Industrial location in the Euro-Mediterranean area :

Market access vs. production costs

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Abstract : Integration could have significant impact on the location of industries. The purpose of this article is to offer an empirical assessment of the industrial location among countries of the euro-mediterranean area. These countries differ in productivity, wages and market potential. Our first aim is to investigate whether traditional and new theoretical forecasts can explain industrial location in such heterogeneous areas. The second aim of this paper is to examine the futur of low-technlogy industries implanted in the Euromed area. Will they be located in other more competitive regions or will they remain in the Euromed area to benefit from the easier access to the large european market ?

Using a two-way panel data model, we estimate the geographical distribution of industries accross 16 countries, 25 sectors and 16 years. The relevance of traditionnal and recent theories depends on countries' and industries' characteristics. The location of demand matters for determining the "North's" industrial specialisation and the location of high-technology industries. However, to explain the geographical distribution of low-techonology firms and to understand "South's" specialisation, both approaches are relevant. Easy access to the european market can not keep low-technology industries in mediterranean countries, however it can allows them to diversify their industrial production.

Keywords : integration, specialisation, concentration, economic geography, panel data, location

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1 Introduction

In the last few years, many free trade agreements have been negotiated between unequally developed countries (the enlargement of the European union, the NAFTA[1] and so on). Since the middle of the Nineties, the European Union and the Mediterranean countries have been engaged in a vast integration project seeking to create the establishment of a free trade area by 2010.

Integration influences the spatial distribution of activities within integrated zones. New theories of international trade as well as new approaches in economic geography underline the tendency of industry to agglomerate on a vast market after a drop in transportation costs (Krugman, 1980, 1991). Much of the literature suggests that economic integration may lead to concentration and unequal regional development (Krugam, 1991; Krugman and Venables, 1995). Empirical analyses seeking to confirm this phenomenon (Brülhart and Traeger, 2005; Amiti, 1999) frequently consider Europe and the United States. Few empirical articles have considered the distribution of activities in heterogeneous areas[2]. However, in the case of North-South integration, differences in production costs between countries influence the location of industries as does market size (Amiti, 2005; Epifani, 2005; Strauss-Kahn, 2005). In the presence of cost advantages, firms tend to disperse when trade costs achieve low values. Comparative advantages can also lead to the dispersion of industries, with some sectors located in the North and others in the South (Ricci, 1999). So what is the impact of North-South integration on the spatial distribution of industries?

The Euro-Mediterranean area is very heterogeneous and so constitutes an interesting framework for this analysis. Following 'North-South' integration, firms will choose between various possible locations. The comparatively small local market or insufficient labour

[1] In 1994, Canada, the United States and Mexico launched the North American Free Trade Agreement (NAFTA) and formed the world's largest free trade area.

[2] Hanson (1998, 2005) studies the effects of trade liberalisation between Mexico and the United States.

productivity can slow industrial development in the 'South'. Yet equally, low wages can attract some sectors to the 'South'. So, will there be a geographical concentration of all industries in one localisation or will industries be dispersed across the integrated zone ?

Integration has important economic repercussions. The convergence of industrial structures and incomes within this zone will depend on the spatial distribution of industries and on countries' specialisation choices (Bensidoun, Gaulier and Ünal-Kensenci, 2001). Countries not only need to retain firms but also to privilege the establishment of high growth potential industries.

First, the article propose a descriptive analysis of the spatial distribution of industries in a large sample of countries belonging to the Euro-Mediterranean area. To do so, comprehensive datasets need first to be constructed. No study has yet been devoted to such a heterogeneous sample of countries.

One aim of the paper is then to investigate whether traditional and new theoretical forecasts can explain the geographic distribution of industries observed in the descriptive analysis. Unlike many other analyses, this question is addressed here using recent panel data models.

The other aim of the paper is to anticipate the future of low-technology industries implanted in the Euro-Mediterranean area. In the context of trade liberalisation, these firms could be tempted to locate to more competitive countries (such as Asian countries for example). However, easier access to the European market could also incite them to remain located in Mediterranean countries.

This study differs from existing literature in several respects. Firstly, the paper studies industrial location and specialisation in an area composed of highly heterogeneous countries. They differ in terms of wages, productivity, and market size. Secondly, unlike other similar approaches (Amiti, 1999), the location quotient is used to evaluate specialisation within this

area. This index means more information can be exploited. Three sets of observation are used in the data (industries, countries, and year) instead of two as is more generally the case. Finally, we use Fields' decomposition method (Fields, 2003) to ascertain the relative importance of each explicative variable in explaining the spatial distribution of industries.

The remainder of the paper is organised as follows : the next section gives a brief survey of the recent theoretical and empirical literature on industrial agglomeration. In section 3, various concentration indexes are used to evaluate the degree of geographical concentration of industries in the Euro-Mediterranean area. Section 4 details the empirical models and the econometric procedure. The results are discussed in section 5, then conclusions drawn in the final section.

2 The underlying theory and the empirical literature

New models of international trade (Krugman, 1980; Krugman and Venables, 1990), and more recently New Economic Geography models (NEG), have helped explain the link between integration and the uneven distribution of activities. Theorists have made progress in modelling location forces attributable not to spatial heterogeneity but to the interplay of market forces and transport costs in homogeneous places.

In Krugman's work (1980), the concentration of activities in a single location following integration is explained by the presence of increasing returns to scale, a difference in the market size of the countries and positive transport costs. By being close to a vast market, firms benefit from high demand. Krugman (1980) also evokes 'a home market effect', with countries being net exporters of goods for which there is keenest domestic demand.

In more recent NEG models, the degree of clustering of firms results from a trade-off between several 'centripetal' and 'centrifugal' forces. In centre-periphery (CP) models

(Krugman, 1991; Fujita, Krugman and Venables, 1999), pecuniary externalities[3] trigger the endogenous agglomeration of activities. Following trade liberalisation, industries and workers will concentrate and initiate the 'circular causality process' leading to the creation of a "core-periphery" structure. In the vertical-linkage version of the CP model, the 'input-output' relationship between firms triggers the endogenous agglomeration process (Venables, 1996; Krugman and Venables, 1995). Labour immobility, and the wage differential this generates, constitute a dispersive force in the models. Very low transport costs induce firms to settle in the periphery and so leads to income convergence between the areas. The authors thus underline the U-shape relation between integration and convergence.

The complexity of the 'core-periphery' approaches and their incapacity to produce clear analytical results gave rise to a new type of modelling. By proposing the 'Footloose capital' model, Martin and Rogers (1995) cut both demand-link and cost-link circular causality. In this approach, the mobile fixed cost (the capital) repatriates all of its earnings to its country of origin. Thus capital concentration is not synonymous with the concentration of workers (and of expenditure), and so the agglomeration is no longer self-reinforcing. Forslid and Ottaviano (2003) and Forslid (1999) propose 'the Footloose Entrepreneur model' and partially reintroduce the 'cumulative agglomeration process'. The concentration of the mobile factor (the 'human capital') generates demand-link and supply-link circular causality[4].

The need to explain the difference in industrial structure between very similar countries means that little attention has been paid to the interplay between comparative advantages and agglomeration. However, there are a few exceptions. Krugman and Venables (1990) consider a model in which countries differ both in terms of factor endowments and their market size. Although in the first stage of trade liberalisation agglomerative forces work against comparative advantage, each country ends up specialising in their comparative

[3] Emanating from the link between supply and demand.

[4] The process is indeed less systematic because only a part of the expenditure moves and follows the production.

advantage industry. Amiti (2005) embeds Heckscher-Ohlin features within a vertical-linkage version of the CP model. Firms differ in factor intensities and choose to locate either in a labour-abundant country or a capital-abundant country. She shows that lower trade costs can generate an agglomeration of all upstream and downstream firms in one country. However for some ranges of trade costs, labour-intensive industries may locate in capital-abundant countries.

Forslid and Wooton (2003) and Strauss-Kahn (2005) analyse the tension between agglomerative forces and a Ricardo-type comparative advantage. Forslid and Wooton (2003) introduce technological differences in Krugman's (1991) model. They show that if trade costs are sufficiently low, comparative advantage favours the dispersion of industries. Strauss-Kahn (2005) simultaneously integrates the vertical linkages and a difference in cost of production factors between countries in an economic geography model. Whereas the agglomeration of activities is observable for intermediate trade costs following integration, comparative advantages and the need to satisfy demand induces firms to disperse. In these different models, the location of industries is jointly determined by market access and differences in production costs.

There is an extensive body of empirical literature that seeks to check these various theoretical precepts. Numerous researchers have examined the data looking for evidence of geographic concentration patterns in Europe, using sectoral output or employment data (Kim, 1995; Amiti, 1999; Aiginger and Pfaffermayr, 2004; Brülhart, 2001a, 2001b, 2004; Dumais, Ellison and Glaeser, 2002). It has proven difficult to distil strong stylised fact from this research as studies differ quite strongly in the data and measures they employ. The majority of these analyses suggest a slow increase in the concentration of European industrial geography. However, some authors evoke a decreasing trend in geographic concentration (Aiginger and Pfaffermayr, 2004; Midelfart-Knarvik *et al*, 2002).

These descriptive approaches have been complemented by an econometric analysis (Amiti, 1999; Haaland, Midelfart Knarvik and Torstensson, 1999; Rosenthal and Strange, 2001). The authors have checked whether agglomeration (measured by concentration indexes) is consistent with predictions of NEG models or other trade theories. These approaches consist in regressing the indexes on proxy variables of trade costs, increasing returns and vertical linkages, while controlling for other more traditional sources of agglomeration (factor endowments, technology, etc.). Kim (1995) regresses Gini indexes calculated at various dates (1880, 1914, 1947, 1967 and 1987) on a proxy for internal scale economies, resource intensity variable and on industry and year fixed effects. His study shows the positive impact of scale economies and so supports NEG models. Using a very similar approach, Amiti (1999) arrived at the same conclusion. High-scale economy firms as well as a high proportion of intermediate goods industries increased their geographical concentration between 1968 and 1990. On the contrary, Brülhart (2001a) finds no significant correlation between measures of increasing returns and agglomeration whereas Haaland *et al* (1999) underline the negative impact of scale economies on concentration.

A second empirical approach consists in comparing NEG models to traditional trade theory by identifying the 'home market effect' on production mentioned by Krugman (1980). According to new models, in the presence of trade costs very keen demand for a good can cause producers to locate in the country concerned. Thus idiosyncratic demand for a good generates an amplification effect on production which does not occur with constant returns to scales[5]. Davis and Weinstein (1996, 1999, and 2003) identify 'the home market effect' thanks to a strong correlation between supply and demand. To integrate this effect, they regress the production of 'goods'[6] on a variable that deviates from rest-of-world demand patterns. Their

[5] In traditional models, production increases at most proportionally with the rise in demand.

[6] They use a 4-digit disaggregated classification of industries.

approach provides strong support for 'home market effects'[7]. The 'home market effect' is also identified in some studies thanks to the impact of countries' expenditure on export structure (Hanson and Xiang, 2002).

Recent analyses of industrial location stress that, more than the presence of increasing return to scale, it is "market potential" which determines industrial location. In NEG models, the local factor prices are higher in large markets. Hanson (2005) studies the determination of wages in the United States. By estimating wage equation, he shows that market potential explains interregional wage differences. In another paper Hanson (1998) takes the example of trade liberalisation in Mexico. He shows that distance from industry centres has a negative effect on relative wages. Other authors have stressed the importance of inter-industrial links as a factor of concentration in major markets. Head and Mayer (2004a) worked with a large sample of Japanese firms established in European countries between 1984 and 1995. They show that a higher market potential can result in a large increase in the probability that a firm settle in a region.

Recent empirical analyses seek to illustrate precisely the 'new theories' by trying to describe structural equations of the models (Head and Mayer, 2006). The contributions of traditional theories are somewhat neglected. These orientations are largely justified. If theory makes it possible to confirm the presence of industrial agglomeration, empirical studies do not. It is difficult to attribute the concentration of industries to the presence of increasing returns or to identify the specific causes of 'the home market effect' revealed by the data. Moreover, these studies are based on data concerning comparatively homogeneous and largely industrialised zones. It is thus less easy and less relevant to study comparative advantages. With the exception of Hanson's works based on Mexico, very few empirical articles study the geographic location of industries in a heterogeneous area.

[7] Note that the results from the 1996 and 1999 studies indicate that controlling for factors of production reject the 'home market effect'.

In this paper, we propose to explain the spatial distribution of activities in some countries of the Euro-Mediterranean area. In this case, cost advantages are decisive and cannot be ignored. Similarly, it is relevant to take into account the context of imperfect competition and differences in market size between Europe and Mediterranean countries (in terms of income or market access). The geographical approach is also justified. The aim of our analysis is not to test the relative relevance of various theories but rather to check if, jointly, they allow for a better apprehension of the industrial fabric in the Euromed zone. Our analysis thus follows on from that of Amiti (1999) or Rosenthal and Strange (2001).

3 The descriptive analysis

This section examines the industrial production pattern in some countries belonging to the Euro-Mediterranean area. is used[8]. The dataset is from INDSTAT3 (2004), proposed by UNIDO[9]. It consists of 16 countries, among which eight Northern European countries (Austria, Denmark, Finland, France, Germany, Ireland, Sweden and the United Kingdom), three Southern European countries (Greece, Italy and Spain), two acceding countries (Cyprus and Hungary), and some Mediterranean countries (Jordan, Turkey and Egypt). The production of 25 industries (SITC Revision 2, 3-digit level) is studied over the period 1985-2000. To facilitate the interpretation of results, industries are classified according to their level of technology[10].

Before presenting some geographic concentration indexes, the evolution of production in the sample of countries is first studied.

[8] Data from all countries belonging to the Euro-mediterranean area is not available. Data concerning the 'Northern Europe' are almost complete. However, it would have been better to integrate some important mediterranean and new member countries (Morocco, Tunisia, Poland and the Czech Repulic).

[9] United Nation Industrial Development Organisation.

[10] We use the classification suggested by Hatzichronoglou (1997) and presented in *Appendix A, table A.1*.

3.1 Evolution of production

It is necessary to underline the evolution of industrial production in our sample of countries before studying the evolution of the concentration indexes. This analysis should prevent any misinterpretation of these indexes.

Even if we note a rising trend in total production between 1985 and 2000[11], some industries seem to have developed more than others. The evolution of each industry's production share in total production makes it possible to underline their development in the zone (*appendix A, figure n°A.1, A.2,A.3, A.4*).

It can first be noted that for most of the low-technology industries, there is a major decrease in their share in total production. There has been a fall of more than 15 points for food products, wearing apparel and footwear over the period 1985-2000. The proportion of textile in total production also decreased of 41 points between 1985 and 2000. Wearing apparel, footwear and textile are unskilled and labour-intensive industries. With trade liberalisation, these sectors face ever greater international competition, in particular from Asian countries. Even Mediterranean countries seem to have gradually lost their comparative advantage in these sectors, explaining these results.

Swings observed in production of food products can be linked to this industry's initially high trade costs. During many years, these costs gave the 'North' a comparative advantage in food production. Since the beginning of the nineties, trade liberalisation has led to a slowdown in production in this sector, in particular in Northern Europe.

The share in total production of most medium-technology industries also fell, in particular iron and steel (-44 points) and non-ferrous metal products (-26 points). All high-technology sectors, except industrial chemicals, recorded an increase in their share in total

[11] Total production increased by 125 % between 1985 and 2000.

production. This increase is particularly significant in transport equipment (+ 33 points) and professional and scientific equipment (+ 46 points).

This study therefore suggests that production growth in our sample of countries mainly occurred in high-technology industries, whilst production of many low-technology sectors dramatically declined between 1985 and 2000. These important facts have to be considered while analysing geographic concentration.

3.2 Spatial distribution of industries

In this paper, the spatial distribution of industries will be evaluated in different ways[12]. First, the geographical concentration will be measured thanks to the entropy index[13], for two distinct years (1985 and 2000). In parrallel, the distribution of each industry in our sample of countries is studied using the concentration ratio *(table A.2, appendix A)*. Finally, the location quotient allows countries' specialisations to be identified. We define :

The location quotient[14] : $L_{ijt}=\frac{C_{ijt}}{C_{jt}}$

and the entropy index : $E_{it}=\sum_{j} C_{ijt}\ln\left(L_{ijt}\right)$

With , $C_{ijt}=\frac{X_{ijt}}{X_{it}}$ *(the concentration ratio[15]) and* $C_{jt}=\frac{X_{jt}}{X_{t}}$

X_{ijt} is the production in industry i, country j and t.

[INSERT Table 1]

[12] The measurement of geographical concentration has attracted interest in new economic geography literature. See Combes, Mayer and Thisse (2006) for a comprehensive survey.

[13] Others indexes have been calculed with no significant differences in the results. Unfortunately, the Ellison and Glaeser (1999) index could not be used since sufficiently disaggregated data is not available.

[14] The sector is said to be 'located' (or the country is said to be 'specialised') if the location quotient exceeds 1. In this case, the share in the industry's total production of the country studied exceeds the country's share in total production.

[15] Note that this index largely depends on countries' size. So, it is not the value of the ratio that is of interest, but the variation in the distribution of each industrial sector between 1985 and 2000.

According to our results, the geographical concentration of industries intensified to some degree between 1985 and 2000 (the concentration level increased for between 21 and 24 sectors). All the indexes reveal a significant and increasing concentration of many low-technology sectors (in particular in textiles (321), wearing apparel (322), leather products (323) and footwear (324)). The concentration ratio (*table A.2, appendix A*) shows a major redistribution of textile production from Northern Europe to Southern Europe and Mediterranean countries. Textile production (321) is now principally located in Egypt, Turkey, Greece and Italy. The production of wearing apparel and leather products has also relocated to the South. In these sectors, Northern Europe's share of the total sectoral production fell by more than 30 points between 1985 and 2000 (*table A.2, appendix A*). In 2000, wearing apparel (322) was mainly produced in Turkey, Cyprus, Greece, Italy and Jordan. Its location in Mediterranean countries and in Southern Europe (in Spain and Italy) rose significantly between 1985 and 2000. Leather products (323) are mainly implanted in South Europe (in particular in Italy and Spain) and in Turkey. Footwear (324) is located in Southern Europe (Italy, Spain and Greece), in new member states (Cyprus and Hungary) and in Jordan. This sector also appears more and more concentrated in Italy and Jordan, whereas its concentration ratio and the location quotient decrease significantly in Northern Europe and new member countries.

The most widely distributed industries in the area studied are of an intermediate technological level (fabricated metal products (381), plastic products (356), non-ferrous metal products (372)).

Finally, some high-technology industries appear fairly localised (in particular, transport equipment (384) and professional and scientific equipment (385)). These industries are principally located in Northern European countries. Concentration ratios in these sectors remain relatively stable between 1985 and 2000 (*table A.2, appendix A*). But, as shown in the

preceding section, production in these sectors has notably increased over this period. Thus, it was largely northern Europe that benefited from this increase. However, these industries are practically nonexistent in Mediterranean countries and new member states (Egypt, Jordan, Cyprus, Turkey and even in Greece). Professional and scientific equipment (385) is present mainly in Ireland, Denmark, Sweden, United Kingdom and France. The transport equipment industry (384) is located mainly in France, Germany, the United Kingdom and Sweden.

The increasing specialisation and geographical concentration suggested by the results can be partly explained by the significant heterogeneity of the sample of countries studied. Low-technology industries are very concentrated because their production takes place in a restricted number of countries (especially Mediterranean and South European countries). Whereas Northern Europe and new member states have reduced their production in many 'traditional' industries (textile, wearing apparel), Mediterranean and South European countries (Italy and Spain) have reinforced their specialisation in these sectors. At the same time, low-technology industries are less and less present in many Euro-Mediterranean countries due to international competition. High-technology industries are evenly distributed because they are implanted in many North European countries, which make up a significant part of our sample. In addition, Northern Europe significantly increased its specialisation in these industries between 1985 and 2000. Medium-technology industries are dispersed, being present in Europe, in new acceding countries and in some Mediterranean countries[16].

Some limits need to be mentioned, principally the insufficient data available for the studied countries. Only part of the Euro-Mediterranean area is analysed. The indices would thus differ significantly were a larger sample of countries analysed. A similar remark also applies to the level of sectoral disintegration considered, which is inadequate - the same sector could include different products (which can differ in terms of their technological content). In

[16] Note that because of differences in the sample of countries studied, our results can not be compared to those in related literature (Amiti, 1999; Midelfart-Knarvik *et al*. 2002).

addition, it is not possible to take into account the fragmentation of the productive process in many low-technology sectors.

After this descriptive analysis, the determinants of the spatial distribution of industries in this zone will now be studied.

4 The empirical model

This section presents the model and the econometric procedure. There is comprehensive theory which explains concentration but, as we have seen in the first section, different strands can indicate which elements should be included in an empirical approach

4.1 The dependent variable

The location quotient is used to evaluate the geographical distribution of each industrial sector in the sample of countries. This index has two main interests. First, three levels of observation can be used (countries (*j*), sectors (*i*) and years (*t*)) instead of two as with more classical indexes. The location quotient also corrects geographical concentration to countries' size effect. The indexe (*Lijt*) compares the share of country *j* in the total production of sector *i* to the share of this country in total production. It is used as the dependent variable in the model.

$$L_{ijt} = \frac{X_{ijt} / \sum_j X_{ijt}}{\sum_i X_{ijt} / \sum_i \sum_j X_{ijt}} \qquad (1)$$

where X_{ijt} represents production in sector *i*, country *j* at *t*.

If it is greater than 1, then country *j* is relatively specialised in industry *i* (or industry *i* is relatively located in country *j*).

4.2 Explicative variables

Relative wages

The low level of wages is one of the main factors responsible for the location of firms in developing countries. Our variable compares the wage in each country to the average wage in the considered industry. As we have seen in the descriptive analysis, Southern countries accounted for higher location quotients. So, a negative relationship between wages and industrial location can be expected.

$$Sal_{ijt} = \frac{w_{ijt}}{\overline{w_{it}}} \qquad (2)$$

w_{ijt} represents the wage per worker.

If low wages offer a clear advantage for developing countries, low wages ought to be associated with low labour productivity. If some industries are seduced by low wages, others attach greater importance to labour productivity (industry heterogeneity plays an important part here). It thus seems essential to take these two effects into account when studying industrial location.

Productivity

According to traditional trade theory, relative technological differences between countries may give rise to comparative advantages and specialisation. Letting these differences be reflected by gaps in labour productivity, defined as production per worker, the index (*Prodijt)* may be computed:

$$Prod_{ijt} = \frac{\frac{X_{ijt}}{E_{ijt}}}{\left(\frac{X_{it}}{E_{it}}\right)} \Bigg/ \frac{\frac{X_{jt}}{E_{jt}}}{\left(\frac{X_{t}}{E_{t}}\right)} \qquad (3)$$

Were *Eijt* is employment in industry *i* in country *j* at period *t*.

This measure of relative productivity is inspired by Haaland *et al.*'s (1999) index[17]. The numerator evaluates productivity in industry *i* in country *j* ($\frac{X_{ijt}}{E_{ijt}}$) relative to average

[17] This index has also been used because of its low correlation with the wage variable.

labour productivity for this industry across countries $\left(\overline{\frac{X_{it}}{E_{it}}}\right)$. The denominator represents labour productivity in country $j\left(\frac{X_{jt}}{E_{jt}}\right)$ relative to average productivity across countries and industries $\left(\overline{\frac{X_{t}}{E_{t}}}\right)$. The greater the cross countries differences in productivity in the industry *i*, the higher the value of *Prodijt*. And therefore, the higher will be the degree of cross country specialisation.

Market size effects

The market size is one of the main agglomeration factors mentioned in economic geography models. Unlike traditional trade theory, new theories predict that demand bias in favour of a particular good creates a large 'home market effect for this good'. According to these theories, differences in expenditure structure may determine production structure and industry location. 'Krugman's market size effect' has been represented in many empirical articles by comparing domestic demand for a good to world demand for this good (Davis and Weinstein, 1999, 2003; Brülhart and Trionfetti, 2005). The measurement of the relative 'idiosyncratic demand' (*Dijt)* used here is inspired by these different studies :

$$D_{ijt} = D_{ijt} - D_{it} \qquad (4)$$

where D_{ijt} is the demand (production minus exports) in country *j* for industrial good *i* at *t*. D_{it} is the total demand for the industry *i* in the area.

The market size effect is also illustrated by the market potential function (*Pmjt*), initially proposed by Harris (1954). It illustrates the fact that the demand arising in a country is not only deriving from local consumers but also from the demand originating from all

consumers in the countries surrounding. Different versions of the function have been used in many empirical articles (Head and Mayer 2004a, 2004b) [18].

$$Pm_{jt}=\sum_{j'}\frac{PIB_{j't}}{d_{jj'}^{\lambda}} \qquad (5)$$

djj' is the geographical distance between country *j* and *j'*, and λ is the distance parameter (here equal to the value estimated by Hummel (1999), 0,92)[19].

These two variables do not exactly measure the same thing. So, they are alternatively introduced into the regressions. The market potential function evaluates the incomes of the country *j* and of countries nearby (*j'*). *Dijt* measures the importance of the national demand for each industry. It has then the advantage of integrating a sectoral level of observation.

Trade costs

Trade costs matter to traditional trade theories as well as to economic geography approaches. Traditional theories predict a positive relationship between integration and specialisation. New economic geography approaches emphasize a tension between production costs and access to a large market. On the one hand, a better market access generate industrial agglomeration. On the other hand, the larger the market, the higher the cost of immobile factors. The relative strength of these effects in determining location depends on the level of trade costs.

Unfortunately, precise data relating to trade costs is not available, so two distinct indexes are used to study their effect on industrial location. First, trade openness has been evaluated thanks to the relative penetration index (*Tpijt*):

$$Tp_{ijt}=\frac{\left(\frac{M_{ijt}}{PIB_{jt}}\right)}{\left(\frac{M_{it}}{PIB_{t}}\right)} \qquad (6)$$

[18] The main difference between these versions and Harris' (1954) fonction is that they do not consider constant price indexes.

[19] We have tested other values but with no significant differences in the final results.

Where *Mijt* representes country's *j* imports of good *i* in *t.* This index evaluates the country *j* relative trade openness in various industries.

Gaulier and Zignago (2002) has proposed an indirect way for measuring obstacles to goods trade. The trade discrimination index is defined as the *de facto* inequality of access for a good in a given market, which various foreign suppliers may experience. The presence of obstacles to trade (tariff and non-tariff barriers) should lead to distortions in the geographic spread of suplies. As a result, the greater the barriers, the more imports will be concentrated in a small number of trading partners. And also, the more market share will be distorted compared to a *pro rata* distribution based on the importance of suppliers on world market.

This index has been calculated for each sector, country and year so as to complete our analysis. The distribution of trade flows is measured by the relative intensity indicator which is the ratio of the observed trade flows to theoretical flows. The latter are determined by the geographical distribution of total trade in the area according to the relative importance of exporters and importers respectively. Discrimination is calculated as a weighted average of the relative intensity factors. The trade discrimination indicator is also corrected for the impact of geographical distances (and others 'natural' impediments to trade)[20].

In this analysis, import discrimination reflects preference for particular countries in the zone and so reveals some specific relationship between countries. It has been known that many European countries have had special relationships with certain Mediterranean countries for many years. These relationships could explain the production pattern in this area. The index will permit us to identify such relationships.

The calculation of this index shows that European countries (Austria, Denmark, and Sweden in particular) are more 'open' than Mediterranean countries (such as Egypt and

[20] See Gaulier and Zignago (2002) for more details on the construction of this index.

Jordan) [21]. It equally confirms that low-technology industries (textile, leather products and so on) are more protected than high value-added sectors (for example, transport equipment).

The relative penetration index and the trade discrimination index are alternatively introduced into the regressions to evaluate countries' openness.

Characteristics of industries and countries

The dummy variable (*Tech*) takes a value of 1 for low-technology industries and 0 for medium or high-technology industries. This variable is based on the classification suggested by Hatzichronoglou (1997). As seen in the descriptive analysis, location quotients are particularly high in some 'South' countries which tend to be specialised in low-technology industries. Therefore a postive relationship can be expected between this dummy variable and the location quotient.

Finally, as integration into a large market could explain the firms' location choice a dummy variable is introduced to reflect membership of the European Union. *Eu* takes a value of 1 if the country belongs to Europe, 0 if it does not.

According to theories, all variables presented in section 4.1.2 have an impact on industrial location. The aim is to ascertain if those variables are the main variables explaining specialisation in the sample of countries. To control for heterogeneity, country and sector specific effects are also introduced in the models. Hence, the location of the industry *i* in the country *j* and in the period *t* may be written as[22] :

$$L_{ijt} = \alpha_i + \alpha_j + \beta_1 Sal_{ijt} + \beta_2 \Pr od_{ijt} + \beta_3 Tp_{ijt} + \beta_4 D_{ijt} + \beta_5 Tech + \beta_6 const_{ijt} + \varepsilon_{ijt} \qquad (7)$$

[21] The indexes are presented in *appendix A, table A.3 and A.4*.

[22] Note that this equation represents only one of the regressions tested (*see section 4*).

4.3 Data and measurement

To build the sample, production, wage and employment[23] data from the INDSTAT3 (2004) database is used. The scale of observation can be disaggregated up to 16 countries[24] 3-digit industrial categories (corresponding to 25 indutries) and 16 years (the period from 1985 to 2000). The CEPII database ('Trade and Production') provides trade data. Finally, data relating to the distance between various countries comes from the 'distances' database built by Mayer and Zignago (2005).

4.4 Specification and econometrical procedure

Several variables measure trade costs and market size. Their impacts on industrial location are alternatively estimated in the regressions.

Several econometric specifications of the model have been tested. The database used has three dimensions (observation by sector, country and year). The aim therefore is to make use of all this information. Unfortunately, because of significant data volatility, three-effect models cannot be proposed, hence two-way models are suggested. Models relating to the whole sample are presented first. In these models, sector and country specific effects are introduced to capture heterogeneity[25]. In order to bring greater precision to this first analysis, to check for coefficient stability and to reduce the heterogeneity, the sample has been split by region (North/South) and by industries' technological levels (low-technology industries/medium and high-technology sectors)[26].

The 'Northern countries' sample is composed of eight countries belonging to the European Union (Austria, Denmark, Finland, France, Germany, Ireland, Sweden and the

[23] All expressed in current US dollars.

[24] Which include Austria, Jordan, Cyprus, Egypt, Greece, Denmark, Finland, Ireland, Hungary, Sweden, Turkey, Spain, the United Kingdom, France, Italy and Germany.

[25] It was decided not to introduce time specific effects because the variance of the dependent variable is higher by sector and country than by year.

[26] Use is still made of the classification proposed by Hatzichronoglou (1997).

United Kingdom). Southern European countries (Italy, Greece and Spain) were integrated in the 'South' sample. As seen in the descriptive analysis, those countries have similar specialisation patterns to those of Mediterranean countries. It therefore seems more relevant to include them in the 'South' sample. However, to take European membership into account the *EU* dummy variable is also introduced in the regression. The 'South' sample also includes Mediterranean countries (Egypt, Jordan and Turkey) and new member states (Hungary and Cyprus). Two-way models are assessed for each sub-sample with sector and country specific effects.

The econometric procedure used is the same for each regression. Both fixed models and random effects models are tested. The 'Hausman test' is used to test for orthogonality of the random effects and the regressors (Green, 1997). When the random model is rejected, the fixed effect model is relevant. However, when the regression deals with time-invariant and sector-invariant (or country-invariant) variables, the Haussman and Taylor estimator is used (instead of the fixed effet model). It permits to control for endogeneity and to estimate the coefficients of time-invariant and sector-invariant (or country-invariant) variables.

The models have also been corrected for autocorrelation (by using an AR1model) and for heteroscedasticity by using the 'White method'[27]. However, these corrections have to be done on one-way models. They have permitted us to check for the stability of the coefficients after correction[28].

As we have a few number of variable, it seems important to identify which of them appear the most relevant to account for industrial location. So, the Fields' (2003) decomposition method has been used in the paper to decompose location inequality[29]. From a log-income based levels calculation, Fields (2003) runs a standard semi-logarithmic income-

[27] Note that the regression details are available from the author.

[28] Only two-way regressions are presented in the paper.

[29] Fields (2003) has proposed this methodology to decompose income inequality.

generating fonction. Than, he denotes the share of the log-variance of income that is attribuable to each explanatory variable and measures also the fraction of the log-variance that is explain by all of the variables. Finally, Fields (2003) calculates the relative factor inequality weights and the corresponding percentage contributions for each explanatory factor[30]. In the paper, this method is used to estimate how much of location inequality is accounted for each explanatory factor.

We have used the same econometric procedure to analyse the production of low-technolgy industries. The relative share these industries in the GDP of each Southern country has been regressed on wages, penetration indexes, and on the access to the european market.

5 The determinants of industrial location in the Euro-Mediterranean area: results and discussion

This section examines the forecasts of theoretical literature so as to determine which of them most closely corresponds to the space distribution of industries in the sample of countries used here. More precisely, the aim is to explain the two main features of the industrial production pattern observed in section 3:

- The increase of geographic concentration and specialisation in the area. High-technology industries are mainly concentrated in Northern Europe whereas low-technology sectors are largely located in Southern Europe and Mediterranean countries.
- Despite the decrease in low-technology industrial production, some countries (in the 'South') are more and more specialised in those sectors. Will these industries remain located in the Euro-Mediterranean area ?

[30] See Fields (2003) for details on this methodology.

As above mentioned, the first part of our econometric analysis consists in explaining the actual distribution of industries in our sample of countries. Then, we will devote attention to the future of low-technology industries in the euro-mediterranean area.

5.1 Which factors explain the industrial location in our sample of countries ?

[INSERT Table 2]

The higher the wages, the lower the geographical concentration. In parallel, the higher the productivity, the higher the geographical concentration. This confirms the descriptive analysis. The most localised industrial sectors are mainly present in Southern countries, which benefit from the lowest wages. Conversely, labour efficiency attracts industries in a market. As has long been recognised by traditional trade theory, comparative advantages affect countries' specialisation pattern.

Results underline the positive impact of 'idiosyncratic demand' on industrial location. This result confirms the relevance of economic geography theories. The higher the national demand for a good, the more concentrated the industry is in this market. Results concerning 'potential market' effects are quite different. The larger a country is or the richer its neighbours are, the less specialised the country is. Once again, the results mentioned in the previous section are found here. Northern European countries have a larger market size (and market potential) and a more diversified industrial fabric.

The study of the penetration index reveals that the greater a country's openness the more concentrated industrial activities are. This result could also be related to a 'size effect', since the smallest countries are very often more open. Taking into account the trade discrimination index allows some different effects to be underlined. A positive and significant relationship can be observed between discrimination and industrial specialisation. Industrial location in this area could be explained by preferential trade relationships between countries.

Therefore, greater diversification in the origin of imports might generate a higher level of diversification in a country's industrial fabric.

Finally, the results show that industrial location is higher in low-technology industries.

Fixed effects analysis again confirms the descriptive study (*appendix B, table B.1*). Industries' fixed effects reveal a greater degree of location for the sectors dealing in tobacco, textile, other non-metallic mineral products, wearing apparel, footwear, wood products and food products. They are low-technology industries and are primarily present in the South. Conversely, medium and high-technology sectors are relatively less located, as is the case for transport equipment, machinery (electric and non-electric), and industrial chemicals. These sectors are present in many Northern countries (Germany, France, the United Kingdom etc.). Fixed country effects confirm that the location quotient is higher in Southern countries (Cyprus, Jordan, Hungary, and Egypt) than in large Northern countries (France, Germany).

5.1.1 Sub-sample regressions

Splitting the sample by area and by the technology level of firms provides even more information on the determinants of industries' location choices. Note that the regressions including the penetration index and the idiosyncrasic demand have not been presented here because the signs of these variables' coefficients remain stable whatever the sample studied.

When the analysis concerns only Northern countries or high-technology sectors[31] (*table 3*), the link between wages and industrial location becomes positive but not always significant. The level of wages does not seem to explain the specialisation of Northern countries. Equally, the location of high-technology industries is more due to a high productivity than to low wages[32]. In these sectors wages are generally high. On the contrary,

[31] The regression including the penetration index and idiosynsic has not been reported because the relationship between this variable and the location quotient remains stable whatever the sample studied.

[32] This result can be connected to a theoretical forecast : technological spillovers might explain the geographical concentration of high value-added industrial sectors.

Southern countries' specialisation or high location quotient in low-technology industries are explained by attractive wages.

[INSERT Table 3]

When the regression deals with Northern countries, market potential coefficients remain negative but not very significant. Although the degree of specialisation is still higher in 'small' countries, this is not as clear as when the entire sample is considered. The sign of this variable changes when the sample concerns high-technology industries. Indeed, these firms are for the most part located in Northern countries, which benefit from a higher market potential (and larger market size).

Trade discrimination explains Southern countries' specialisation and the location of low-technology industries. The industrial landscape of this area is therefore in part the result of specific commercial links between countries. As has been noted in many Femise reports (2005), trade flows in the Euro-Mediterranean area reflect the adaptation of Mediterranean production to European Union demand. However, the complementarity of some Southern countries does not enable them to develop the structure of their specialisation. On the contrary, this trade discrimination limits the specialisation of Northern countries and do not explain location of high-technology industries.

Lastly, it can be noted that even if Southern European countries are included in the 'South' sample, these countries remain less specialised than the other Southern countries. These results could be related to their membership of the European Union.

The principal results can be summarised in several points:

- On the one hand, countries with the highest location quotients are not the largest. Market potential has a positive effect on firms' location only if the analysis concerns high-technology industries. On the other hand, the results underline the dominant impact of idiosyncratic demand on industrial location.

- Firms are attracted by countries with the highest sectoral productivity and the weakest wages. Production costs are therefore decisive in firms' location choices, proving the relevance of traditional trade theories. However, lower wages are not crucial for technological industries and do not explain the specialisation of Northern countries.
- The most open countries have a less diversified industrial landscape and concentrate their production in specific sectors in which they are relatively powerful. In parallel, trade discrimination is generally a factor in geographical concentration.

We can so conclude that economic geography theories, like traditional trade theories, seem relevant in explaining specialisation in the sample of countries studied here. However, economic geography theories are more relevant in understanding the location of high-technology industries and the specialisation of Northern countries, whereas traditional trade theories better explain the location of low-technology firms and the specialisation of Southern countries. A large market and an high sectoral productivity explain in high-technology industries' location choice and could impact on Northern countries' specialisation pattern. On the contrary, Southern countries' specialisation and low-techonogy industries' location are mainly the result of attractive production costs and high trade discrimination.

5.1.2 The decomposition of location inequality

The Fields' (2003) decomposition method also reveals that, after the residual (which is very high), wages are the most important variable in accounting the level of inequality of industrial location in 1985 and 2000 (*table 4*). We have also noticed that the respective inequality weights of productivity, european membership and technological intensity increase

between 1985 and 2000. However, the importance of "market size" variables (market potential and idiosyncrasic demand) appears moderate.

Finally, differences in specialization degrees are more in more due to the belonging of the european market or to industries' characteristics. Regarding the growing share of residuals, we can also note that comparative advantages and access to a large market are insuffisant to explain specialisation inequality.

[INSERT Table 4]

5.2 What is the futur of low-technology industries in the euro-mediterranean area ?

In the first section of this paper, it was noted that the production of low-technology industries decreased in the sample of countries used, even though some countries (in the 'South') are more and more specialised in those sectors. It could be possible that low-skill industries remain implanted in this area because of the accessibility to the european market. If it is not the case, these industries will be less and less located in the euro-mediterranean area following the international trade liberalisation.

In this part, our aim is to understand which factors explain the production of low-technology industries in the South. We are no longer interesting in countries' relative specialisation patterns. The location quotient is thus irrelevant here.

In this analysis, the dependent variable is the relative share of low-technology industries (l) in the GDP of each Southern country (s)[33]. By using this variable it is possible to focus on production (and not on specialisation) and correct it for countries' size to avoid misinterpretation. Production (P_{lst}) is then regressed on the wages (Sal_{lst}), the penetration index (Tp_{lst}) and the access to the European market[34](A_{st}) :

[33] The database is then composed by 8 countries, 11 industries and 16 years.

[34] The variables are presented in *appendix C.*

$$P_{lst} = \alpha_l + \alpha_s + \beta_1 Sal_{lst} + \beta_2 Tp_{lst} + \beta_3 A_{st} + \beta_4 const_{lst} + \varepsilon_{lst} \quad (8)$$

[INSERT Table 5]

Firstly, this analysis reveals a negative relationship between wages and production. Therefore, low-technology production in the South could be explained by low labour costs. Openness is negatively related to production. The more open the country is, the less it produces low-technology goods. Trade liberalisation will therefore reduce the production of these sectors in Southern countries. This result can be related to the increasing competition of Asian countries. Southern countries gradually lose their comparative advantages in low-technology industries. Finally, easier access to the European market is associated to lower production by low-technology firms. Thus, access to the European market incites countries to diversify their production.

These results reveal that easier access to the European market does not seem sufficient to keep low-technology industries in the Euro-Mediterranean area. Southern countries therefore have no choice but to change their specialisation pattern.

5.2.1 The decomposition of production inequality

The fields' decomposition methodology reveals (*table 5.6*) that inequality in relative production is mainly due to the european market access in 1985, and to the penetration index in 2000. We also note that the impact of wages slightly increases between 1985 and 2000. On the contrary, market openness appears more en more important to explain production inequality.

[INSERT Table 6]

6 Concluding remarks

This paper proposes an empirical analysis of the spatial distributions of industries in the Euro-Mediterranean area. The first stage of the study is descriptive and underlines that production growth in our sample of countries occurred in high-technology industries, whilst production of many low-technology sectors declined between 1985 and 2000. In parallel, we note an increasing sectoral concentration of activities within the sample of countries. Northern Europe attracts more and more high value-added sectors whereas Southern European and Mediterranean countries are more and more specialised in the production of low-technology goods. New member countries are in an intermediate position. They still produce many low-technology products but are abandoning some traditional sectors (textiles and so on). They also produce more and more medium-technology goods.

The econometric analysis has permitted us to identify the factors explaining the specialisation pattern in the area. It shows the relevance of both traditional and new theories. Market size as well as production costs explain industrial location in the Euro-Mediterranean area. However, the impact of different factors (market size, wages, productivity) sometimes depends on country and industry characteristics. While the presence of idiosyncratic demand has an influence on firms' location choices, any impact of the potential market is more a matter for debate. Countries which benefit from a large potential market are more diversified. On the other hand, high-technology industries are attracted to large markets. It can also be noted that trade discrimination explains the industrial agglomeration of low-technology industries and the concentration of firms in Southern countries. However it does not explain the location of high value-added industries and concentration of firms in Northern countries.

It can thus concluded that Northern countries' specialisation and the location of high-technology industries cannot be explained by the same factors as Southern countries' specialisation and the location of low-technology industries. The former mainly results from

high productivity and the presence of easy market access whereas the latter results from favourable production costs and preferential trade relationships.

As Southern countries' specialisation in low-technology industries tends to increase, we have also investigated the futur of these industries in the euro-mediterranean area. It can be noted that low-technology sectors remain in this area because of low production costs. However, with trade liberalisation, the production of these industries will decrease gradually in spite of the proximity of the European market.

Trade liberalisation in the Euro-Mediterranean area could lead to the diversification of the Southern industrial structure by promoting access to a large market. However, if the South (Mediterranean countries in particular) does not significantly improve its industrial productivity this might not happen. It will then continue to specialise in low-technology industries.

To benefit from integration and growth mediterranean countries have to modify their specialisation pattern. In the contrary case, integration could lead to an important divergence of the industrial structures and incomes between the countries of the Euromed area. To this end could be added a progressive de-industrialization of the mediterranean countries.

Since all industries do not react in the same way, the results also underline the importance of an empirical analysis dealing with sectoral characteristics. The literature on heterogeneous firms seems to be the most promising framework to investigate this issue.

Finally, some limits have to be mentionned. Factors introduced in the model remain insufficient to precisely explain industrial location. Other variables should be introduced (to evaluate the political context or the development of infrastructures, for example). Indeed, the biggest constraint concerning research on location patterns in Euro-Mediterranean area is the quantity and quality of available data.

Table 1 : Geographical Concentration in 1985 and 2000.

Code	Industry	Entropy index		%change	Location quotient	
		1985	2000	1985-2000	Highest (2000)	Lowest (2000)
311	Food products	0,04	0,04	-1%	Cyprus	Finland
313	Beverages	0,04	0,04	3%	Cyprus	Finland
314	Tobacco	**0,21**	**0,31**	47%	Jordan	Finland
321	Textiles	0,10	0,25	153%	Egypt	Sweden
322	Wearing apparel, except footwear	0,06	**0,26**	369%	Turkey	Sweden
323	Leather products	0,11	**0,58**	410%	Italy	Denmark
324	Footwear, except rubber or plastic	**0,19**	**0,50**	162%	Italy	Ireland
331	Wood products, except furniture	**0,13**	0,13	1%	Finland	Egypt
332	Furniture, except metal	0,03	0,08	164%	Cyprus	Ireland
341	Paper and products	**0,16**	0,17	7%	Finland	Ireland
342	Printing and publishing	0,11	0,12	8%	United Kingdom	Germany
351	Industrial chemicals	0,02	0,04	129%	Jordan	Cyprus
352	Other chemicals	0,01	0,04	232%	Ireland	Finland
355	Rubber products	0,02	0,04	44%	Turkey	Jordan
356	Plastic products	0,02	0,03	50%	Greece	Sweden
362	Glass and products	0,03	0,03	19%	Turkey	Jordan
369	Other non-metallic mineral products	0,04	0,08	135%	Jordan	Sweden
371	Iron and steel	0,04	0,06	47%	Turkey	Ireland
372	Non-ferrous metals	0,02	0,04	99%	Greece	Ireland
381	Fabricated metal products	0,01	0,04	241%	Italy	Ireland
382	Machinery, except electrical	0,04	0,05	26%	Ireland	Greece
383	Machinery, electric	0,03	0,06	114%	Finland	Cyprus
384	Transport equipment	0,03	0,09	208%	France	Cyprus
385	Professional & scientific equipment	0,09	0,09	5%	Ireland	Turkey
390	Other manufactured products	0,09	0,14	57%	Cyprus	Egypt

Table 2 : Determinants of industrial location

		Haussman and Taylor Estimator	Haussman and Taylor Estimator	Haussman and Taylor Estimator
Location quotient (lijt)				
Explicative variables				
Relative wages (salijt)		-0,44 (-15,85)	-0,37 (-12,48)	-0,35 (-11,58)
Relative productivity (prodijt)		0,47 (12,44)	0,48 (16,76)	0,46 (16,130)
Trade cost				
	Penetration index (tpijt)	0,14 (12,44)	0,13 (11,22)	
	Trade discrimination index (tijt)			0,22 (2,38)
Market effect				
	Idiosyncrasic demand (dijt)	0,13D-05 (4,51)		
	Market potential (pmjt)		-0,78D-05 (-4,90)	-0,10D-04 (-6,60)
Technological level (tech)		0,44 (4,51)	0,40 (4,08)	0,36 (3,83)
Constant		0,80 (2,01)	0,66 (3,79)	1,33 (3,62)
country effects		Yes	Yes	Yes
sector effects		Yes	Yes	Yes
Number of observations		6400	6400	6400
Hausman test		15,51	14,32	18,39

Table 3 : Determinants of industrial location (Sub-sample regression results)

	North sample (random effects model)	**South sample** (random effects model)	**High-technology industries** (twoway fixed effects model)	**low-technology industries** (twoway fixed effects model)
Locational quotient (lijt)				
Explicative variables				
Relative wages (salijt)	0,02** (0,79)	-0,22 (-2,85)	0,22 (4,80)	-0,22 (-2,48)
Relative productivity (prodijt)	0,57 (25,52)	0,58 (8,56)	0,64 (20,08)	0,78 (14,63)
Trade discrimination index (tijt)	-0,26* (-1,80)	0,32 (2,51)	2,73** (1,01)	0,17* (1,80)
Market potential (pmjt)	-0,61D-05* (-1,72)	-0,23D-04 (-7,26)	0,19D-05* (1,90)	-0,82D-05 (-1,99)
EU membership (eu)		-0,49 (-9,92)		
Constant	-0,2** (-0,17)	1,90 (4,50)	0,47 (4,58)	0,82 (8,06)
country effects	Yes	Yes	Yes	Yes
sector effects	Yes	Yes	Yes	Yes
Wald test :				
country effects			423,27	479,25
sector effects			557,9	141,35
Adjusted R2			0,29	0,26
Number of observations	3200	3200	3584	2816
Lagrange multiplier test	13071,67	20092,19		
Hausman test	3,24**	5,2**	228,48	16,46

*Notes : ** non-significant coefficients ; * significant coefficient at 10 per cent*

Table 4 : Fields' decomposition of factor contributions to Lijt inequality.

	1985	**2000**	**1985**	**2000**
Wages	18,6%	16,9%	21,6%	18,2%
Relative productivity	6,0%	9,1%	5,5%	8,8%
Market potential	8,8%	3,9%		
Indiosyncratic demand			1,6%	2,0%
Technological intensity	4,3%	7,3%	0,6%	1,0%
Penetration index	3,2%	2,7%	3,8%	2,5%
EU	0,7%	1,2%	1,4%	6,9%
residual	58,4%	58,9%	65,5%	60,6%

Table 5: Determinants of low-technology production in the South

	Random effects model
Production (Plst)	
Explicative variables	
Relative wages (slst)	-0,19D-06 (-3,26)
Penetration index (tplst)	-0,12 (-2,06)
Access to the european market (ast)	-0,12D-11 (-3,93)
Constant	0,02 (4,0)
Number of observations	1408
country effects	89,85
sector effects	1947,76
Lagrange multiplier test	22104,55
Hausman test	43,85**

*Notes : ** non-significant coefficients*

Table 6 : Fields' decomposition of factor contributions to Pijt inequality

	1985	2000
Penetration index	7%	10%
European market access	8%	7%
wages	3%	4%
residual	82%	79%

Appendix A: Description analysis

Table A.1 : Industries' characteristics.

Code	Industries	Technological level
311	Food products	1
313	Beverages	1
314	Tobacco	1
321	Textiles	1
322	Wearing apparel, except footwear	1
323	Leather products	1
324	Footwear, except rubber or plastic	1
331	Wood products, except furniture	1
332	Furniture, except metal	1
341	Paper and products	1
342	Printing and publishing	1
351	Industrial chemicals	3
352	Other chemicals	3
355	Rubber products	2
356	Plastic products	2
362	Glass and products	2
369	Other non-metallic mineral products	2
371	Iron and steel	2
372	Non-ferrous metals	2
381	Fabricated metal products	2
382	Machinery, except electrical	3
383	Machinery, electric	3
384	Transport equipment	3
385	Professional & scientific equipment	3
390	Other manufactured products	2

(1) Classification proposed by Hatzichronoglou (1997). 1 represents the lower technological level.

Figure A.1 : Part of Food production in total industrial production, 1985-2000.

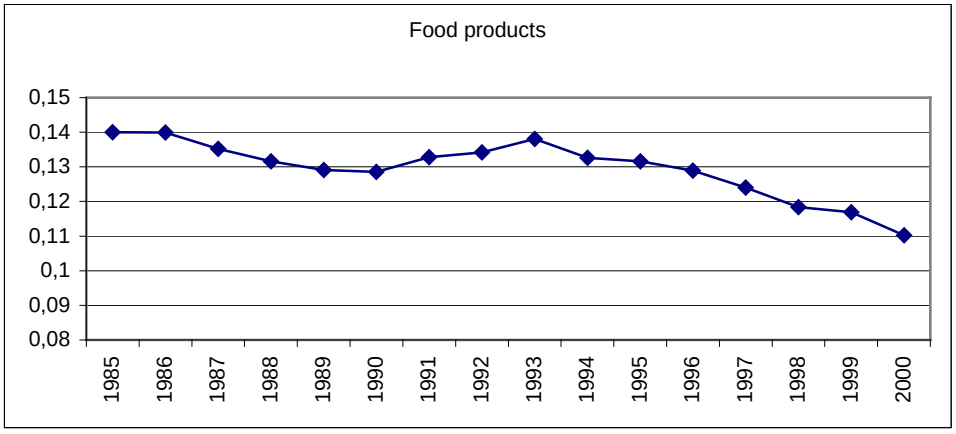

Figure A.2 : Production part of low-technology industries in total industrial production, 1985-2000.

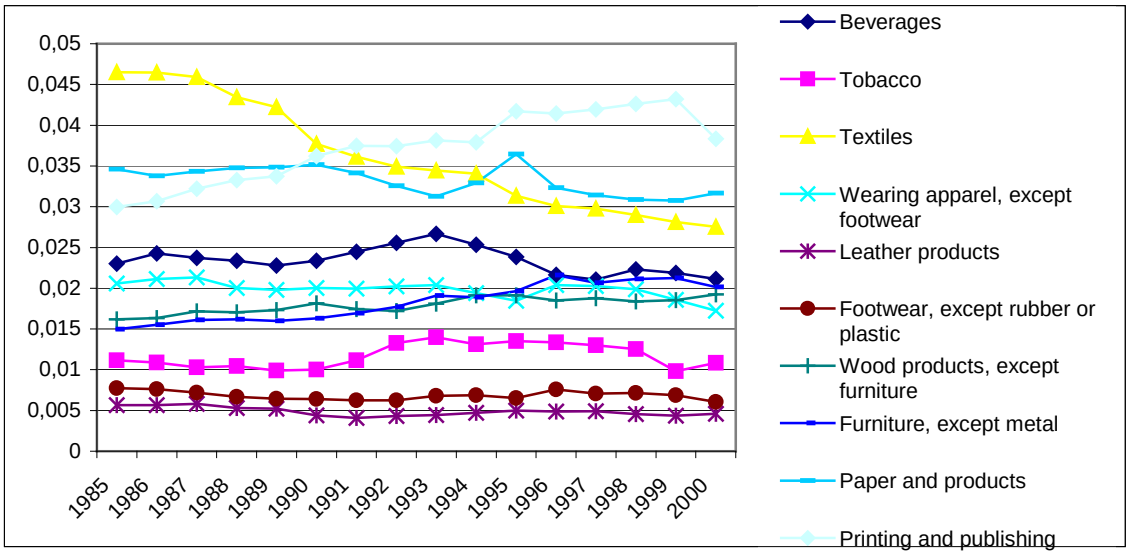

Figure A.3 : Production part of medium-technology industries in total industrial production, 1985-2000.

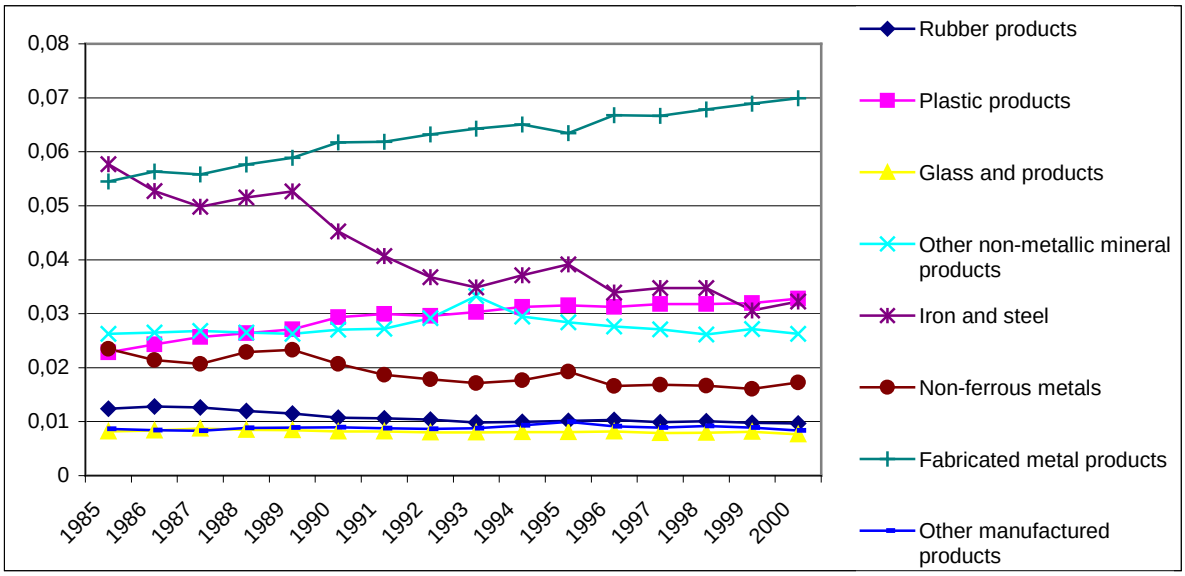

Figure A.4 : Production part of high-technology industries in total industrial production, 1985-2000.

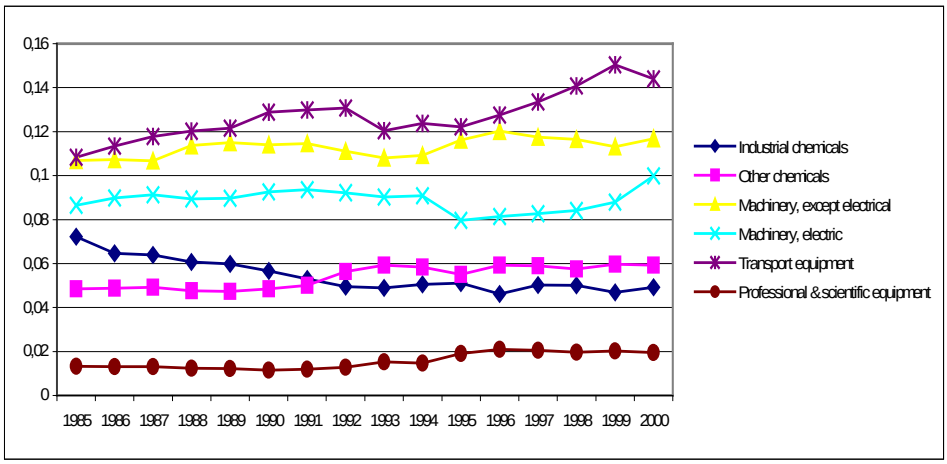

Table A.2 : Concentration ratio in 1985 and 2000 (in%).

Code sector	Sector	Year	Northern Europe	Southern Europe	New members	Mediterranean countries
311	Food products	1985	77%	18%	2%	3%
		2000	67%	27%	1%	5%
313	Beverages	1985	76%	19%	1%	3%
		2000	67%	29%	1%	3%
314	Tobacco	1985	72%	15%	1%	12%
		2000	84%	8%	1%	8%
321	Textiles	1985	64%	27%	1%	8%
		2000	43%	43%	1%	14%
322	Wearing apparel,	1985	71%	26%	2%	2%
		2000	40%	49%	1%	10%
323	Leather products	1985	60%	36%	2%	2%
		2000	24%	73%	0%	3%
324	Footwear, except	1985	55%	41%	3%	1%
		2000	26%	71%	1%	2%
331	Wood products,	1985	82%	16%	1%	2%
		2000	68%	30%	1%	1%
332	Furniture, except metal	1985	78%	20%	1%	1%
		2000	59%	39%	0%	2%
341	Paper and products	1985	82%	16%	1%	2%
		2000	76%	22%	1%	2%
342	Printing and publishing	1985	82%	16%	1%	2%
		2000	73%	24%	1%	2%
351	Industrial chemicals	1985	77%	19%	1%	2%
		2000	78%	19%	1%	3%
352	Other chemicals	1985	77%	19%	1%	3%
		2000	73%	23%	1%	4%
355	Rubber products	1985	76%	21%	1%	3%
		2000	68%	27%	1%	4%
356	Plastic products	1985	77%	21%	1%	2%
		2000	71%	26%	1%	2%
362	Glass and products	1985	76%	20%	1%	3%
		2000	67%	28%	1%	5%
369	Other non-metallic	1985	73%	21%	1%	5%
		2000	54%	40%	1%	6%
371	Iron and steel	1985	70%	24%	1%	4%
		2000	65%	28%	1%	7%
372	Non-ferrous metals	1985	77%	18%	2%	4%
		2000	67%	29%	1%	3%
381	Fabricated metal	1985	83%	15%	1%	2%
		2000	65%	33%	1%	1%
382	Machinery, except	1985	87%	11%	1%	1%
		2000	74%	24%	1%	1%
383	Machinery, electric	1985	84%	13%	1%	2%
		2000	79%	17%	2%	2%
384	Transport equipment	1985	83%	15%	1%	1%
		2000	81%	18%	1%	1%
385	Professional & scientific	1985	80%	17%	2%	0%
		2000	79%	21%	0%	0%
390	Other manufacture	1985	78%	18%	3%	1%
		2000	60%	38%	0%	2%

Table A.3 : Trade discrimination indexes (by country)

The indexes presented here is calculated on average by country and by sector.

Countries	Trade discrimination index	Row*
Austria	-0,037250757	1
Germany	0,003197062	3
Cyprus	0,016792895	4
Denmark	-0,024830927	1
Egypt	0,073937852	4
Spain	-0,011953086	2
Finland	0,001631491	3
Greece	-0,015515843	2
Hungary	-0,021825263	1
Italy	0,00678029	3
Jordan	0,023128712	4
United Kingdom	-0,013267898	2
Sweden	-0,020225438	1
Turkey	0,005583773	3
Ireland	0,022238586	4
France	-0,008421446	2

**growing with the level of discrimination*

Table A.4 : Trade discrimination indexes (by industry)

Sector	Trade discrimination index	Row*
Food products	7,8125E-10	4
Beverages	3,90625E-10	3
Tobacco	8,59375E-09	4
Textiles	7,8125E-10	4
Wearing apparel, except footwear	-5,85937E-10	2
Leather products	2,73437E-09	4
Footwear, except rubber or plastic	1,17188E-09	4
Wood products, except furniture	-3,90625E-10	3
Furniture, except metal	1,84653E-19	3
Paper and products	-1,5625E-09	1
Printing and publishing	7,8125E-10	4
Industrial chemicals	3,125E-10	3
Other chemicals	-1,17187E-09	1
Rubber products	1,60156E-09	4
Plastic products	1,5625E-09	4
Glass and products	-1,17187E-09	1
Other non-metallic mineral products	-1,17187E-09	1
Iron and steel	-1,17187E-09	1
Non-ferrous metals	-3,90625E-10	3
Fabricated metal products	-2,27734E-09	1
Machinery, except electrical	-6,25E-10	2
Machinery, electric	7,8125E-11	3
Transport equipment	-2,73438E-09	1
Professional & scientific equipment	-1,5625E-09	1
Other manufactured products	-2,73437E-09	1

**growing with the level of discrimination*

Appendix B : Econometric analysis

Tables B.1 :Industries and countries fixed effects

Code	Industries	Industries fixed effets	Countries	Countries fixed effets
311	Food products	0,28	Austria	-0,45
313	Beverages	0,20	Germany	-0,48
314	Tobacco	0,48	Cyprus	0,65
321	Textiles	0,38	Danemark	-0,32
322	Wearing apparel, except footwear	0,27	Egypt	0,57
323	Leather products	0,02	Spain	-0,01
324	Footwear, except rubber or plastic	0,17	Finland	-0,30
331	Wood products, except furniture	0,22	Greece	0,31
332	Furniture, except metal	-0,12	Hungary	0,50
341	Paper and products	0,19	Italy	-0,14
342	Printing and publishing	-0,15	Jordan	0,63
351	Industrial chemicals	-0,07	United Kingdom	-0,15
352	Other chemicals	-0,08	Sweden	-0,35
355	Rubber products	-0,29	Turkey	0,41
356	Plastic products	-0,17	Ireland	-0,40
362	Glass and products	-0,17	France	-0,48
369	Other non-metallic mineral products	0,31		
371	Iron and steel	-0,02**		
372	Non-ferrous metals	-0,03**		
381	Fabricated metal products	-0,17		
382	Machinery, except electrical	-0,31		
383	Machinery, electric	-0,23		
384	Transport equipment	-0,45		
385	Professional & scientific equipment	-0,24		
390	Other manufactured products	-0,03		

*Notes : ** non-significant coefficients.*

Appendix C : Description of the variables

Relative production *:* $P_{lst}=\frac{X_{lst}}{PIB_{st}}$, where X_{lst} represents the production of contry s in industry l at t.

Wages : S_{lst} is the salary by workers

Penetration index: $Tp_{lst}=\frac{M_{lst}}{P_{st}}$

Access to the european market : $A_{st}=\sum_{n'} \frac{PIB_{nt}}{dist_{ns}}$, where *n* represents all european countries and *s*, southern countries describe in section 4.

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