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Competition in quality inside Monetary Union: What about Intra-Industry Trade and Asymmetric Shocks?

Janique BEAULANDE *

Abstract :

We address the issues of specialisation and intra-industry trade (IIT) in the optics of monetary union introducing the role of vertically differentiated products. Indeed, those issues, when assessed with the traditional inferences for optimal currency areas, misses this important dimension. Kenen's argument for industrial diversification in national productions has been hastily translated in a need for primary share of IIT inside unions. But when considering for two-way trade in quality differentiated products, the argument for IIT inside single currency areas partially loses of its relevance. Moreover, competition without exchange rates instrument enhanced the role of non-price competitiveness factors and is likely to lead to quality specialisation. Thus, depending on the qualitative advantages distribution among countries and industries, IIT if qualitative could be even more destabilising than inter-industry trade. Indeed, external supply shocks and particularly parity changes with respect to third countries, could affect member countries in highly asymmetric ways. A theoretical trade model is developed, introducing technological investment and quality improvement, to illustrate the dynamics of quality specialisation depending on technological advantage distribution.

Résumé :

On envisage les problèmes de spécialisation et de commerce intra-branche en union monétaire en tenant compte du rôle de la différenciation qualitative de la production. Le traitement de ces problèmes par la théorie des zones monétaires optimales néglige en effet cet aspect fondamental. Le critère de diversification de Kenen a été rapidement traduit par l'importance de la part du commerce intra-branche, mais la prise en compte du commerce croisé de produits différenciés qualitativement relativise l'intérêt du commerce croisé en général. Par ailleurs, la concurrence en l'absence de l'instrument du change accroît le rôle des facteurs de compétitivité hors-prix et est susceptible de conduire à une spécialisation qualitative. Selon que les avantages qualitatifs seront ou non distribués entre pays membres, le commerce intra-branche de qualité peut être particulièrement déstabilisant. En effet, les chocs d'offre externes et en particuliers les modifications de parités vis-à-vis des pays tiers, pourraient affecter de façon très asymétrique les membres de l'union. Un modèle théorique de commerce introduisant l'investissement technologique et l'amélioration de la qualité est développé pour illustrer la dynamique de spécialisation qualitative en fonction de la distribution des avantages technologiques.

Key words : Asymmetric shocks ; monetary union ; exchange rates ; intra-industry trade ; non-price competitiveness.

* Université de Poitiers – Faculté de sciences économiques – CRIEF/MOFIB – 93, avenue du recteur Pineau – 86022 Poitiers Cedex – France – e-mail : janique.beaulande@etu.univ-poitiers.fr

Introduction

Economic literature interest on economical regulation inside monetary unions and its outcomes, occurrence and impact of asymmetric shocks between member countries, did not cease growing since the implementation of the European monetary integration process. With Euro were born a single exchange rate between member countries and third ones, a single European monetary policy and the setting-up of exogenous limits on budgetary and fiscal policy instruments. The completion of monetary unification is thus at the origin of new stakes as for the determination of optimal macroeconomic policies to regulate economic activity in member countries. The management of possible national shocks has to be done from now on without nominal exchange rate changes alternative, as national currencies inside Union have definitively disappeared[1].

In such perspective, the issue of asymmetric shocks is at the core of the debate animating economists interested in monetary union problems. Indeed, the question of single currency is generally addressed using the traditional theory of optimal currency areas (Mundell, 1961). In this literature, concerns on mutual openness (McKinnon, 1963), bilateral trade patterns and asymmetries between members countries are central. On the one hand, the sustainability and the desirability of a monetary union are reduced by the occurrence of asymmetric shocks between its members, since countries have to adjust without the exchange rate instrument. On the other hand, Kenen (1969) highlights that diversified economies - interpreted as countries having a large share of intra-industry trade in their total trade - will experience more symmetric shocks.

An abundant empirical literature has thus searched for the last years to analyse the importance of asymmetric shocks to which European economies were subjected in the past, in order to infer the risk for asymmetric shocks that will prevail inside Monetary Union[2]. The bulk of empirical studies, in the line of Bayoumi and Eichengreen (1993), conclude that shocks are highly asymmetric in Europe, except for a small group of core countries. However, the course to the single currency constitutes an important regime change which could deeply modify structures and mechanisms running in Europe. The exogeneity of shock asymmetry has thus been called into question (Boone, 1997) mainly to support that real integration should reinforce the symmetry of shocks leading EMU to be “more justifiable ex-post than ex-ante” (Frankel and Rose, 1997, 1998). With regard to bilateral trade patterns, this view goes with the conclusion of the Emerson Report[3] which asserted that comparative advantages will lose their significance as determinants of trade patterns and that industry-specific shocks would consequently affect a large number of member countries in the same way, leading to a reduction of asymmetries.

But new arguments have been developed since, sustaining the opposite position and considering the possibility of an increase in the occurrence of asymmetric shocks[4]. Indeed, in addition to the inevitable appearance of new shocks linked to the common monetary policy - henceforth external and which are likely to affect in an asymmetric way the different member countries - some authors following Krugman support the idea that integration deepening could accentuate specialisation between member states. In these conditions, productive structure divergences could emphasise asymmetry of shocks and leave European economies more exposed to sectoral shocks[5].

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[1] See Tavera (1999) for a survey of convergence issues associated with monetary union.

[2] Blanchard and Quah (1989), Masson and Taylor (1994), De Nardis, Goglio and Malgarani (1996).

[3] Emerson and al. (1991).

[4] See Fontagné (1999) for a review of literature on this subject and Levasseur (2001) on homogenisation vs. specialisation debate.

[5] Krugman, (1993), Krugman and Venables (1993) but also Levasseur (2001).

In addition, contemporary developments in empirical research highlight the importance of the nature of product differentiation in international trade: intra-industry trade can indeed arise between horizontally differentiated goods (two-way trade in varieties) as well as between vertically differentiated products (two-way trade in qualities)[6]. While the former type fits Kenen hypothesis, the latter does not exclude major differences in R&D, skills and specific factors content between high and low quality goods. Hence, a large share of intra-industry trade in products differentiated by their quality no longer ensures the symmetry of shocks. This issue proves to be of particular relevance in European Union given the increasing weight of two-way trade in vertically differentiated products[7].

The purpose of this study is to address these issues through the analysis of specialisation and intra-industry trade in the optics of monetary union and introducing the role of vertically differentiated products. This approach of product differentiation refers to non-price competitiveness factors which become all the more critical within monetary union framework[8]. Exchange rates, which the European economies adopting Euro gave up, indeed constitute basic economic policy instruments that allow dealing with potential shocks and external competitiveness losses. Research and preservation of national production competitiveness, without this major tool, then appear as essential stakes of monetary union. Non-price competitiveness usually includes the whole of elements allowing qualitative differentiation of production with respect to competitors. This differentiation is mainly promoted by R&D investments and innovation. It confers to producers a monopoly power insofar as it makes it possible selling at prices in excess compared to competitors and higher than production costs.

New growth theories have pointed out knowledge accumulation, especially achieved through R&D activities, as an essential factor of technological progress. Many studies focusing on quantitative analysis of growth factors during last decades, showed the importance of R&D accumulation contribution to growth process[9]. Econometrical analysis also exhibit significant differences in R&D impacts on market shares according to the industries and the countries[10]. R&D and the ability to generate technological progress thus prove to be essential elements for national competitiveness. But, if innovation and technological progress arise from firm competition and are above all micro-economical phenomenons, technological progress factors in an environment essentially favourable to externalities are not without consequence on international competition. These are as many factors of national competitiveness of which it seems that the different union members do not have the same availability.

Giving up their national currencies, member states of a monetary union are definitively dispossessed of the ability to modify their currency value with respect to their trading partners, in order to face shocks affecting their economy specifically. But differentiated technological evolutions can be at the origin of endogenous disturbances of industrial and national systems. These, although not constituting shocks in a strict sense, could necessitate exchange rate parity modifications in order to restore internal equilibrium but also to protect industries most exposed to technological weakness and allow them to catch up the leading economies. A model introducing the whole of competitiveness dimensions previously evoked is necessary to investigate this mechanism

[6] Abd-El-Rahman (1986).

[7] Fontagne, Freudenberg and Péridy (1997, 1998), Fontagne, Freudenberg and Ünal-Kesenci (1999).

[8] Magnier and Toujas (1993), see also Mathis, Mazier and Rivaud-Danset (1988) for a review of competitiveness determinants and the distinction between price and non-price competitiveness.

[9] Mairesse and Sassenou (1991), Joly (1993), Griliches and Mairesse (1984).

[10] Zaidman and Bovar (1993), Magnier and Toujas (1993), Harrigan (1999) and Montobbio (2003).

1. Description of the model

The model used to explore the dynamics of international specialisation, introducing non-price factors of competitiveness, is based on a 2 countries and 2 sectors ($n = 1,2$) framework[11]. It has ricardian features in its supply side characteristics as national production conditions are determined by labour and material input coefficients. Differences in production techniques then generate ricardian comparative advantages. However, analogy with the traditional trade framework is limited to those supply conditions as products are afterwards assumed to be differentiated with respect to their country of origin, following Armington assumption[12].

Thus, demand functions establish an imperfect substitutability between goods from different countries so that appearance of a comparative advantage does not lead systematically to a perfect distribution of good productions between countries, namely, to inter-industry trade. In contrast, trade is generally intra-industrial[13] and comparative advantages result in sectoral market share differences between countries. Comparative advantages are reflected in national production structures, that is, in national relative shares of each industry in global production.

In addition, price determination assumptions are used to allow the opportunity for producers to rectify their margin behaviours, in order to modify competitive conditions else than through salaries or productivities.

First, we present a simple static version of the model before adding all sources of the system dynamics[14]. In this way, we consider technical progress introduction which allows for product quality improvement. The relevance of exchange rate changes for trade specialisation is then assessed through simulations. Dynamics introduced via technical progress imply the necessity to use simulations in order to solve the model. By the way, we are interested in the transition from initial equilibrium to final one and not on this final equilibrium itself which, by hypothesis on equilibrium technical levels, is identical for both economies. Our aim is to study national deviations that may appear during the process, given that those divergences could generate cumulative movements ignored by the long term characteristics of the model.

1.1 Consumers behaviour

Representative consumers in each country maximise a constant elasticity of substitution (CES) utility function, differentiating good varieties with respect to their country of origin, according to Armington assumption. Precisely, domestic and imported good demands come from a two step optimisation program. Consumers first maximise a separable function of sub-utilities associated to different sectors, with respect to a budget constraint, in order to allocate total income between composite goods 1 and 2. Then, they divide the share allocated to each sector between imports and domestic goods, along with the sectoral maximisation problem.

The general utility function is defined as:

$$U = \gamma_1 Log(u_1) + \gamma_2 Log(u_2) \qquad \text{with } \gamma_1 + \gamma_2 = 1,$$

where u_1 and u_2 stand for the utilities associated to consumption of composite goods from industry 1 and 2, respectively and parameters γ_1 and γ_2 reflect relative preferences for each good.

[11] It is inspired by a model developed in Landesmann and Stehrer (2000).

[12] Armington (1969).

[13] However, it does not exclude *a priori* the possibility for comparative advantages to be important enough to result in the *de facto* disappearance of one good production in each economy.

[14] Presentation is made for domestic economy and variables are supplemented with * when concerning foreign economy. Given the similarity of relations for both industrie, only equations concerning industry 1 are presented.

Sub-utilities u_1 and u_2 are CES functions of domestic and imported varieties consumed for goods 1 and 2 respectively. In addition, possibility for quality differences between domestic and imported varieties is considered. To this end, a sub-utility function formulation derived from Erkel-Rousse and Le Gallo's work (2002) is adopted:

$$u_1 = \left[\theta_1 \left(y_1\right)^{\frac{\sigma_1 - 1}{\sigma_1}} + \theta_1^* \left(x_1^*\right)^{\frac{\sigma_1 - 1}{\sigma_1}} \right]^{\frac{\sigma_1}{\sigma_1 - 1}}$$

where y_1 is consumption of good 1 domestic variety, x_1^* is consumption of imported variety i.e. foreign country exports of good 1, θ_1 and θ_1^* are quality indices for domestic and imported varieties respectively and $\sigma_1 > 1$ is the elasticity of substitution between domestic and imported varieties in industry 1.

The optimal program for consumers is solved in two stages. The first one consists in the maximisation of the general utility function and provides B_1 and B_2 shares of total income (B) allocated to each composite good:

$$B_1 = P_1 Y_1 = \gamma_1 B \tag{1}$$

where Y_1 and P_1 are respectively total demand and price for composite good 1.

According to volume-price distribution of B_1 and B_2 expenditures (Hickman et Lau, 1973), we have:

$$P_1 = \left[\frac{\left(\theta_1\right)^{\sigma_1}}{\left(\theta_1\right)^{\sigma_1} + \left(\theta_1^*\right)^{\sigma_1}} \left(p_1\right)^{1-\sigma_1} + \frac{\left(\theta_1^*\right)^{\sigma_1}}{\left(\theta_1\right)^{\sigma_1} + \left(\theta_1^*\right)^{\sigma_1}} \left(p_1^{x*}\right)^{1-\sigma_1} \right]^{\frac{1}{1-\sigma_1}} \tag{2}$$

Next, each sub-utility maximisation, with respect to the budget constraint, determines domestic and imported varieties demand for goods 1 and 2:

$$y_1 = \frac{\left(\theta_1\right)^{\sigma_1}}{\left(\theta_1\right)^{\sigma_1} + \left(\theta_1^*\right)^{\sigma_1}} \left(\frac{p_1}{P_1} \right)^{-\sigma_1} \frac{B_1}{P_1} = \frac{\left(\theta_1\right)^{\sigma_1}}{\left(\theta_1\right)^{\sigma_1} + \left(\theta_1^*\right)^{\sigma_1}} \left(\frac{p_1}{P_1} \right)^{-\sigma_1} \frac{\gamma_1 B}{P_1} \tag{3}$$

$$x_1^* = \frac{\left(\theta_1^*\right)^{\sigma_1}}{\left(\theta_1\right)^{\sigma_1} + \left(\theta_1^*\right)^{\sigma_1}} \left(\frac{p_1^{x*}}{P_1} \right)^{-\sigma_1} \frac{B_1}{P_1} = \frac{\left(\theta_1^*\right)^{\sigma_1}}{\left(\theta_1\right)^{\sigma_1} + \left(\theta_1^*\right)^{\sigma_1}} \left(\frac{p_1^{x*}}{P_1} \right)^{-\sigma_1} \frac{\gamma_1 B}{P_1} \tag{4}$$

Any variety demand (domestic and imported) is consequently a decreasing function of its relative price and an increasing function of its relative quality and of total income. The greater the elasticity of substitution between varieties (σ_1), the more sensitive are varieties demands to relative prices and to relative qualities.

1.2 Production features

Production technology is given by material and labour input coefficients. A distinction is made between skilled and unskilled labour (respectively labelled by s and u).

Unit costs are defined in a traditional way as the sum of intermediate goods and labour unit costs. Capital compensation is ensured by use of a constant margin rate on labour and material costs. This frequently used assumption refers to "normal profit" concept which expresses the

producers will to maintain profit margin stability through their mark-up behaviour[15]. Production costs are thus fixed applying a margin coefficient to input unit costs (m), according to:

$$c_1 = (1 + m_1) \cdot \left(a_{11} p_1 + a_{21} p_2 + a_{l1}^s w_1^s + a_{l1}^u w_1^u \right) \quad (5)$$

with

c_1	production unit costs in industry 1,
p_1	domestic price for composite good 1,
m_1	margin rate in industry 1,
a_{11}, a_{21}	material input coefficients for industry 1,
w_1^s, w_1^u	respectively skilled and unskilled wage rates in industry 1,
a_{L1}^s, a_{L1}^u	labour input coefficients for industry 1.

Normal unit profits followed, given by:

$$\pi_1 = m_1 \cdot \left(a_{11} p_1 + a_{21} p_2 + a_{l1}^s w_1^s + a_{l1}^u w_1^u \right) \quad (6)$$

In an open economy, domestic prices are partly set by production costs described in (5) but they also hold account of imported prices. Thus, competitor product prices have to be incorporated in the relation portraying domestic prices determination[16].

Indeed, if the law of one price must hold in a perfect competition framework, trade relationships generally observed in European Union are connected little with such perfect competition. In this context, it seems appropriate to use a more general framework than the law of one price, in order to take into account the non competing formation pattern of prices. A "cost-plus" type formulation, improved with potential importation pressures exerted on prices, is thus used. Besides, this assumption allows for the opportunity to rectify producer margin behaviours so as to modify competitive conditions without requiring the use of salary or productivity adjustments.

In the absence of any difference on perceived qualities between varieties from different countries, the equilibrium prices of domestic producers on their market are given by:

$$p_1 = \alpha_1 \cdot c_1 \cdot + (1 - \alpha_1) \cdot p_1^{x*} \quad (7)$$

where α_1 is the weight of domestic production price compared to imported variety price for good 1 p_1^{x*} which is also foreign exportation price for good 1 valued on domestic market.

Goods exported by any trade partner are valued on domestic market following[17]:

$$p_1^{x*} = c_1^* \cdot e \quad (8)$$

where $e = 1/e^*$ is the exchange rate defined as the amount of domestic currency obtained for one unit of foreign currency.

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[15] We are aware that this usual assumption results in a mechanical increase in unit margin amount when wages increase and to a symmetric decrease of margins when productivity improves or when unit labour needs decrease. However, this phenomenon having no consequences on the model conclusions, we chose to preserve this assumption as it constitutes a real simplification.

[16] In this static version of the model, prices are defined without any delay and directly linked to given wage levels. The dynamic framework introduced thereafter will consider elements likely to modify wages.

[17] A similar expression to the one reflecting domestic pricing could be used for export pricing. Here, in order to simplify the model, producers are supposed to take into account imported prices when fixing prices on their domestic markets but they only considered their production costs and have no interest in foreign producer prices for export pricing decisions. The introduction of transaction costs allowing for the study of the consequences of their decrease due to monetary union is also possible in this framework which is not the case in this work.

However, relations (7) and (8) do not allow to take explicitly account of possible quality differentiation between varieties whereas one major producer interest to invest in quality improvement is the opportunity that came with quality differences to generate extra profits. Expressions (7) and (8) are therefore modified to explicitly introduce a valuation of quality differences between varieties produced. Equilibrium prices on domestic market are then supposed to be described by relation (7'):

$$p_1 = \alpha_1 \cdot c_1 \cdot \left(1 + \cdot\theta_1 \left|\frac{\theta_1 - \theta_1^*}{\theta_1 + \theta_1^*}\right|\right) + (1 - \alpha_1) p_1^{x*} \tag{7'}$$

and: $p_1^{x*} = c_1^* \cdot \left(1 + \theta_1^* \cdot \left|\frac{\theta_1 - \theta_1^*}{\theta_1 + \theta_1^*}\right|\right) \cdot e$ (8')

Accordingly, market prices are the result of production costs amplified in proportion to the quality level of goods but also depending on the quality difference with competitor goods which is normalized by the sum of qualities.

Consequently, prices will stand over their production costs when their quality improves but only if good qualities depending on country of origin are different. Whatever quality levels, if domestic and foreign product qualities are identical, domestic prices will only be determined by domestic and imported production costs. The more quality differentiation, the more producers take their quality level into account when fixing their prices.

From (7') and (8') comes out a possibility for a gap to appear between effective unit profits and their normal values π_1 and π_2 since equilibrium prices do not adjust perfectly to unit costs as defined in (5). Each sector then produces unit rents on domestic production (r^d) and on exported sells (r^x):

$$r_1^d = p_1 - c_1 \tag{9}$$

Domestic production rents are the results of a market power which allows some producers to sell beyond their production costs without experiencing market share losses. Several elements can explain the existence of a partial monopoly power in this particular framework with imperfect substitutability, among which a difference between production conditions that generate a difference in production costs. This gap between equilibrium prices and production costs can also come from an exchange rate misalignment that modify competitiveness conditions or from a quality gap between competing varieties[18].

Exported products, as well, are able to generate rents but those can only be the results of quality gap allowing producers to sell beyond their costs.

$$r_1^x = c_1 \cdot \left(1 + \theta_1 \cdot \left|\frac{\theta_1 - \theta_1^*}{\theta_1 + \theta_1^*}\right|\right) - c_1 = c_1 \cdot \theta_1 \cdot \left|\frac{\theta_1 - \theta_1^*}{\theta_1 + \theta_1^*}\right| \tag{10}$$

Total amount of rents, which will be referred thereafter as "innovational rents" or "technological profits" in contrast to "normal profits" defined in (6), is then explained by R :

$$R_1 = r_1^d \cdot (q_1 - x_1) + r_1^x \cdot x_1 \tag{11}$$

with q_1 for production of industry 1 and x_1 for exports of industry 1

[18] It can be the result of the existence of transaction costs when they are introduced in the model.

Those rents are used to promote technology improvement process (via research and development investments) which will be developed further when presenting the dynamic aspects of the model.

Producers perfectly adjust to consumers demand defined by its various components: intermediate consumptions, domestic production share of final demand and demand for exports from the second country[19].

$$q_1 = CI_1 + y_1 + x_1 \tag{12}$$

where CI_1 stands for intermediate consumption of good 1, y_1 is domestic consumption share of good 1 satisfied by domestic production and x_1 is exports of good 1, i.e. foreign final consumption share of good 1 satisfied by domestic production.

- Intermediate consumptions are defined by input-output coefficients matrix and the amount of production:

$$CI_1 = a_{11}q_1 + a_{12}q_2 \tag{13}$$

- Final consumption comes from perceived wages and from an exogenous income ensuring the existence of an autonomous expenditure[20]. This final demand is partly satisfied by domestic production, the remainder coming from the trade partner in the form of imports.

The income that determine final expenditure amount for consumption is constructed as:

$$B = W + G = \left[\left(a_{L1}^{s}w_1^{s} + a_{L1}^{u}w_1^{u}\right)q_1 + \left(a_{L2}^{s}w_2^{s} + a_{L2}^{u}w_2^{u}\right)q_2\right] + G \ ; \tag{14}$$

where W is salaries total income and G is the exogenous income,

This income has then to be optimally distributed by domestic consumers between domestic and imported varieties for both goods in accordance with (3) and (4) such as:

$$B = p_1 y_1 + p_1^{x^*} x_1^* + p_2 y_2 + p_2^{x^*} x_2^*$$

Starting from any equilibrium, dynamics is introduced by modifying a model variable assuming imperfect adjustment or by introducing a dynamic variable, both schemes implying a dynamic adjustment process of the economy as a whole.

The model we developed aims at describing evolutions of trade and specialisation conditions between two countries sharing or not a single currency, in order to assess the consequences of exchange rate loss for production specialisation in a monetary union. Moreover, we wish to introduce non-price competitiveness factors which appeared to be an essential element in international trade between developed countries. In this way, technical progress is introduced which is supposed to be generated endogenously by the system and produces in turn dynamics. Technological level is improving in both industries and both countries and gradually modifies competitiveness conditions through improving of good qualities.

[19] A demand for capital investment coming from producers and financed by a part of the profits could also be considered. Simulations were carried out including investment demands and showed that if production amounts are obviously more important and induces acceleration in the observed dynamics, the direction of evolutions and the conclusions of the simulations remain unaffected.

[20] Autonomous expenditure is required to avoid attraction of the dynamic system to a zero fix-point.

1.3 Technological progress and the system dynamics[21]

Each industry is characterised by an indicator k accounting for its "technological potential". It should be seen as a pool of cumulative technical knowledge which – given the characteristics of particular industries – is industry-specific. This technology growth is promoted by research and development (R&D) investments from each industry but also experience cumulative features. This technological level is furthermore limited to a maximum exogenously fixed.

The technological level index is modelled using a logistic function[22] :

$$\dot{k}_1 = g_{11} k_1 (1 + g_{13} I_1)(1 - k_1 / g_{12}) \tag{15}$$

with

$\dot{k}_1 = dk_1/dt$	the technological level variation in industry 1,
k_1	the technological level index in industry 1,
g_{12}	the maximum technological level in industry 1,
g_{11}, g_{13}	the logistic parameters.

g_{11} is a parameter accounting for technological improvement speed: all other things equal, the technological level will increase all the more quickly as this parameter is high.

g_{13} stands for the investment size necessary for technological level improvement in industry 1: given an invested amount, the state of technology will increase all the more quickly as this parameter is high and conversely. It thus illustrates investment efficiency.

g_{12} corresponds to the exogenously fixed maximum for technological level in industry 1 and thus translates the technological improvement potential.

The presence of the technological level index as a multiplying factor in relation (15) accounts for the assumption according to whish technological progress is subjected to cumulative forces.

In following simulations, the two countries will be differentiated according to their ability to generate technical progress from R&D investments and thus according to their aptitude to improve the state of technology. To this end, one of the economies will be supposed to require heavier investments for the same result in terms of technical progress. This technological advantage will be either industrially distributed between countries ($g_{13} > g_{13}^*$ and $g_{23} < g_{23}^*$) or concentrated ($g_{13} > g_{13}^*$ and $g_{23} > g_{23}^*$).

Technological progress in each country and each industry will then result in quality improvement of goods produced along with:

$$\dot{\theta}_1 = \xi_1 \dot{k}_1 \tag{16}$$

Another parameter (ξ) is introduced which expresses the efficacy with which the translation from accumulation of knowledge into actual quality improvement proceeds in different industries and countries.

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[21] Variables with a “dot” are differentiated with respect to time.

[22] The logistic functional form can be justify by the empirical evidence that "technological trajectories " follows this functional pattern. R&D investments spent some time to produce technological progress effects following what a phase of cumulative improvements is engaged followed again by a slowing down in the rates and step sizes by which further improvements are added to the existing stock (Dosi 1984).

Wages, assumed to be fixed until now, are going to react to the modification of production conditions related to technological progress. Indeed, they will adjust according on the one hand to the share of "innovational profits" distributed to the employees and on the other hand to a tendency towards wage equalisation between industries for every skill group. In other words, wage modifications occur in response to two different mechanisms:

- An industry-specific effect corresponding to responses in wage movements of the different skill groups to the emergence of "technological rents" or to a margin contraction (if rents are negative) in their industries. h_i^z ($z = s,u$) then accounts for the proportion of rents which are absorbed in the form of wage increases by workers of different skill categories[23]. The chosen formulation guarantees that these increases in wage rates are uniformly distributed across skill groups within an industry.
- An economy-wide but skill-group-specific effect standing for inter-industrial labour mobility assumption which leads in the long term to the disappearance of remuneration disparity between industries for given skill levels.

Wages dynamic is thus explained by the following relations:

$$\dot{w}_1^s = \frac{h_1^s \cdot R_1}{\left(a_{L1}^s + a_{L1}^u\right) \cdot q_1} - h_w^s \left(w_1^s - \overline{w}^s\right) \tag{17}$$

$$\dot{w}_1^u = \frac{h_1^u \cdot R_1}{\left(a_{L1}^s + a_{L1}^u\right) \cdot q_1} - h_w^u \left(w_1^u - \overline{w}^u\right) \tag{18}$$

where $h_1^s = h_1 w_1^s / \left(w_1^s + w_1^u\right)$; $\overline{w}^s = \left(L_1^{Ds} w_1^s + L_2^{Ds} w_2^s\right) / \left(L_1^{Ds} + L_2^{Ds}\right)$

$h_1^u = h_1 w_1^u / \left(w_1^s + w_1^u\right)$ $\overline{w}^u = \left(L_1^{Du} w_1^u + L_2^{Du} w_2^u\right) / \left(L_1^{Du} + L_2^{Du}\right)$

with

h_1	the share of « technological rents » transferred to wages in industry 1,
h_w^s, h_w^u	the adjustment parameters towards medium wages by skill level,
$\overline{w}^s, \overline{w}^u$	the medium wage for skilled and unskilled labour, respectively,
$L_1^{Ds} = a_{L1}^s q_1$ $L_1^{Du} = a_{L1}^u q_1$	skilled and unskilled labour demand in industry 1,
$L_2^{Ds} = a_{L2}^s q_2$ $L_2^{Du} = a_{L2}^u q_2$	skilled and unskilled labour demand in industry 2,

This formulation does not prohibit wage adjustments to the fall but imply that this adjustment takes place only when rents are negatives, all other things equal, which means that normal profits are not ensured any more[24]. As long as rents although decreasing remain positives, wage growth is only slowed down. Hence, the first term of wage dynamic relations stands for the relative wage rigidity within European Union.

Price dynamics is the result of the perfect adjustment of equilibrium prices set in (7) in reaction to domestic production cost evolutions on the one hand and to imported price variations on the other hand, following:

$$\dot{p}_1 = -\left[p_1 - \overline{p}_1\right] = -\left[p_1 - \left(\alpha_1 \cdot c_1 + \left(1 - \alpha_1\right) \cdot p_1^{x*}\right)\right] \tag{19}$$

[23] To simplify, a perfect symmetry with the rise as with the fall is assumed.

[24] In the case where equilibrium rents remain negatives, which is only possible if $h_i^z = 0$, wages are then perfectly rigid and labour market adjustment will occur by means of quantity changes i.e. through unemployment

Technology improvement is realised through R&D investments fed partly from « normal profits » and from "innovational profits" once distributed the share intended for wages:

$$I_1 = j_{r1}(1-h_1)R_1 + j_{\pi 1} \cdot \Pi_1 \quad (20)$$

with

j_{r1}	the propensity to invest from "innovational profits" in industry 1,
$j_{\pi 1}$	the propensity to invest from "normal profits" in industry 1,
$\Pi_1 = \pi_1 \cdot q_1$	total amount of "normal profits" in industry 1.

The R&D investment is thus achieved in each industry through profits completed by the industry itself[25]. This assumption, perfectly justified in the absence of financial market, still remain acceptable when considering the existence of such market as it translates in a simple way the principle according to which capital investments are distributed in relation to the profit opportunities offered by each industry. As part of innovational profits is distributed to employees, a $(1-h_1)$ share remains to be invested[26].

2. Simulation results

We are now turning to the exploitation of the model previously developed in order to investigate a particular case where economies A and B are supposed identical except for a difference in their R&D investments efficacy with obtaining technological progress. Industry 1 and 2 are also differentiated with respect to their labour input coefficients. This differentiation is not actually exploited in this work but help for the graphic distinction of both industries in simulation results.

Initially, our purpose is to show that faculty differences in adjusting to competitive pressures between countries are sufficient to produce disequilibrium between industrial production conditions and that, under these circumstances, qualitative advantages are likely to appear between initially identical economies. Those advantages are disappearing in the long term because of the model statements, but we already noticed that this long term equilibrium could not be considered as relevant[27]. Long term evolutions of economies ignored by the model are indeed disturbing the theoretical equilibrium determined by this model.

Trade is by assumption perfectly intra-industrial in the initial situation. Two different scenarii are presented for the evolution of trade between two countries when no using of bilateral exchange rate is made.

When technology advantages are distributed between countries, natural evolution of both economies can lead either to the preservation of intra-industrial character of trade or to specialisation and thus less intra-industry trade between considered countries, depending on producer strategies. On the other hand, when technology advantages are concentrated in one economy, natural evolution leads to a relative maintenance of intra-industry trade if not to the disappearance of the weakest economy.

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[25] Investments can be negatives when rents are strongly negatives. This amounts supposing that producers disinvest when experiencing net losses in the production process and that it can lead to a decrease in the technological potential according to (15). Technological improvement is then supposed to be reversible and if a cumulative pattern exists, it requires minimum invests as long the maximum technological level has not been reached. Actually, this returns to a situation where industry is quite simply not viable and should disappear.

[26] This implies a simplification as wages are also modifying related to an inter-industry equalisation trend: the rent share actually distributed to workers is slightly different from h_1.

[27] Our aim is not to assess growth effects on countries specialisation but only the consequences of short or medium term differentiated technological improvements between countries.

Turning to qualitative aspects, both scenarii are far from being equivalents. Indeed, the first scenario always leads to a distribution of qualitative advantages between countries while the second picture leads to a concentration of qualitative advantages in one economy.

Monetary union removes by construction the option of parity modification for currencies concerned. From this strict point of view, it can be assimilated to an irrevocable fixed exchange rate regime. From now on, exchange rate can no longer be used as adjustment variable. Competitiveness maintenance for a country experiencing a general technological delay will thus necessitate margin contractions, in the absence of costs adjustment, in order to restore competitiveness through price advantages. This mechanism, limiting investment opportunities, all the more decreases the catching up capacity of the economy.

We show in the second time that devaluation opportunity, which still existed before unification, allows for the country undergoing a competitive disadvantage to mechanically restore price competitiveness and to limit market share losses. This allows in return maintaining a sufficiently important investments amount to compensate their relative lack of efficiency.

2.1 Effects of quality improvement with no exchange rate intervention (monetary union)

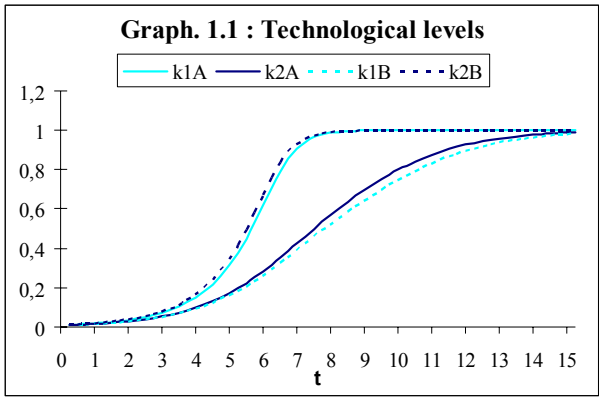
Starting with an initial equilibrium defined according to the static model, R&D investments - and technological progress that goes with it - are supposed to modify in differentiated ways the perceived quality of goods produced. Two simulations are realised considering or not a distribution of technological advantages between countries.

Distribution of technological advantages

Country A is here supposed to have a technological advantage allowing greater technological progress for a given investment amount in industry 1 while B has got the same kind of advantage in industry 2.

That means (table 1): $g_{13}^{A} > g_{13}^{B}$ and $g_{23}^{A} < g_{23}^{B}$.

Along with the logistic function characteristics which describe its evolutions, technological level primarily grows in a relatively slow way before its improving speed starts to increase quickly (graph. 1.1). Consequently, relative weakness of investment efficacy of B in industry 1 leads to a slower increase of technological level in this industry while country A in parallel suffers the same delay in industry 2. Quality improves thus faster in industry 1 for A and in industry 2 for B, leading to a symmetrical quality gap in both industries between A and B (graph. 1.3).



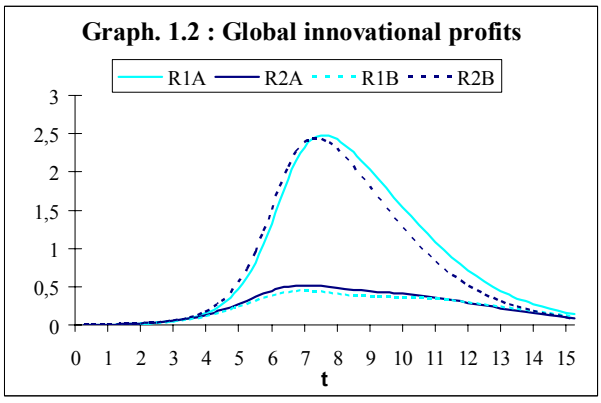


Table 1: Parameters and starting values used in the simulation

System parameters		Pays A	Pays B
Production techniques	a_{11}	0.20	0.20
	a_{12}	0.05	0.05
	a_{21}	0.05	0.05
	a_{22}	0.20	0.20
Labour coefficients	a_{l1}^s	0.50	0.50
	a_{l1}^u	1.00	1.00
	a_{l2}^s	1.00	1.00
	a_{l2}^u	1.00	1.00
Exchange rates	e	1.00	1.00
Mark-up ratios	m_1, m_2	0.20	0.20
Weights in domestic prices determination.	α_1, α_2	0.75	0.75
Propensity to invest innovational profits	j_{r1}, j_{r2}	0.50	0.50
Propensity to invest normal profits	$j_{\pi 1}, j_{\pi 2}$	0.10	0.10
Wages share of innovational profits	h_1, h_2	0.05	0.05
Intra-indus. wage equalisat° speed	h_w^s, h_w^u	0.10	0.10
Commodities share of total demand	γ_1, γ_2	0.50	0.50
Autonomous expenditure	G_1, G_2	5.00	5.00

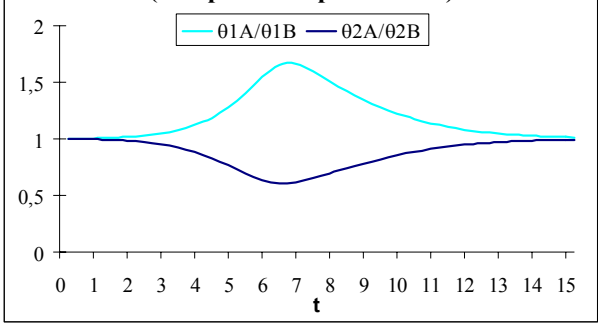
System parameters		Pays A	Pays B
Quality parameters	ξ_1, ξ_2	0.25	0.25
Maximum technological potential	g_{12}	1.00	1.00
	g_{22}	1.00	1.00
Technological potential adjustment parameters	g_{11}	0.25	0.25
	g_{21}	0.25	0.25
	g_{13}	**4.00**	**3.00**
	g_{23}	**3.00**	**4.00**

Starting values		Pays A	Pays B
Wage rates	w_1^s, w_2^s	0.50	0.50
	w_1^u, w_2^u	0.25	0.25
Quality indexes	θ_1, θ_2	0.10	0.10
Prices	p_1	0.706	0.706
	p_2	1.437	1.437
Technological potential	k_1, k_2	0.01	0.01
Productions	q_1	40.617	40.617
	q_2	21.809	21.809

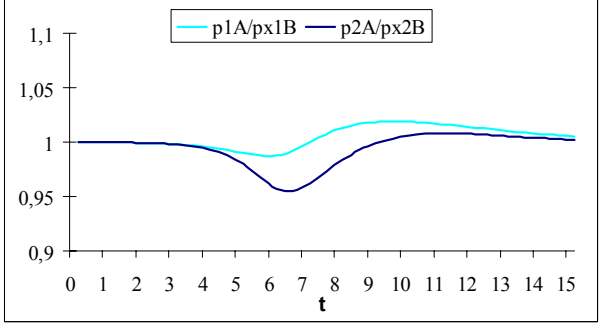
For each industry, when the technological level of the leader country gets close to its maximum, its progression rate begins to slow down, allowing for catching up of the less advanced country. This catching up process is gradually achieved since the leader country has reached its maximal technological level.

Total innovational profits (graph. 1.2) - and thus invested amounts - gradually expand with quality improvement. Country A, whose quality improves faster in industry 1, even comes to a great expansion of its profits and investments in this industry after a few periods, while B achieved this performance in industry 2. The quality gap is such as the development of those consequent profits is achieved while conquering market shares (graph. 1.6).

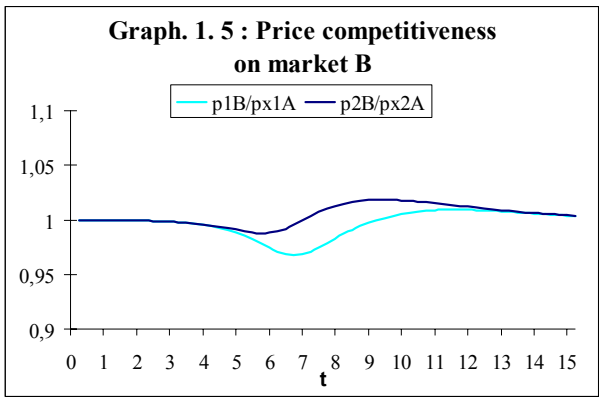
Graph. 1.3 : Relative qualities (non-price competitiveness)

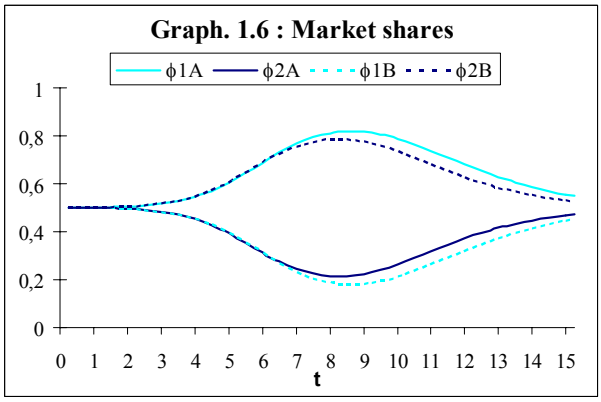


Graph. 1.4 : Price competitiveness on market A



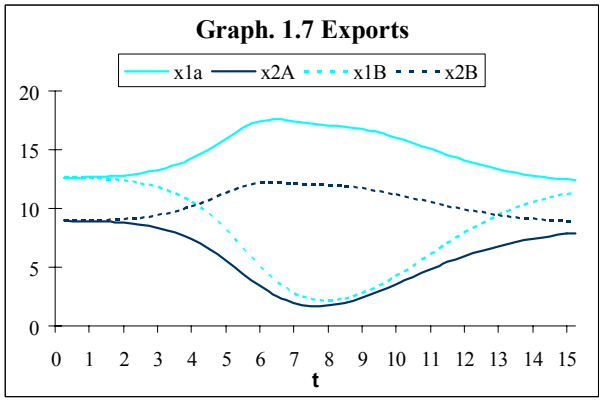
In both industries, quality gap between national varieties induce such competitive pressures that less advanced country producers are unable to obtain significant profits. Indeed, non-price competitiveness deteriorates (graph. 1.3) and the need to acquire price competitiveness in order to preserve market shares leads producers to strongly reduce their profits. This all the more limits their investment capacity and slows down always more the development of non-price competitiveness elements.

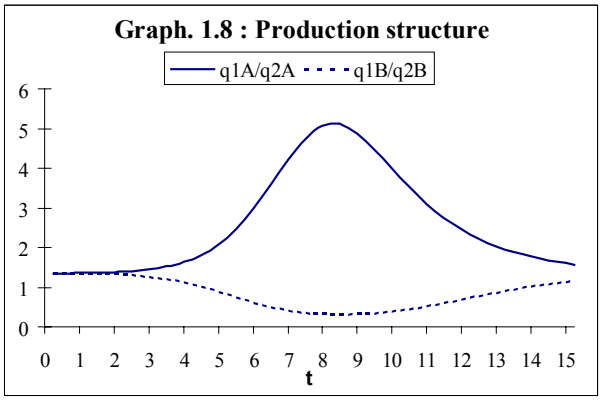




Price competitiveness on each national market is measured by the ratio of domestic producer prices over imported good prices (graph. 1.4 and 1.5). For each industry, as quality improves faster in one of the economy, selling prices in leading industries are fixed ahead of production costs and higher quality goods present a soft competitive disadvantage in terms of price on both markets. Producers of lower quality varieties are indeed forced to maintain prices close to production costs as they cannot use quality improvement to generate profits. As a result, they gradually obtain soft price competitiveness while their non-price competitiveness is strongly deteriorating. But this relative price competitiveness is far from being sufficient to preserve market shares (graph. 1.6 and 1.7).

Specialisation thus appears in the transition from initial equilibrium to final one between the two countries considered (graph. 1.6 and 1.7). Intra-industrial trade which was initially perfect – represented by equality in market shares and exportation amounts - gradually yield place to inter-industry trade. Given the distribution of industrial technological advantages between A and B, qualitative specialisation is also distributed between the economies: country A gets specialised in high quality goods of industry 1 while B concentrates its productive activities on high quality varieties in industry 2.





Specialisation is not complete and disappears thereafter, given the assumptions we made on technological level. However, this quality divergence can generate cumulative movements that are not considered in the model. Two interesting options can be considered in particular,

whether non competitive producers in each industry decide or not to give up with catching up efforts with the aim of concentrating on productivity gains and price competitiveness.

Indeed, if producers of low quality varieties in each industry decide to redirect investment efforts to productivity improvement, in order to restore their global competitiveness through price competitiveness progress, they will reduce inter-industry trade to the profit of more intra-industry trade. But this intra-industry trade will nevertheless be characterised by qualitative differentiation between goods. Precisely, country A will produce and export high quality varieties of good 1 and low quality varieties of good 2, while contrary , B will specialise in high quality goods of industry 2 and low quality goods from industry 1.

On the other hand, low quality industries in each country should quite simply disappear because of a lack of competitiveness, leading to an extreme case where trade become exclusively inter-industrial.

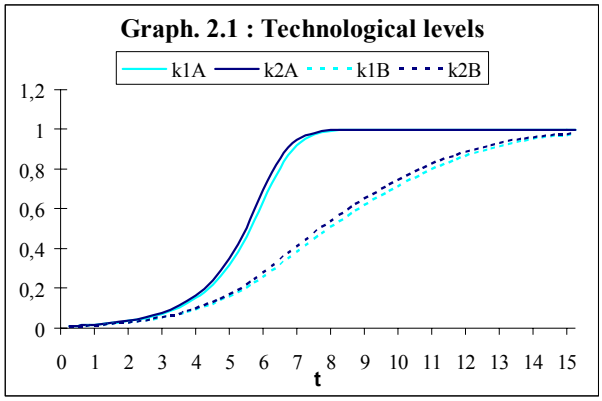
Whatever the final result, the allocation of technological advantages ensures a relative balance in the final economical situation between countries, not involving the need for bilateral exchange rate modification between A and B. Moreover, the distribution of qualitative advantages also protects those economies from asymmetric effects of potential external parity variation and generally from external supply shocks. In particular, if they belong to a monetary union, an appreciation of their common currency relative to any other one will symmetrically affect both of them.

Concentration of technological advantages

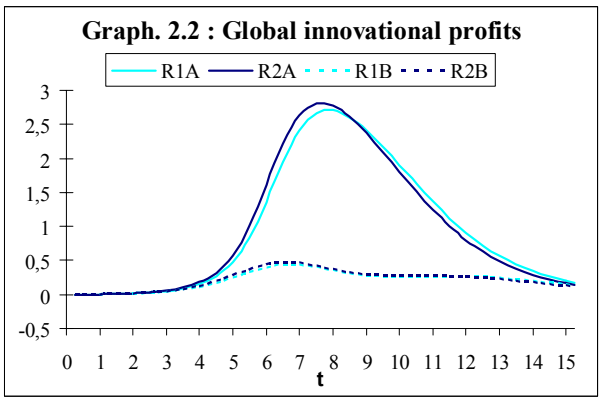
We have seen that competitiveness search, when reached by means of non price factors improvements, could generate specialisation or at least qualitative specialisation. The scenario previously investigated presumed a balanced distribution of technological advantages between countries. We are now turning to the case in which those technological advantages happened to be concentrated in one economy.

Country A is thus supposed to benefit from a technological advantage in both industries. The parameters and starting values remain identical to the preceding simulation except for technological parameters which are now chosen such as: $g_{13}^{A} > g_{13}^{B}$ and $g_{23}^{A} > g_{23}^{B}$.

That is : $g_{13}^{A} = g_{23}^{A} = 0{,}40$ and $g_{13}^{B} = g_{23}^{B} = 0{,}30$

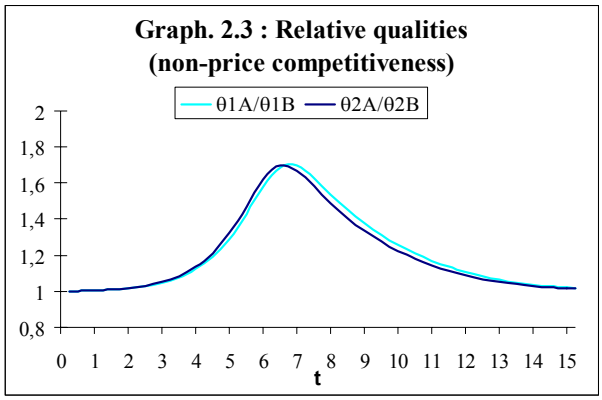


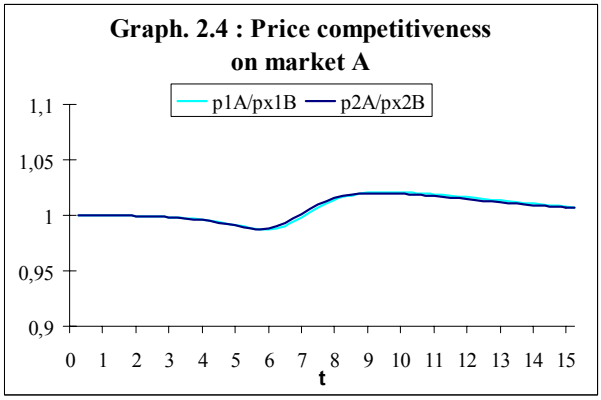
Graph. 2.1 : Technological levels



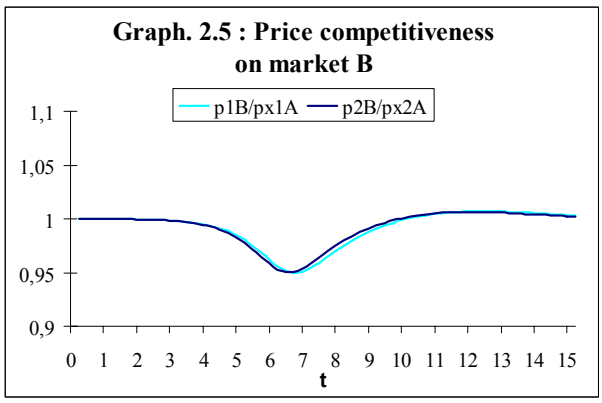
Graph. 2.2 : Global innovational profits

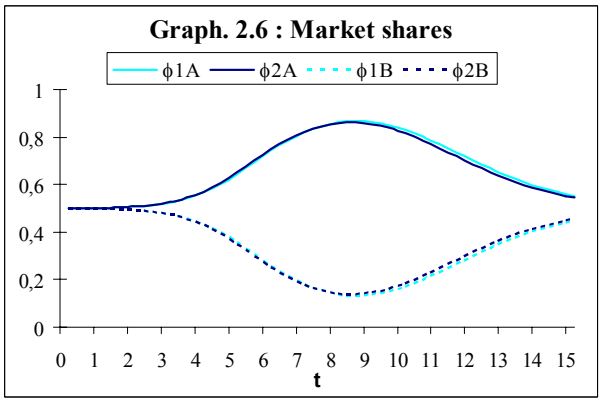
Evolution of technological progress proved to be similar to the preceding one: quality level initially grows slowly before clearly accelerating (graph. 2.1). Relative weakness of economy B in its investment efficacy leads to the digging of a quality gap between goods from the two countries (graph. 2.3), what is clearly accentuated with time in both industries.





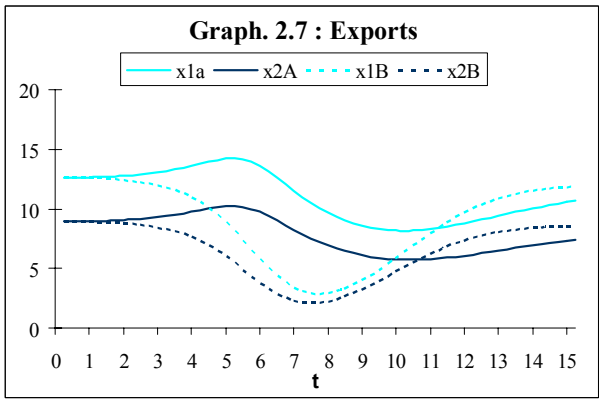
When this quality gap reached is maximum it then decreases gradually as country B carries out its catching up process in both industries. Again, innovational profits gap and hence R&D investments divergence are getting wider as country A is improving non-price competitiveness (graph. 2.2). However, this time both industries are affected in country B and country A experiences important profit expands together with market share gains (graph. 2.6) as well in industry 1 as in industry 2.

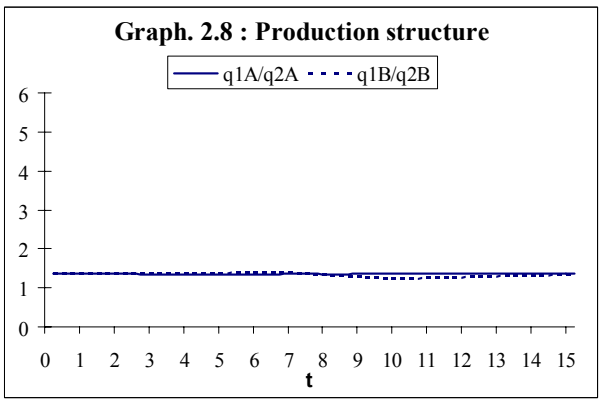




In economy B, quality increases is not sufficient whatever the industry, as competitive pressure exerted by country A prevents producers from B to produce significant innovational profits. Price competitiveness improves in a very limited way and cannot compensate for the effects of non-price competitiveness loss (graph. 2.4 and 2.5). Thus, country B is progressively losing market shares in both markets (graph. 2.6).

In this case also, a qualitative specialisation appears during the transition phase since technological progress is differentiated between countries. Nevertheless, technological advantages being concentrated in country A, the effects are finally much more serious as country B appears to be particularly touched and weakened.





Again, the non–price disadvantage undergone by country B disappears with the catching up process in the long term but it is strongly likely not to occur as producers from B will be tempted to give up with quality search to turn to productivity and price competitiveness search. If not, they would risk complete disappearance as they are engaged in a global cumulative loss of structural competitiveness. Although the production structure seems not to be affected (graph. 2.8), it reflects in reality a global competitive deficit and a generalised fall of production.

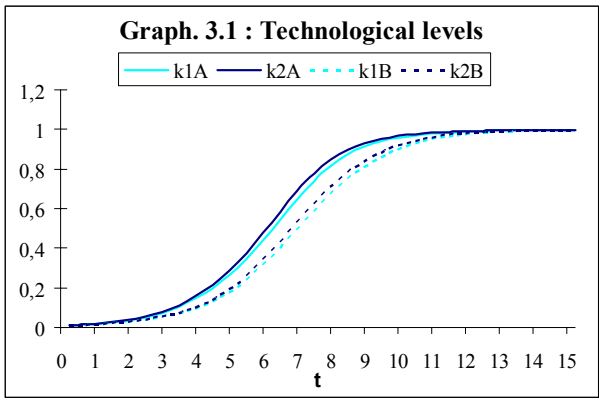
In the absence of any possible recourse to exchange rate parity changes, the producers from B will probably be brought to modify their strategy and to give up with quality catching up. They will then concentrate on price competitiveness and low quality products in order to compensate non-price disadvantages and restore market shares. This will carry out a return to more intra-industry trade in appearance but it will hide an important qualitative specialisation. Though limiting the competition pressure between countries – and thus the need for exchange rate adjustment between currencies - as they will be specialised on different segments of the quality scale, this situation will be all the more risky when considering external exchange rate with a third country. Any appreciation of a common currency with respect to any other currency will indeed result in a strongly asymmetric shock.

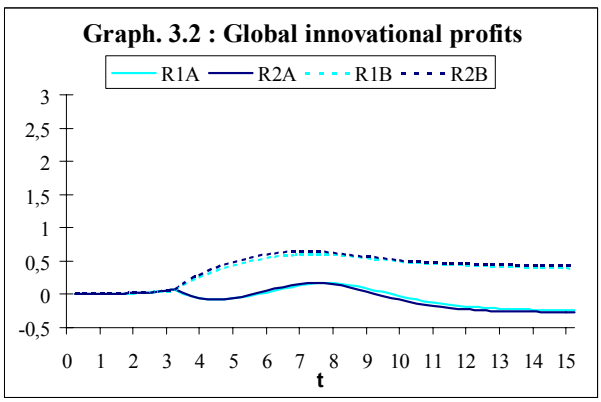
A monetary union in that case in point would certainly not be a good thing if measures aiming at compensating the loss of bilateral exchange rate adjustment are not set up. This is precisely the relevance of exchange rate adjustments in this situation we are now going to explore.

2.2 The devaluation effect in a fixed but adjustable exchange rate regime

Competitiveness when reached through quality improvements proved to be likely to generate qualitative specialisation between countries. If exchange rate interventions are of no utility when technological advantages are distributed between countries, they seem to be much more useful when those technological advantages are concentrated in one country. We turn now to the examination of this role of exchange rate movements on the technological dynamics. The opportunity to devaluate country B currency is thus introduced, this devaluation being able to intervene whatever the "announced" regime except for monetary union. It will allow for country B to sustain its general competitiveness but also will reduce – even eliminate – qualitative specialisation.

Starting with the preceding simulation, we suppose that country B is able to devaluate its currency with respect to country A. In t = 3, exchange rate is fixed to $e_A = 1{,}10$ [28]



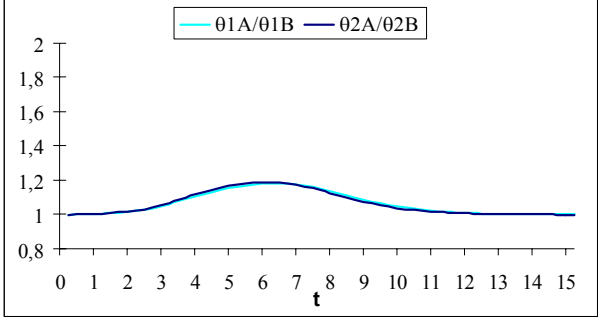


[28] This 10% value for the devaluation is the one allowing country B to remain technologically close and to limit quality gap without catching up country A. A greater value should lead to a technological advantage inversion between the two economies. Moreover, for a given result in terms of catching up, the devaluation has to be all the more important as it is carried out tardily.

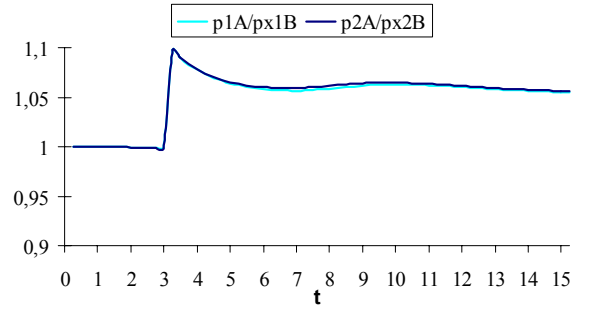
The first mechanical effect of devaluation is to generate immediate price competitiveness (graph. 3.4 and 3.5) which is sufficient to compensate the lack of non-price competitiveness it is starting to experience. Devaluation appears as a form of protection releasing producers of country B of competitive pressures exerted by country A. Country B is thus limiting market share losses while generating a slightly more important profit amount (graph. 3.2). Moreover, the devaluation emphasize competitive pressures exerted on country A whose relative quality advantage is no more sufficient and who is now led to control its prices in order to remain competitive.

Profits achieved by country B allow it to offset investment lack of efficacy more especially as country A is no longer in a position to benefit from relative quality of its good and to sell them above their production costs. Consequently, quality improvement is slowed down and country B limits to a minimum its non-price competitive disadvantage with respect to country A in both industries (graph. 3.3).

Graph. 3.3 : Relative qualities (non-price competitiveness)

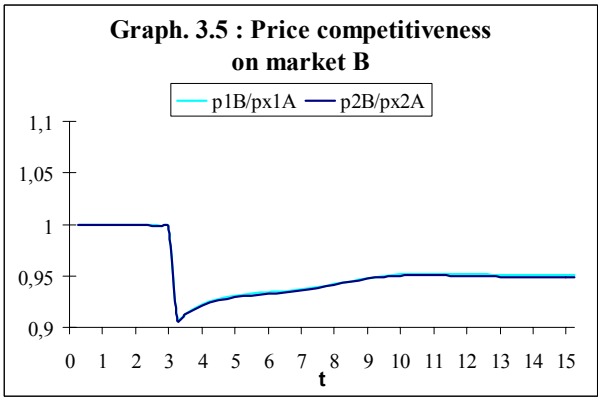


Graph. 3.4 : Price competitiveness on market A

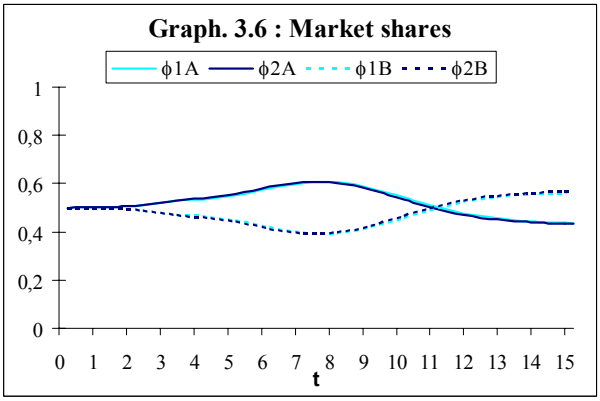


Thanks to the devaluation, country B is able to generate price competitiveness (graph. 3.4 and 3.5) despite domestic prices that are superior to imported ones. Nominal price competitiveness is thus achieved in spite of a real competitive disadvantage what allows country B to engender greater profits than does country A. This last preserve, despite that, soft non-price competitiveness (graph. 3.3) and is able - since producers control price evolution - to gain few market shares (graph. 3.6).

Graph. 3.5 : Price competitiveness on market B



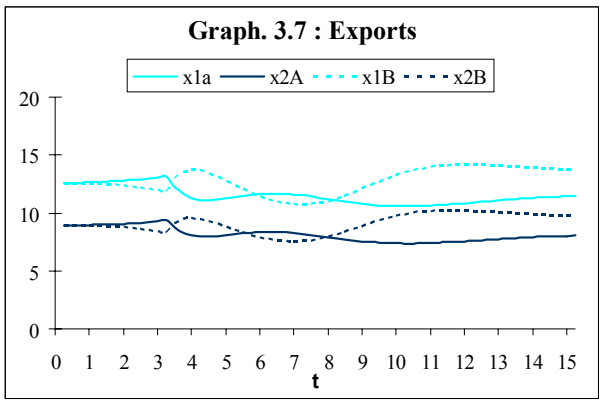
Graph. 3.6 : Market shares

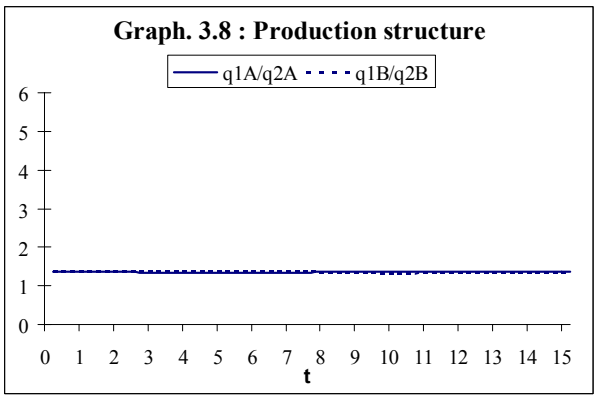


Thus, devaluation, in more of restoring global competitiveness in country B, also brings down qualitative differentiation as qualitative level between varieties from country A and B is near to identical (graph. 3.3).

More interesting still, intra-industry trade appears to be helped if not even ensured by exchange rate variations (graph. 3.7) and this intra-industrial character his achieved without qualitative

specialisation between countries, contrary to what was previously noticed in the absence of possible devaluation.





In this state of figure, intra-industry trade is based on two-way trade of mainly horizontally differentiated products. Exchange rate adjustment between countries thus ensures at the same time global competitiveness and preservation of this strictly intra-industrial nature of trade.

Conclusion

When considering for two-way trade in quality differentiated products, the argument for intra-industry trade prominence inside single currency areas partially loses of its relevance. Kenen's criterion for optimal currency area was that of production diversification and it remains crucial. Indeed, a country specialised in a very few products would be deeply disturb by a sectoral shock affecting one of its industry. But the concern for European monetary union and the assertion that European trade was mainly intra-industrial, has lead most of economic observers to concentrate on intra-industry trade importance. The symmetry of shocks was at the heart of the investigations and the argument for intra-industry trade was that countries were less exposed to asymmetric shocks if intra-industry trade was the rule in European trading relations. In fact, intra-industry trade is not crucial in the optics of monetary union, even if it protects from sectoral asymmetric shocks. Indeed, as long as countries are sufficiently diversified, any sectoral shock will not necessitate exchange rate intervention whatever the nature of trade, as the economy as a whole will be slightly affected.

Intra-industry trade argument was in reality linked to a fear of changes in production structures that member countries were likely to experience inside monetary union. This modification in the production structure appears in our simulations when qualitative specialisation and distribution of competitive advantages lead to a redistribution of activities. This could be costly if labour markets are unable to react and adjust and it explains the fear of production redistribution inside union that characterised the literature on European monetary union. But as long as competitiveness is concerned, we established that a distribution of qualitative advantages and the consequent specialisation between countries is the best way to avoid direct competition between member countries. The less the union members are in competition for trade, the less they will need exchange rate interventions. Moreover, this situation is also likely to ensure symmetry of global supply shocks effects - and particularly euro bilateral changes - as countries will all have specialised in industries were they enjoy non-price competitiveness which are less exposed to exchange rate modifications.

Conversely, intra-industry trade preservation in a context of competition without exchange rate instrument is likely to occur on a qualitative base with some countries specialised on high quality goods and other forced to specialise on low quality products. This situation leads inevitably to highly asymmetric effects of external supply shocks.

Turning to European monetary union experience, it seems evident that the options previously proposed will not constitute a choice but will more probably be the result of acquired technological advantages. Given the evidence that quality advantages are already developed in Europe and generally concentrated to the labelled “core countries”, another question is to arise. If leading countries can distribute qualitative activities depending on technological comparative advantages, “peripheral countries” could be in the situation where they concentrate all qualitative disadvantages exposing them to a great sensitivity to external shocks. It could thus be interesting to consider instruments alternative to exchange rate modifications which could help for catching up and promote acquisition by those countries of some qualitative advantages.

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