CI-CPRI

Portugal in the EU: the Perspective of Convergence

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2.2.2.1   Model of Linnemann

According to this model, exchanges between two countries are determined by an equation that uses variables like the exchange fluxes between the countries I and j (Xij), the GDP (Yi and Yj), the population (Mi and Mj) and the geographic distance (Gij), being Cij the commercial preference factor between the country i and the country j, from which results:

$$X_{ij} = \gamma_0 Y_i^{\gamma_1} M_i^{-\gamma_2} Y_j^{\gamma_3} M_j^{-\gamma_4} G_{ij}^{-\gamma_5} C_{ij}^{\gamma_6}$$ (G.1)

The signs of each coefficient reflect the negative or positive impact of the exchange fluxes. So it's easy to understand that, once logarithmized, the several γ will give the elasticity of exportations of the country i to j, considering the respective differences in terms of population, domestic income, preferences and distance separating both countries.

This is a short term static model, the values of domestic income and production are given, introduce new variables to explain exchanges doesn't bring problems; under a non-realistic but simplifying possibility, the equation of exchange fluxes can have as only exchange determinants the chosen independent variables of the general normalisation. But the model doesn't include prices, reason for significant critics all over the years.

2.2.2.2 Model of Bergstrand

Bergstrand (1985) finally introduces prices, as well as new hypothesis, to the model of Linnemann, developing the microeconomics bases of its equation.

Departs from a maximisation of individual profits and utilities on N countries, with a unique production factor in each country, to build a model of general equilibrium of international exchanges. Each consumer has a utility function with constant utility of substitution and each firm has a production function with constant elasticity of transformation. The reduced form of the model takes in consideration the transport costs, exchange barriers and all available resources to determine the exchange fluxes.

Bergstrand also adds new hypothesis under a context of partial equilibrium:
1)   The market of external exchanges is smaller than the other markets
2)   Utilities and production functions are identical in all countries
3)   A model without prices may be constructed according to new conditions:
    $\Rightarrow$ Perfect substitution between products
    $\Rightarrow$ Perfect arbitrage between products
    $\Rightarrow$ Null taxes
    $\Rightarrow$ Null transport costs

These hypotheses are very important in the construction of the gravitational equation because they simplify it. So, 1) allows Yi (j) exogenous and variations in Xij and Cij not significant over Yi (j), Cii and Cjj. 1) and 2) allow that, including a constant term and a error term distributed logarithmically, the generalised gravitational equation may be estimated using the econometric method of the mean squared errors (MSE). 3) lead to a similar model to the one of Linnemann, but being these constraints too restrictive, Bergstrand realises that the generalised gravitational equation is better.

Bergstrand develops his analysis in 1989, building a model with two countries, two industries and two products:
◊   Under no exchange risk
◊   With constant elasticity of substitution of products
◊   All firms of each industry trade at the same price under the same exportation market
◊   Using equal Cobb-Douglas utility functions

This model has several advantages. Under the traditional perspective, goods were perfect substitutable, here they aren't. Because of the inclusion of exchange rates and prices, there isn't necessarily a parity of the purchase power.

The model is also very interesting because it takes into consideration the GDP per capita (that can be positive or negative, as couldn't before) and the factors dotation (K/L), which study can explain the Intra-industry and the inter-industry fluxes, in this case between Portugal and the other state-members of the EU.

To better understand why, the equations are as follow; and for that a new nomenclature. Being:

Demand side:

The individual utility function will be:

$$U_{kt} = \left[\left(\sum_{m=1}^{M} \sum_{n=1}^{N_{wm}} X_{Wnmtk}^{\beta_w} \right)^{1/\beta_w} \right]^{\lambda} \left[\left(\sum_{m=1}^{M} \sum_{n=1}^{N_{Zm}} X_{Znmtk}^{\beta_z} \right)^{1/\beta_z} - X'_Z \right]^{1-\lambda} \qquad (G.2)$$

Two are the industries, W and Z. Each industry has n firms. X_{Wnmkt} is the production of manufactured (or non-manufactured) goods in the firm n of the industry, in an m country, wanted by a k consumer of the country t. β is an elasticity of substitution. X'_Z need a consumption minimum of the good. λ is an elasticity of substitution. The income is:

$$Y_{kt} = \sum_{\theta=W,Z} \sum_{m=1}^{M} \sum_{n=1}^{N_{\theta m}} \left(\frac{P_{\theta mt} TR_{\theta mt}}{ER_{mt}} \right) . X_{\theta nmtk} \qquad (G.3)$$

Y_{kt} is the income of consumer I, $TR_{\theta mt}$ equal to 1+ exogenous tax rate over exportations, ER_{mt} the exchange rate, $P_{\theta mt}$ and the production price of each n firm, of one the W or Z industry.

Consequently, the demand for the products of the industry W in the country t, by a firm i in the country k, will be:

$$P_{Wkt} = \lambda^{1/\sigma_w} X_{Wik}^{-1/\sigma_w} Y_t^{1/\sigma_w} (1 - y_t^{-1})^{1/\sigma_w} TR_{Wmt} ER_{mt} \left[\sum_{m=1}^{M} \sum_{n=1}^{N_{Wm}} \left(\frac{P_{Wntm} TR_{Wmt}}{ER_{mt}} \right)^{1-\sigma_w} \right]^{-1/\sigma_w} \quad (G.4)$$

Yt is the individual nominal income and $\sigma_W = 1/(1 - \beta_W)$ is the constant elasticity for imports substitution.

For getting the demand for the production of the industry B, $(1 - y_t^{-1})$ is substituted by $(1 + \frac{\lambda}{1-\lambda} y_t^{-1})$.

Offer side:

There is monopolistic concurrence because industries produce differentiated products. Both industries use the same technology and two production factors: labour (L) and capital (K). Being δ the fixed costs to produce on unity of good and α the constant needs for the production of that unity, and $L_{\theta ik}$ the labour needed for the firm i of the industry θ of the country k to produce $X_{\theta ik}$ at the same time as $K_{\theta ik}$ is the capital needed for the same purpose, than technology is reached according to the formulas:

$$L_{\theta ik} = \delta_{L\theta} + \alpha_{L\theta} X_{\theta ik} \quad (G.5)$$
$$K_{\theta ik} = \delta_{K\theta} + \alpha_{K\theta} X_{\theta ik} \quad (G.6)$$

So the offer of labour and capital is reached in the following way:

$$L_k = \sum_{n=1}^{N_{Wm}} L_{Wnk} + \sum_{n=1}^{N_{Zm}} L_{Znk} \quad (G.7)$$

$$K_k = \sum_{n=1}^{N_{Wm}} K_{Wnk} + \sum_{n=1}^{N_{Zm}} K_{Znk} \quad (G.8)$$

It's time to consider that the production is distributed according to the following elasticity of transformation (independently of being for exportation or for the domestic market):

$$X_{\theta ik} = \left[\sum_{m=1}^{M} \left(T_{\theta km} X_{\theta ikm} \right)^{\gamma_{\theta}} \right]^{1/\gamma_{\theta}} \tag{G.9}$$

$T_{\theta km}$ is the variable for the transport costs between the country k and m.

The elasticity of transformation (χ) of the production for the different markets of exports is constant and $\chi = 1/(\gamma_W - 1)$, the equilibrium is reached after the maximization of the profit function leading to the following generalised gravitational equation:

$$Q_{Wkt} = \lambda^{1+\chi_{W/\sigma_W}+\chi_W} \left(\alpha_{KW} \alpha_{LZ} - \alpha_{KZ} \beta_{LW} \right)^{-1} (Y_k^K)^{\sigma_W - 1/\sigma_W + \chi_W} \left[\alpha_{LZ} - \beta_{KZ} \left(\frac{K_k^*}{L_k^*} \right)^{-1} \right]^{\sigma_W - 1/\sigma_W + \chi_W}$$

$$Y_t^{1+\chi_{W/\sigma_W}+\chi_W} (1 - y_t^{-1})^{1+\chi_W/\sigma_W+\chi_W} T_{Wkt}^{-\sigma_W(1+\chi_W)/\sigma_W+\chi_W} TR_{Wkt}^{-\sigma_W(1+\chi_W)/\sigma_W+\sigma_W} ER_{kt}^{\sigma_W(1+\chi_W)/\sigma_W+\chi_W} \tag{G.10}$$

$$\left[\left(\sum_{m=1}^{M} \left(\frac{P_{Wkm}}{T_{Wkm}} \right)^{1+\chi_W} \right)^{1/1+\chi_W} \right]^{-\chi_W(\sigma_W-1)/\sigma_W+\chi_W} \left[\left(\sum_{m=1}^{M} \frac{P_{Wmt} T_{Wmt}}{E_{mt}} \right)^{1-\sigma_W} \right]^{-(1+\chi_W)/\sigma_W+\chi_W}$$

Q_{Wkt} is the exchange value from k to t inside the industry W and Y_k^K the GDP of k in terms of capital units.

Facing a large equation like this, Bergstrand simplifies it in the following way:

$$Q_{\theta kt} = \mu_0 Y_k^{\mu_1} Y_t^{\mu_2} y_k^{\mu_3} y_t^{\mu_4} D_{kt}^{\mu_5} B_{kt}^{\mu_6} A^{\mu_7} E_{kt}^{\mu_8} P_{\theta k}^{\mu_9} P_{\theta t}^{\mu_{10}} \tag{G.11}$$

Yk is the GDP of the country k, yk the ratio of factors dotations by the GDP. Prices are represented by $P_{\theta k}$ and $P_{\theta t}$ based in the same year. A_{Wkt} is, in the model, substituted by variables that reflect a common market with reduced taxes. Transports costs are represented by the variable of distance D_{ij} and by $(B_{kt})^2$ that show how there is a mutual frontier between the two countries; B_{kt} and C_{Aij} are also different because a mutual frontier leads to less transport costs.

But the model of Bergstrand receives critics from Péridy (1991):
- ◊ The model only considers two products and two industries, so the interpretation of α_3 is biased
- ◊ The model considers $\alpha_5 = \alpha_6 = \alpha_7 = \alpha_8$, in absolute value, but the effects that these coefficients are most probably different from each other

◊ Using indexes of aggregate prices have considerable negative consequences; the coefficients of prices and exchange rates don't seem much significant
◊ Only 40 to 80% of the variations of fluxes of trade are explained

To these remarks, two others can possibly be added since firms don't have homogenous technology all through the state-members and the exchange market isn't necessarily smaller than the other markets.

Despite these remarks, and since there is no perfect model, the Bergstrand approach seems appropriated in the context I'm dealing with.

3. Trade – Own Estimations

3.1 Analysis Over the Portuguese Evolution – Historical Resume

To better understand the context that influenced the Portuguese trade, I present here a summarized enunciation of the Portuguese events of the last twenty years.

Portugal came out wounded from the seventies because of the political and social battle resulted from the war in the overseas colonies and the subsequent revolution of the 25th of April. Years of changes obliged the new government to adopt a stabilisation policy between 77/80 under the International Monetary Found (IMF), so that domestic capitals wouldn't leave the country as much as before. Adjustments were made in the administrative prices, the external deficit was reduced and some constraint measures were imposed to imports of non-essential consumption. So that the diminishing imports would not affect the domestic demand, the state imposed a successive punctual depreciation of the escudo. This justifies the better accounts with the exterior, despite the slower growth of the economy as a whole because of the dropping investment and the fall of real wages. But the times where of international crises with higher oil prices and unemployment rates and, consequently, higher production costs and inflation rates. Portugal ended importing those crises and the exterior accounts were no longer able to function as the national prime impulse.

The Portuguese economy suffered even more in the beginning of the eighties. Especially between 83/84, repercussions were far worse than the ones after the revolution. Interest rates fallen increasing inflation rates and the exchange risk, reason for which capitals begun strongly leaving the country again. So, the Bank of Portugal signed a new arrangement with the FMI, following the prime objective of controlling the balance of payments deficit, stimulating savings and their application in domestic coin, under a deliberated protectionist policy that

limited imports and promoted exports. There was especial concern about imports and exports of technology. The crawling-peg (monthly and programmed depreciation) of the escudo returned after some time unused.

The slower growth of the productive activity of the centre of Europe was inverted in 83. The Portuguese economic recuperation only began in 85, mainly because of a positive evolution of employment, investment, domestic demand, production, real wages and inflation rate.

Portugal entered in the European Regional Block, back then called Economic European Community (CEE), on a favourable conjuncture. There was economic and politic stability and inflation control, so the economic agents had higher expectations on the markets.

There were lower oil prices allowing international expansion as well as more Portuguese exports, at the same time as the dollar dropped, diminishing the price of Portuguese imports, increasing imports. The deficit of the current transactions account increased but not much. International expansion permitted more investment, re-equilibrating firms from the previous period of crisis and increasing production as well as exports. With gains of productivity, costs dropped and inflation rates too. There were also more opportunities for employment and real wages did go up and so did consumption.

Portugal became part of the European Monetary System (EMS) in the year of 1992. The complete liberalisation of the capitals growth happened in that same August. The SEM exchange crisis conducted to adjustments of the escudo. The external environment was no longer good. The dynamic of the Portuguese domestic demand, on a context of total employment capacity, brought higher imports. Nevertheless, Portugal had gains of trade for selling at a higher price than buying and exports rose too, especially to the United Kingdom since the main partners, Spain and Germany, are living days of economic constraint.

The Unique market and the total mobility of production factors and capitals, started in 1993, since the needed competitiveness depended of productive efficiency and of some specific advantages development, not being advisable administrative barriers limiting trade. So, was of the interest of Portugal a quick convergence so that the escudo would not have to stop its real appreciation, creating as well correct incentives to the process of economic restructure. In a small open economy like Portugal the depreciation of the coin could only give short-term gains and the illusion of strong and permanent profitability, reducing the potential of economic growth for not investing in modernization at the needed levels.

Was only in the following year (1994) that the crisis environment was substituted by a new dynamic of Portuguese exports (Netherlands, Spain, France and United Kingdom), investment (mainly in the public administration) and demand, at the same time as nominal wages were controlled, inflation rates fallen