the minimum available values of the preference parameters ($\sigma_H = \sigma_F = \sigma = 1$). This corresponds to the limiting case of the Krugman's model of trade (Krugman, 1980) having minimum admissible value of sigma parameter in the CES utility function, equal to unity. Any other configuration of consumer taste distributions and country sizes leads to a smaller trade-income ratio. The more similar countries are in size the larger is the share of intraindustry trade. So, the one of the most important finding of ours is that an intrinsic heterogeneity of consumers, providing nonzero dispersion in their taste parameters, makes unachievable the maximum value of the share of intraindustry trade. The larger the dispersion in consumers' tastes the less is the trade-income ratio. This is in line with Linder's arguing that across-country taste diversity impedes the trade intensity.

Preliminary analysis shows that the key parameter determining the share of intraindustry trade seems to be the weighted sum of the aggregated price elasticities $\bar{\varepsilon} = \theta\bar{\varepsilon}^{HH} + (1-\theta)\bar{\varepsilon}^{FF}$ in the destination countries. Our calculations show that it is negatively related with the share of intraindustry trade: the greater $\bar{\varepsilon}$ provides less S and vice versa. The aggregate price elasticity coefficients $\bar{\varepsilon}^{HH}$ and $\bar{\varepsilon}^{FF}$ appearing in $\bar{\varepsilon}$ depend upon the number of parameters (among which are the transportation costs, population shares, mass of firm ratios etc.), but the most significant impact on the magnitude of these parameters exert the average sigmas in home ($\bar{\sigma}_H$) and foreign ($\bar{\sigma}_F$) countries, correspondingly. Any reduction in the magnitude of the average preference parameters $\bar{\sigma}_H$ and $\bar{\sigma}_F$ (no matter in what particular country it occurs) automatically reduces the value of the average price elasticity $\bar{\varepsilon}$ and increases the share of intraindustry trade. As a result, the trade-income ratio turns out to be greater for the tradables facing less elastic world demand. This also means that multinational corporations in their attempts to extend the scope and intensity of intraindustry trade should be interested not only in the equalization of the preference parameters of consumers both within and across trading countries, but also in reducing their average values.

References

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