Master EPP, International Macroeconomics
New Trade Models

1 Demand and prices under Dixit-Stiglitz preferences

Consider a utility function featured by Dixit-Stiglitz preferences:

$$U = C_M; \quad C_M = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}} \quad ; \quad \sigma > 1$$

where N is the number of varieties available for consumption. Varieties i are differentiated and σ measures the elasticity of substitution between two varieties.

The consumer's aggregate nominal expenditure E is assumed exogenous. The indirect utility function can be written as:[1]

$$V = \frac{E}{P_M}$$

where P_M is the "ideal" price index associated with Dixit-Stiglitz preferences.

1. Write the consumer's utility maximization and derive the first-order conditions.

The consumer maximizes her utility under her budget constraint:

$$\begin{cases} \max_{c_i} U(c_1, ..., c_N) \\ s.t. \quad \sum_{i=1}^{N} p_i c_i \leq P_M C_M \end{cases}$$

The Lagrangian of this problem is:

$$\mathcal{L} = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}} + \lambda \left[P_M C_M - \sum_{i=1}^{N} p_i c_i\right]$$

and the first-order condition is:

$$c_j^{-1/\sigma} \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}-1} = \lambda p_j$$

2. Use the first order conditions associated with two distinct varieties to derive relative consumption. Interpretation.

[1] In economics, a consumer's indirect utility function $V(p,,w)$ gives the consumer's maximal utility when faced with a price level p and an amount of income w. It represents the consumer's preferences over market conditions. A consumer's indirect utility $V(p,w)$ can be computed from its utility function $U(c)$ by first computing the most preferred bundle $c(p,w)$ by solving the utility maximization problem; and second, computing the utility $U(c(p,w))$ the consumer derives from that bundle. The indirect utility function for consumers is analogous to the profit function for firms.

Consider two distinct varieties j and j', the first order conditions are:

$$c_j^{-1/\sigma} \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}-1} = \lambda p_j$$

$$c_{j'}^{-1/\sigma} \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}-1} = \lambda p_{j'}$$

$$\Rightarrow \quad \frac{c_j}{c_{j'}} = \left(\frac{p_j}{p_{j'}} \right)^{-\sigma}$$

In the Dixit-Stiglitz framework, the relative consumption of two distinct varieties is a function of their relative price. The elasticity of substitution (defined as $\frac{\partial c_j / c_{j'}}{\partial p_{j'}/p_j}$) is constant and equal to σ. This explains why the Dixi-Stiglitz utility function is called a "Constant Elasticity of Substitution" (CES) function.

3. Combine the previously derived relative consumption with the budget constraint to get an expression of the "ideal" price index.

Using the optimal relative consumption, the right-hand side of the budget constraint can be rewritten as:

$$\sum_{i=1}^{N} p_i c_i = \sum_{i=1}^{N} p_i c_{i'} \left(\frac{p_i}{p_{i'}} \right)^{-\sigma} = c_{i'} p_{i'}^{\sigma} \sum_{i=1}^{N} p_i^{1-\sigma}$$

and the left-hand side:

$$P_M C_M = P_M \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} = P_M c_{i'} p_{i'}^{\sigma} \left[\sum_{i=1}^{N} p_i^{1-\sigma} \right]^{\frac{\sigma}{\sigma-1}}$$

Combining both together gives:

$$P_M = \left[\sum_{i=1}^{N} p_i^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

4. Finally, conclude on optimal demands under Dixit-Stiglitz.

Using the budget constraint and the relative consumption derived in the previous questions, one get:

$$\sum_{i=1}^{N} p_i c_i = P_M C_M$$

$$\Leftrightarrow \quad c_{i'} p_{i'}^{\sigma} \sum_{i=1}^{N} p_i^{1-\sigma} = P_M C_M$$

$$\Leftrightarrow \quad c_{i'} = \left(\frac{p_i}{P_M} \right)^{-\sigma} C_M = \left(\frac{p_i}{P_M} \right)^{-\sigma} \frac{E}{P_M}$$

At the consumer's optimum, the demand for an individual variety is a function of the relative price of this variety with respect to the aggregate price index, with an elasticity σ, and the real aggregate consumption.

5. Why is the CES utility function referred to as "love for variety" preferences?

Given the optimal demand function, the utility can be rewritten as:

$$U = \left\{ \sum_{i=1}^{N} \left[\left(\frac{p_i}{P_M} \right)^{-\sigma} \frac{E}{P_M} \right]^{\frac{\sigma-1}{\sigma}} \right\}^{\frac{\sigma}{\sigma-1}}$$

Assume prices are homogeneous across goods: $p_i = p,\ \forall i$. Utility thus becomes:

$$\begin{aligned} U &= \left\{ \sum_{i=1}^{N} \left[\frac{p^{-\sigma} E}{\sum_{i=1}^{N} p^{1-\sigma}} \right]^{\frac{\sigma-1}{\sigma}} \right\}^{\frac{\sigma}{\sigma-1}} \\ &= N^{\frac{1}{\sigma-1}} \frac{E}{p} \end{aligned}$$

Thus, the same level of expenditure spread over more varieties increases utility. Utility rises with N, so in this sense, consumers love variety for variety's sake. Moreover, even if each variety is priced differently, adding a new one increases utility if prices of the existing varieties are unchanged; this is very easily seen by using the expression for the perfect price index in the discrete case.

6. Consider firms' price setting under Dixit-Stiglitz preferences. Each firm produces a symmetric variety subject to a homothetic cost function. The typical firm's objective function is revenue, $p_j c_j$ minus costs $a_m w c_j$ where w is the equilibrium wage and a_m is the firm's unit cost. What is the optimal price setting under Bertrand competition? under Cournot competition? What is the optimal price under monopolistic competition, when the number of firms is large enough so that each firm as a negligible impact on aggregate price and consumption?

Under Bertrand competition, a firm solves the following maximization program:

$$\begin{cases} \max_{p_j} \left[p_j c_j - w a_m c_j \right] \\ s.t. \quad c_j = \frac{p_j^{-\sigma}}{\sum_{i=1}^{N} p_i^{1-\sigma}} E \end{cases}$$

Substituting the demand constraint into the firm's objective and deriving with respect to p_j yields:

$$\begin{aligned} & (1-\sigma) p_j^{-\sigma} \frac{E}{\sum_{i=1}^{N} p_i^{1-\sigma}} - \frac{E p_j^{1-\sigma}}{\left[\sum_{i=1}^{N} p_i^{1-\sigma}\right]^2} (1-\sigma) p_j^{-\sigma} + \frac{a_m w E}{\sum_{i=1}^{N} p_i^{1-\sigma}} \sigma p_j^{-\sigma-1} + \frac{a_m w p_j^{-\sigma} E}{\left[\sum_{i=1}^{N} p_i^{1-\sigma}\right]^2} (1-\sigma) p_j^{-\sigma} = 0 \\ \Leftrightarrow\ & (1-\sigma)(1-s_j) + a_m w p_j^{-1} \left(\sigma - (\sigma-1) s_j\right) = 0 \\ \Leftrightarrow\ & p_j \left(1 - \frac{1}{\sigma - (\sigma-1) s_j} \right) = a_m w \end{aligned}$$

where:

$$s_j = \frac{p_j c_j}{E} = \left(\frac{p_j}{P_M} \right)^{1-\sigma} = \left(\frac{c_j}{C_M} \right)^{1-\frac{1}{\sigma}}$$

is firm j's market share. Thus, in the case of Bertrand competition, the price elasticity the firm perceived ($\varepsilon = \sigma - (\sigma - 1)s_j$) is a decreasing function of her market share. For instance, with symmetry, $s_j = 1/N$ and

$$p_j = \frac{\sigma N - (\sigma - 1)}{(\sigma - 1)(N - 1)} w a_m$$

and the mark-up decreases as long as the number of competitors increases.

Under Cournot competition, a firm solves the following maximization program:

$$\begin{cases} \max_{c_j} \left[p_j c_j - w a_m c_j\right] \\ s.t. \quad p_j = \frac{c_j^{-1/\sigma}}{\sum_{i=1}^{N} c_i^{1-1/\sigma}} E \end{cases}$$

Substituting the demand constraint into the firm's objective and deriving with respect to c_j yields:

$$\begin{aligned} & \left(1 - \frac{1}{\sigma}\right) c_j^{-1/\sigma} \frac{E}{\sum_{i=1}^{N} c_i^{1-1/\sigma}} - \frac{c_j^{1-1/\sigma} E}{\left[\sum_{i=1}^{N} c_i^{1-1/\sigma}\right]^2} \left(1 - \frac{1}{\sigma}\right) c_j^{-1/\sigma} - a_m w = 0 \\ \Leftrightarrow \quad & \left(1 - \frac{1}{\sigma}\right) c_j^{-1/\sigma} \frac{E}{\sum_{i=1}^{N} c_i^{1-1/\sigma}} (1 - s_j) - a_m w = 0 \\ \Leftrightarrow \quad & p_j \left[1 - \frac{1}{\sigma} - \left(1 - \frac{1}{\sigma}\right) s_j\right] = a_m w \end{aligned}$$

Again, in the case of Cournot competition, the price elasticity the firm perceived ($1/\varepsilon = \frac{1}{\sigma} + \left(1 - \frac{1}{\sigma}\right) s_j$) is a decreasing function of her market share. Under symmetry, the optimal price is:

$$p_j = \frac{\sigma N}{(\sigma - 1)(N - 1)} w a_m$$

and the mark-up again decreases with N.

In the particular case of monopolistic competition, each firm has a negligible share of the market ($s_j \rightarrow 0$) and both competition types yield the same optimal price:

$$p_j = \frac{\sigma}{\sigma - 1} w a_m$$

In this case, a firm's optimal price is a constant mark-up over marginal cost and does not depend upon the degree of competition. Four comments are in order. First, note that with an infinite number of atomistic competitors i.e. under Dixit- Stiglitz assumptions equilibrium pricing does not depend upon the typical firm's conjecture about other firms' reactions. Bertrand and Cournot conjectures produce the same result. While this is convenient, it is a strong assumption that rules out many interesting effects, such as the pro-competitive effect. Second, in the discrete varieties version of Dixit-Stiglitz preferences, one must assume that N is large enough to approximate ε with σ. When assuming a continuum of varieties of mass N rather than a discrete number of varieties, there are an uncountable infinity of varieties, so s is automatically zero. Third, the invariance of the Dixit-Stiglitz mark-up to changes in the number (mass) of firms is easily understood. One starts with the assumption that the number of competitors is infinite, so adding in more competitors has no effect. Infinity, after all, is a concept, not a number. Fourth, the invariance of the mark-up leads to so-called mill pricing. That is, if it costs τ_1 to ship the goods to market 1, and τ_2 to ship them to market 2, firms will fully pass the shipping costs on to consumer prices, so the ratio of consumer prices in market 1 to market 2 will be τ_1/τ_2. This is called mill pricing, or factory gate pricing, since it is as if the firm charged the same price "at the mill" or at the factory gate, with all shipping charges being born by consumers. Another way of saying this is that with mill pricing, a firm's producer price is the same for sales to all markets (see the second exercise).

2 Scale economies, Product differentiation and the Pattern of Trade (Krugman, 1980)

Motivation: Develop a model with economies of scale, product differentiation and imperfect competition explaining the pattern of international trade, notably the prevalence of intra-sectorial trade among the industrial countries.

Consider a model à la Dixit-Stiglitz in which firms can costlessly differentiate their products and equilibrium takes the form of Chamberlian monopolistic competition: each firm has some monopoly power but entry drives monopoly profits to zero.
The model has two regions with two kinds of production: agriculture, which is constant-returns sector, and manufactures, an increasing-returns sector. The agriculture sector is featured by perfect competition and zero trade cost. Its role in the model is to simplify the analysis by equalizing wages across countries. It is taken as numéraire. In the increasing-returns sector, there are a large number of potential goods, all of which enter symmetrically into demand. All individuals have the same utility function:

$$U = C_M^{\mu} C_A^{1-\mu}, \quad C_M = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 1, \quad 0 < \mu < 1$$

where C_A is consumption of the agricultural good, c_i is consumption of the ith variety of the manufacturing good and N the number of actually produced varieties, assumed to be large, although smaller than the potential range of products.
There are L individuals in the economy, each endowed with one unit of labor. In equilibrium, individual expenditure is thus equal to the wage rate. Labor is the only factor of production. The agricultural good is produced under constant returns, with one unit of labor producing one unit of good. In the manufacturing sector, all varieties are produced with the same cost function:

$$l_i = \alpha + \beta x_i$$

where l_i is labor used in producing the ith good and x_i is output of that good. α is the fixed producing cost and β the (constant) marginal cost.
Firms maximize profits, but there is free entry and exit of firms, so that in equilibrium profits will always be zero. Because firms can costlessly differentiate their products and all products enter symmetrically into demand, two firms will never want to produce the same product. At the same time, as the number of goods produced is large, the effect of the price of any one good on the demand for any other is negligible. As a result, each firm can ignore the effect of its actions on other firms' behavior. Under monopolistic competition, equilibrium is determinated.

1. Discuss the properties of the technological function in the manufacturing sector.

The technological function is composed of a fixed and a marginal costs of production. As a consequence, average cost declines at all levels of output, ie the technology features increasing returns to scale.

Equilibrium in a Closed Economy

2. Write the market-clearing conditions.

For each individual good i, aggregate demand must equal output:

$$x_i = Lc_i$$

Moreover, the labor-market equilibrium implies:

$$L = \sum_{i=1}^{N} (\alpha + \beta x_i) + L_A$$

where L_A is the quantity of labor used in the agricultural sector. Finally, in the agricultural sector, the market-clearing condition writes:

$$L_A = LC_A$$

3. Derive optimal demand functions maximizing individuals' utility.

An individual maximizes her utility subject to a budget constraint. At the aggregate level, the consumption of agricultural and manufacturing goods is the solution of:

$$\begin{cases} \max_{C_A, C_M} C_M^{\mu} C_A^{1-\mu} \\ s.t. \quad P_A C_A + P_M C_M \leq PC \end{cases}$$

where P_A, P_M and P are respectively the price index for the agricultural, the manufacturing and the composite good and C is aggregate consumption. The first-order conditions of this problem are:

$$\begin{aligned} &(1-\mu) C_A^{-\mu} C_M^{\mu} = \lambda P_A \\ &\mu C_A^{1-\mu} C_M^{\mu-1} = \lambda P_M \\ &\lambda [PC - P_A C_A - P_M C_M] = 0 \end{aligned}$$

with λ the multiplier associated with the budget constraint. The first-two conditions imply:

$$P_A C_A = \frac{1-\mu}{\mu} P_M C_M$$

which can be used in the budget constraint to get:

$$P_M C_M = \mu PC$$

$$P_A C_A = (1-\mu) PC$$

Finally, the ideal price index P can be found using the budget constraint and the optimal consumptions:

$$\begin{aligned} PC &= P \left(\frac{(1-\mu)PC}{P_A} \right)^{1-\mu} \left(\frac{\mu PC}{P_M} \right)^{\mu} \\ \Leftrightarrow \quad P &= \frac{P_A^{1-\mu} P_M^{\mu}}{(1-\mu)^{1-\mu} \mu^{\mu}} \end{aligned}$$

When the aggregate consumption is a Cobb-Douglas function of sectoral consumptions, each sector receives a constant share of aggregate expenditures ($PC = E = w$).

In the manufacturing sector, optimal consumptions on each variety can be found by solving the following program:

$$\begin{cases} \max_{c_i} C_M = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \\ s.t. \quad \sum_{i=1}^{N} p_i c_i \leq P_M C_M \end{cases}$$

As already shown in the first exercise, this gives the following inverse demand:

$$c_i = \left(\frac{p_i}{P_M} \right)^{-\sigma} C_M = \left(\frac{p_i}{P} \right)^{-\sigma} \frac{\mu PC}{P_M}$$

where the aggregate expenditure PC is equal in equilibrium to the individual's income, ie the wage rate. The ideal price index P_M is then defined by:

$$P_M = \left[\sum_{i=1}^{N} p_i^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

4. Find the equilibrium price of agricultural goods.

As the agricultural sector is perfectly competitive, equilibrium prices are equal to the marginal cost of producing:

$$P_A = w \equiv 1$$

5. Find the optimal price set by the producer of a given manufacturing variety.

Calling w the equilibrium wage, an individual producer maximizes the following profit function:

$$\pi_i = p_i c_i L - w(\alpha + \beta L c_i)$$

subject to the demand function:

$$c_i = \left(\frac{p_i}{P_M}\right)^{-\sigma} \frac{w}{P_M}$$

The first order condition of this program is:[2]

$$(1-\sigma) p_i^{-\sigma} P_M^{\sigma-1} w L = -\sigma w \beta L p_i^{-\sigma-1} P_M^{\sigma-1} w$$

which implies the following "mill-pricing" rule:

$$p_i = \frac{\sigma}{\sigma - 1}\beta$$

Note that since σ and β are the same for all firms, prices are the same for all goods: $p_i = p$.

6. Use the free entry condition and the market-clearing conditions to derive the equilibrium number of produced goods.

Under free-entry, profits are driven to zero:[3]

$$\pi_i = p_i x_i - (\alpha + \beta x_i) = 0$$

Using the mill-pricing condition, this gives the equilibrium output per firm:

$$x_i = c_i L = \frac{\alpha}{\beta}(\sigma - 1)$$

which is invariant across firms and depends on two cost parameters (α and β) and a demand parameter (σ). This is a direct and inevitable implication of the constant mark-up and free entry. A fixed mark-up of price over marginal cost implies a fixed operating profit margin ($(p - w\beta)x = px/\sigma = w\beta x/(\sigma - 1)$). Therefore, there is a unique level of sales that allows the typical firm to just break even, ie to earn a level of operating profit sufficient to cover fixed costs.

Finally, one can determine the number of goods produced by using the condition of full employment:

$$L = \sum_{i=1}^{N} (\alpha + \beta x_i) + L_A$$

$$\Leftrightarrow \quad N = \frac{\mu L}{\alpha \sigma}$$

Costly Trade Equilibrium

[2] Note that we do not need to derive P_M with respect to p_i under monopolistic competition.

[3] If profits were positive, new firms would enter the market, causing the marginal utility of income to rise and profits to fall.

Assume two countries of size L and L^*, sharing the same tastes and technologies, open to trade. Trade is perfectly free in the agricultural sector but there is a transportation cost for manufacturing goods. Transportation costs are assumed to be of the "iceberg" type: to sell one unit of good abroad, the firm has to produce $\tau > 1$ units because $\tau - 1$ units are "lost" during transportation.
An individual in the home country has a choice over N products produced at home and N^* products produced abroad. She maximizes:

$$U = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} + \sum_{i^*=1}^{N^*} c_{i^*}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\mu\sigma}{\sigma-1}} C_A^{1-\mu}, \quad \sigma > 1$$

where N^* is the number of varieties produced in the foreign country. Finally, trade costs induce market segmentation so that firms can charge different prices in their domestic and export markets.

7. Show that wages are equalized internationally under these assumptions.

International wage equality is the result of free trade and perfect competition in the agricultural sector. As this good is homogeneous, the law of one price holds ($P_A = P_A^*$) and thus, wages are equalized across countries: $w = w^* = 1$.

8. Derive the price charged on domestic and foreign sales by a domestic producer. Discuss the impact of firms' location choices on aggregate manufacturing prices.

A domestic firm $i = 1...N$ selling goods in her domestic and her foreign markets chooses prices by solving the following program:

$$\begin{cases} \max_{p_i, p_i^*} [p_i L c_i + p_i^* L^* c_i^* - \beta(L c_i + \tau L^* c_i^*) - \alpha] \\ s.t. \quad c_i = \left(\frac{p_i}{P_M}\right)^{-\sigma} \frac{w}{P_M} \\ \qquad c_i^* = \left(\frac{p_i^*}{P_M^*}\right)^{-\sigma} \frac{w^*}{P_M^*} \end{cases}$$

This gives the following optimal prices:

$$\begin{aligned} p_i &= \frac{\sigma}{\sigma-1}\beta \\ p_i^* &= \frac{\sigma}{\sigma-1}\beta\tau = \tau p_i \end{aligned}$$

In the foreign market, the CIF price is equal to the transportation cost time the FOB price, ie transportation costs are fully passed through consumer prices. Note also that the extent of price discrimination ($p_i^* - p_i = (\tau - 1)p_i$) is sustainable ie arbitrage is not profitable.
Given these pricing rules, the manufacturing price indices can be rewritten as:

$$\begin{aligned} P_M &= p \left[N + N^* \tau^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \\ P_M^* &= p^* \left[N \tau^{1-\sigma} + N^* \right]^{\frac{1}{1-\sigma}} \\ \Rightarrow \quad \frac{P_M}{P_M^*} &= \left[\frac{N/N^* + \tau^{1-\sigma}}{N/N^* \tau^{1-\sigma} + 1} \right]^{\frac{1}{1-\sigma}} \end{aligned}$$

Thus, the relative price of manufacturing goods in the domestic country is a decreasing function of the relative number of firms located in the market.

9. The equilibrium distribution of firms across countries ($s_n = \frac{N}{N+N^*}$) is determined by equalizing profits across countries. Determine s_n as a function of $s_L = \frac{L}{L+L^*}$. Interpretation.

In equilibrium, profits are equalized across countries so that no firm has an incentive to relocate from a country to another:

$$
\begin{aligned}
& p_i c_i L + \tau p_i c_i^* L^* - w(\alpha + \beta c_i L + \tau \beta c_i^* L^*) = p_{i^*}^* c_{i^*}^* L^* + \tau p_{i^*} c_{i^*} L - w^*(\alpha + \beta c_{i^*}^* L^* + \tau \beta c_{i^*} L) \\
\Leftrightarrow \quad & \left(\frac{p_i}{P_M}\right)^{-\sigma} \frac{wL}{P_M} + \tau \left(\frac{\tau p_i}{P_M^*}\right)^{-\sigma} \frac{w^* L^*}{P_M^*} = \left(\frac{p_{i^*}}{P_M^*}\right)^{-\sigma} \frac{w^* L^*}{P_M^*} + \tau \left(\frac{\tau p_{i^*}}{P_M}\right)^{-\sigma} \frac{wL}{P_M} \\
\Leftrightarrow \quad & \frac{L}{N + N^* \tau^{1-\sigma}} + \frac{\tau^{1-\sigma} L^*}{N \tau^{1-\sigma} + N^*} = \frac{L^*}{N \tau^{1-\sigma} + N^*} + \frac{\tau^{1-\sigma} L}{N + N^* \tau^{1-\sigma}} \\
\Leftrightarrow \quad & s_n = \frac{s_L - \tau^{1-\sigma}(1 - s_L)}{1 - \tau^{1-\sigma}}
\end{aligned}
$$

Note that

$$\frac{ds_n}{ds_L} = \frac{1 + \tau^{1-\sigma}}{1 - \tau^{1-\sigma}} > 1$$

so that an increase in the relative size of the domestic country leads to a more than proportional increase in the relative number of firms located in the domestic market. If both countries are of equal size ($s_L = 1/2$), the distribution of firms is homogeneous across countries ($s_n = 1/2$). However, if the domestic country is “large” with respect to the foreign one, the it can be shown that $s_n > s_L$, ie firms are more than proportionally concentrated in the large market. This is what Krugman calls the “Home Market Effect”.

The intuition is that locations that have good access to several markets offer firms a greater profit. Indeed, a region’s demand increases with the accessibility and size of this region (through the decreased price index). The profitability of firms is further enhanced by increasing returns, since the growth in their volume of production also generates a drop in their average production costs. Hence, we expect that the firms that set up in the large region enjoy higher profits than the ones installed in the small one. In the long term, the large region should therefore attract new firms, thereby heightening the inequalities between the core and the periphery. Nevertheless, as firms set up in the large region, competition there is also heightened, thereby holding back the tendency to agglomeration.