LA LETTRE DU

N° 179 – MAY 1999

CEPII

CENTRE
D'ETUDES PROSPECTIVES
ET D'INFORMATIONS
INTERNATIONALES

HIGH-TECHNOLOGY PRODUCTS: A SOURCE OF ASYMMETRY IN EUROPE ?

The creation of the monetary union has put the issue of asymmetry among member countries at the heart of Europe's econo - mic debate. An analysis of the position of the different countries in trade in high-technology products highlights a source of asymmetry which is often neglected. European countries appear to be unequally specialised in high-tech products and their positioning in product quality ranges is clearly different. Furthermore, the geographic structure of their trade does not expose them to economic shocks in a similar manner. To be sure, technological products only represent a small share of European production and trade. But, heterogeneity among European countries may lead to cumulative asymmetries, given the specifici - ties of these products and the rents they generate. This should encourage a re-examination of the objectives and means of Community structural policies

The implementation of the euro has generated a lively debate about the consequences of economic events affecting European countries differently. Given the suppression of the exchange rate as a means of adjustment, and the lack of a sizeable federal budget, Economic and Monetary Union limits macroeconomic capacity for dealing with "asymmetric shocks". Hence it is important to see whether such shocks risk being frequent and how they may be prevented. As the sources of real asymmetry lie notably in the specialisation of Member States, an analysis of intra-European trade should provide an initial response to this issue. It indicates that 60% of the trade carried out within the Union is intra-industry trade[1]: thus the relative diversity of the activities of each Member State reduces the risks of sectoral asymmetric shocks.

However, new approaches to international trade[2] qualify this conclusion. They suggest that insertion in the world economy should be looked at from a dynamic perspective, and that the type of products in which a country is specialised is not neutral. In particular, the spreads in technological content across the branches in which a country is specialised are likely to have permanent consequences for growth. Leads or lags in technology products are cumulative and have an impact on the international distribution of income: technology lies at the origin of rents. The cumulative and localised character of the production of knowledge may lead, in the long run, to a polarisation of economies. From this point of view, Europe manifests strong asymmetry across countries (be they inside or outside EMU), which merits attention. Furthermore, the positioning of countries along quality ranges must also be taken into account[3].

European Trade in High-Technology Products

However, On of the reasons there are few empirical studies in high-technology products is that they are difficult to identify using the common production and trade classifications. Markets for such technological products have very specific characteristics. The first actors present in such markets, which are subject to imperfect competition, have a strategic advantage. Technical standards play a great role and products are R&D intensive. The costs for launching a product are high, whereas the product life-cycle is getting ever shorter. Preserving intellectual property is a permanent

1. See in particular: L. Fontagné and M. Freudenberg, "L'impact du marché unique sur le commerce européen", ***La Lettre du*** CEPII, n°154, 1997 and the CEPII, ***Compétitivité des nations***, Economica, 1998.
2. See in particular, G.M. Grossman and H. Helpman, Innovation and Growth in the Global Economy, MIT Press, Cambridge, Massachusetts, 1991.
3. The 60% of intra-industry trade can be broken down into 20% trade in similar products and 40% trade in products of different quality.

problem. These specificities[4] make it difficult to identify technological products on the basis of explicit and reproducible criteria.

The definition of technological products used here is based on the work of the OECD and Eurostat[5]. Using Input-Output tables for member countries, the OECD first identified eight sectors of activity in which products embody (directly of indirectly) a high level of R&D spending[6]. Given that these sectors are aggregates, experts in both organisations subsequently used foreign trade statistics to identify high-technology products within these branches[7]. The list retained here, from these selections, contains 252 high-technology products. Trade in high-technology goods is geared primarily to production: more than 50% of this trade is in intermediate goods (component parts, modules etc.) and more than 40% is in capital goods (Table 1). High-tech products for final consumption are essentially in pharmaceuticals and medical equipment. Intermediate goods (Column 1 in Table 1) belong mainly to the electronics production chain (IT equipment, electronic components and telecommunications equipment). The second category is for the aerospace industry. Capital equipment goods are also linked to these two branches (with aerospace dominating clearly), to which measuring instruments should be included. This dominance of "intermediate goods" as broadly defined underlines the fact that the international trade in such goods is likely to generate strong feedback in terms of technical progress and growth: 94% of such technology products "return" to the productive sphere.

Table 1 - The distribution of EU high-technology trade by branch and stage of production

	Intermed.	Equip.	Consump.	Total
353 aircraft and spacecraft	6,8	15,4	0,1	**22,2**
300 office equipment and computers	14,1	2,2	0,0	**16,3**
332 instruments for measuring and checking etc.	1,9	8,6	0,0	**10,5**
322 television and radio transmitters etc.	3,7	6,3	0,0	**10,0**
244 pharmaceuticals etc.	4,8	0,0	4,0	**8,9**
321 electronic components	6,2	0,7	0,0	**7,0**
323 sound or video apparatus	0,1	3,4	0,4	**4,0**
294 machine tools	1,1	2,7	0,0	**3,8**
241 basic chemicals	3,6	0,0	0,0	**3,6**
242 agro-chemicals	3,2	0,0	0,0	**3,2**
291 machinery except cehicles	2,2	0,0	0,0	**2,2**
233 processing of nuclear fuel	1,3	0,5	0,0	**1,8**
316 electrical equipment n.e.c.	0,5	1,3	0,0	**1,7**
331 medical, surgical and orthopaedic appliances	0,0	0,2	1,4	**1,6**
312 electr. Distribution and control apparatus	1,2	0,0	0,0	**1,2**
334 optical and photographic equipment	0,6	0,4	0,2	**1,2**
313 insulated wire and cable	0,3	0,0	0,0	**0,3**
296 weapons and ammunition	0,0	0,0	0,2	**0,2**
366 miscellaneous n.e.c.	0,0	0,2	0,0	**0,2**
Total trade in high technology	**51,9**	**41,9**	**6,3**	**100**

Source: Eurostat-Comext, author's calculations.
*Su of exports and imports. The products drawn together here by industry, according to the NACE Rev-1 classification and according to the BEC classification for the production stages.

In 1996, high technology products accounted for 10% of trade by the European Union. The United States takes fully 20% of technology sales in Europe, making it the Union's largest supplier[8], followed by Germany, France, the United Kingdom and the Netherlands, whose market shares range from 13% to 6%. To be sure, the relative size of these economies partly explains this observation. With the size effect taken out, the presence of certain Asian countries is striking. Thus technology products make up between 14% and 28% of sales to Europe by the four "dragons", Malaysia and the Philippines.

In as far as high-technology products only account for a small share of trade, shocks affecting trade should only have negligible macroeconomic consequences in the short term. However, from a dynamic point of view their impact, which is strongly concentrated sectorally, risks being far more important than their static impact. It is thus useful to examine the specialisation of Member States in these activities.

Unequal Presence by Member States

Overall, the European Union has a slight comparative advantage in high-technology products (which in 1996 exceeded its total trade by 1.7%). This reflects a specialisation in these products and a commitment of resources to innovative activities. However, this European position covers very diverse national specialisations.

In 1996, only four European countries had structural surpluses with the rest of the world (Column 1 Table 2) in high-technology products. They were Sweden, France, the United Kingdom and Germany. In contrast, Portugal, Spain, Italy and Austria displayed particularly strong comparative disadvantages.

Even greater differences may be observed when an analysis of high-tech product qualities is taken into account, which represents one dimension of the innovation effort, along with product variety. To do this, quality ranges were introduced using unit values for traded products, calculated with a very detailed level of classification[9].

The overall advantage for the European Union (1.7%) for all high-tech products includes a deficit (-2.7%) in

4. For a more detailed list see OECD, ***Technology and Industrial Performance***, 1996.
5. See L. Fontagné, M. Freudenberg, and D. Ünal-Kesenci, "Haute technologie et échelles de qualité : de fortes asymétries en Europe", CEPII ***Working Paper***, 99-08.
6. Aerospace, Information Technology, electronics, pharmaceuticals, precision instruments, electrical machinery, non-electrical machinery, chemicals and arms.
7. Within production data, eight technology sectors are classified on the basis of the SITC classification, at 3 or 4 digits. The classification used for international trade statistics is the HS (the Eurostat Harmonised System), at the 6 digit level.
8. America's position in the European market is three times as great for these products as it is for other products.
9. Quality scales have a different meaning here than is usual: quality cannot be assimilated to trademark effects, in as far as intermediate goods and capital equipment goods are mainly at issue here, and not consumer goods.

Table 2 - Technology specifications of EU members, 1996

Partners / Pays	World	EU 15	Third Countries
Sweden	**12,3**	-5	**17,4**
France	**9,8**	-3,6	**13,4**
United Kingdom	**8,8**	**9,9**	-1,1
Germany	**2,4**	**3,2**	-0,8
Finland	-1,7	-10,2	**8,5**
Italy	-9,2	-9,8	**0,5**
Netherlands	-0,4	**8,9**	-9,4
Belgium-Luxembourg	-0,5	**0,6**	-1,5
Ireland	-4,8	**5,3**	-10
Denmark	-2,8	-1,6	-1,2
Austria	-8,2	-7,9	-0,3
Greece	-13,6	-11,5	-2,1
Spain	-16,2	-15,2	-1
Portugal	-16,4	-14,6	-1,9

Source: Eurostat-Comext, authors' calculations.
Note: specialisation is measured here by the contribution of products and trade partners to the trade balance. The indicator is expressed in per thousandths of the country's trade.

down-market products (i.e. established and outdated products), which is offset by surpluses (3.1‰) in up-market products (new products, at the top of the range) and mid-market products (1.2‰). Thus, the varieties exported by the Union are on average higher up the range than the varieties imported, indicating a comparative advantage in innovative activities. But, of the fifteen Member States, only the United Kingdom, Sweden and France have an advantage in the up-market, high-tech products (Table 3). France and Sweden also have an advantage in mid-market, high-tech goods, which is also the case for Finland. As for Germany, it has a very marked advantage in up-market, non-high-tech goods.

The Sources of Divergence

From the point of view of modern mechanisms for analysing economic growth and international trade, the must unfavourable configuration is a specialisation combining down-market, low-high-tech goods. Italy along with Greece, Portugal and Spain - three countries often classified as on the "periphery" of the Union are in this situation. To be sure, these countries' macro-financial records and their levels of industrial diversification have converged with the performance of Europe's "core". Nevertheless, their specialisation constitutes a source of asymmetry which is all too often neglected, and which may be potentially destabilising in the long term.

Thus, even in the case of Spain - frequently put forward as an example of successful integration in the Union from the perspective of the convergence of its productive structures - the diffusion of high-technology appears incomplete. The importation of high-tech products (which is reflected by a strong negative contribution to the trade balances of the importing countries) has, without doubt, made it possible for production processes and products to converge on those of the most advanced partners. This is especially so as high-tech products are mainly intermediate goods or capital equipment goods destined for use in production, which thus help the spread of technology. That said, such diffusion effects have not prevented the persistence of an asymmetry between Europe's "core" and "periphery".

Apart from the important differences in sectoral positioning in technology products, a second source of asymmetry results from the exposure of such activities to different external shocks. This is shown up by the geographical breakdown of the contributions by high-tech products to the trade balances of the EU-15 (Columns 2 and 3 in Table 2). Sweden, France, Finland and Italy record important surpluses with non-European countries. The high-technology sectors of these countries are thus particularly exposed to a downturn in growth outside Europe. Symmetrically, the United Kingdom, Germany, Benelux and Ireland have a comparative advantage in

Table 3 - Position of European countries according to technology and quality criteria

Position on the quality scale	High-technology	Other products
Up-market	United Kingdom Sweden France	Germany Ireland Denmark France Netherlands Sweden United Kingdom Italy
Mid-market	France Sweden Finland	Finlind Greece Portugal Austria United Kingdom Belgium-Lux. Netherlands Spain
Down-market		Greece Italy Portugal Spain

Source: Eurostat-Comext, authors' calculations.
Note: each box of the table lists those countries whose trade exhibiting both criteria provides a positive contribution of more than 3 thousandths to the trade balance. In each box, the countries are listed in decreasing order of the contribution.

intra-European trade and a deficit with respect to third countries. These countries are therefore more exposed to shocks in the European business cycle.

Rethinking Community Aid

The potential consequences of the two types of asymmetry shown up here raise the question of how they may be corrected. The principal instrument available at the Community level at present lies in the Structural

Funds (euro 195 billion in the Agenda 2000). But these Funds are geared to regions with lagging development[10], and not to countries suffering from technology lags. Furthermore, 70% of these Funds is also concentrated on "Objective 1"[11]. The use of these Funds for opening up peripheral regions, or aid to structural adjustment of old industrial heartlands is not debatable. In contrast, even if Structural Funds policies do not rule out limited intervention in support of innovative activities, their action is necessarily limited in scale. Above all, such support is concentrated in the least-favoured regions, whereas empirical studies show that growth and the accumulation of knowledge are geographically located[12], within the "favoured" regions[13].

Such conclusions thus challenge the whole horizontal education policy and the R&D aid policy of the EU, as well as the modesty of the resources allocated to these areas. The opportunities for a real policy supporting innovation in dynamic peripheral regions of the Union - combining aid to peripheral countries and capitalising on agglomeration and diffusion effects - needs to be examined. Such a policy could be grounded on horizontal Community policies under Title 3 of the budget, which is presently burdened by the CAP and the Structural Funds[14].

Lionel Fontagné
Deniz Ünal-Kesenci

Just Published

Document de travail

HAUTE TECHNOLOGIE ET ÉCHELLES DE QUALITÉ : DE FORTES ASYMÉTRIES EN EUROPE

Lionel Fontagné,
Michael Freudenberg,
Deniz Ünal-Kesenci

SECRÉTARY: 01 53 68 55 67
CEPII - 9, rue Georges-Pitard - 75015 Paris

---

10. See P. Martin, "Convergence et politiques régionales en Europe", ***La Lettre du*** CEPII, n°159, July 1997 and P. Cour and L. Nayman, "Fonds structurels et disparités régionales en Europe" ***La Lettre du*** CEPII, n°177, March 1999 - also available in English on the CEPII website: http://www.cepii.fr
11. Objective 1 corresponds to the development and structural adjustment of regions whose income is less than 75% of the Community average, see ***La Lettre du*** Cepii, n° 177, op cit.
12. See for example D.B. Audretsch and M.P. Feldman, "Knowledge Spillovers and the Geography of Innovation and Production", ***CEPR Discussion Paper***, n°953, March 1994.
13. The rationale of setting up a technology park in Crete, financed by the ERDF, may thus be questioned.
14. The CAP, the Structural Funds and Title 3 (internal policies) accounted for respectively 49%, 34% and 6% of the Community budget, in 1998.

LA LETTRE DU CEPII

EDITORIAL OFFICES

Centre d'études prospectives
et d'informations internationales,
9, rue Georges-Pitard
75015 Paris.
Tél. 33 (0)1 53 68 55 14
Fax : 33 (0)1 53 68 55 03

PUBLISHER:
Jean-Claude Berthélemy
Director fo the CEPII

CHIEF EDITORS:
Agnès Chevallier
Stéphanie Guichard

TRANSLATION:
Nicholas Sowels

DTP:
Annick Hutteau

DISTRIBUTION
La Documentation française.

SUBSCRIPTION only to the original, French version.
(11 numéros)
France FF 301.74 inc. VAT (E 46 VAT)
Europe FF 311.58 VAT (E 47.50 VAT)
DOM-TOM (NET, avion éco.)
FF 308.30 NET (E 47)
Other countries (NET, avion éco.)
FF 311.58 NET (E 47.50 NET)
Please send your orders to:
La Documentation française,
124, rue Henri Barbusse
93308 Aubervilliers Cedex
Tél. : 01 48 39 56 00.

Le CEPII est sur le WEB
son adresse : **www.cepii.fr**
ISSN 0243-1947

CCP n° 1462 AD
2nd Quarter 1999
May 1999

Imp. ROBERT-PARIS
Imprimé en France.