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THE EFFECTS OF KNOWLEDGE SPILLOVERS ON INDUSTRIAL EMPLOYMENT IN EUROPEAN REGIONS (1980-1992), A COMMENT

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Abstract

In this paper, it has been tried to link the evolution of industrial employment in European regions to the degree of specialization and diversity of the territorial area, to their historical conditions and to production costs. The results, obtained from the disintegration in activity groups, seem to confirm that industrial employment has evolved, between 1980 and 1992, more positively in regions that present a higher degree of specialization in such industries. In this sense, the regional specialization level of an industrial activity would be the most determinant factor in its location. Furthermore, in most of the sectors the degree of regional specialization seems even more important than the own level of the sectorial employment in the past. At the same time, the inter-industrial productive links seem to have the greatest influence on the location decisions of the emerging industrial sectors and on those that have the highest levels of geographical dispersion.

Introduction

In most conventional economic models, an increase in the number of firms in a particular location reduces the profits firms get in that location. This tends to generate an outcome in which firms tend to be geographically dispersed. But, if the increase in the number of firms in a single location raises profits, then agglomeration would happen. In this case, the territorial dispersion would be inefficient and firms would tend to concentrate in a few locations, although it would be difficult to predict in which ones.

Economic literature indicates that agglomeration requires the existence of positive linkages between the activities of agents who operate in the same location. These linkages could be technological externalities with a limited spatial range, or pecuniary externalities which can arise in an imperfect competitive industry. If an increase in the number of firms at a location raises profits of other firms in that area through an increase in the demand for output, then there would be a demand linkage. When the increase of profits comes from a reduction in input costs, there would be a cost linkage.

Callejón and Costa's research (1995,1996) gives a complementary view of agglomeration economies. The authors indicate that external economies must be understood not only as a single transference of economic effects between agents located in the proximity, but also as the presence of an intangible asset, with a limited spatial range, where all the firms located in the same area get a profit. At the same time, they take part in the creation of these external economies. So, when we study the reasons that determine the persistence of an activity in a specific place, then it would be obligatory to analyse the role of externalities. It will be the case, then, to identify the gains of efficiency that come from agglomeration of economic activity in a limited space and that cannot be captured by the price mechanism.

For a long time economic literature has been interested in the factors that decide the location of the productive activities, but recent analytical advances have allowed the

so-called new geographic economy to consider the external economies and the linkages between economic activities inside a limited geographic area as determining factors in the industrial location. As early as the fifties, the extensive economic development literature was concerned with the key elements in industrial location. In this way, the notion emerged of a big push by Rosenstein-Rodan (1943), the growth poles by Perroux (1955), the circular and cumulative causation by Myrdal (1957), the forward and backward linkages by Hirschman (1958) or the later contributions by Pred (1966) on the dynamics of the industrial employment in the cities. Theses researches already gave way to the idea that the larger markets are where more firms and workers are located, a view retrieved in Krugman (1991).

In the most recent analysis, the decisions on economic activities location in an area are understood from the interaction between the opposing agglomeration and dispersion forces. If we exclude those specific factors that give rise to territorial comparative advantages or disadvantages, the essential determinant of agglomeration is the presence of increasing returns. The increasing returns may come from the existence of scale economies either internal to the firms or external to the firms and internal to whole concentration of firms in a location. So, the notion of agglomeration economies is closely related to the internal scale economies, the external localization economies or the external urbanization economies.

Traditionally, regional economics identifies the localization economies with the efficiency gains received by the firms of a same activity when they locate together and identifies the urbanization economies with the efficiency gains reached by the firms when they locate in places with a great variety of activities. The first of these externalities used to be associated with specialization because, in spite of being external to the firms, they are internal and specific to particular sectors, whilst the second one comes from the interaction of several activities within the same agglomeration and are external to the firm and the sector but internal to the agglomeration where the activity is located. Therefore, urbanization externalities express the advantages of the diversity and the knowledge spillovers between different activities. As a consequence, while localization economies could come from

the intra-industrial specialization, the urbanization economies have an inter-industrial source. Moreover, localization externalities correspond with the local endowment of specialized services, a local specialized market and the externalities derived from the knowledge diffusion. So, they can be strengthened by greater facilities of communication, the availability of highly developed specific input markets or the impulse towards training and technological specific policies. On the other hand, urbanization economies are more related with the size of the local market and they will be strengthened by the supply of transport and communication infrastructures, the development of new markets or urban development policies.

The analysis of the externalities comes from Marshall's contribution (1890, 1919). He puts into effect the first systematic analysis on localization economies. The firms of a sector get advantages agglomerating in areas from the increasing returns for the entire concentration, that don't exist for each single firm. In Marshall's analysis, industrial districts are seen as specific agglomerations of firms of a small size and similar characteristics, who run efficiently on taking advantage of a complex network of interactions. With the notion of external economies, Marshall shows that it is feasible to reach scale economies according to the productive size of a system of firms located in an area instead of the particular dimension of each firm, because a system of small specialized firms in different productive stages is the result of labour division and benefits from the flexibility in their relations and from an industrial atmosphere that encourages innovation.

In Marshall's view, the analysis on the activity of a firm is not possible without understanding every interaction and dependency that draws together the firm with its productive and social environment. To identify the increasing returns coming from the external effects, Marshall stated that there are three elements that generate externalities and boost the spatial concentration of firms in a particular sector:

- The information flows related to specific skills and knowledge of the activity are disseminated more easily between firms located together and give rise to a cumulative process, in time and space, of the sector's own know-how.

- The agglomeration of firms also helps the settlement of other complementary activities, such as suppliers of specialized inputs and services. This labour division is possible because a critical mass of activity exists and reduces the cost function for the firms as a whole.

- Finally, the availability of a highly specialized labour market that is shared with all the firms of the sector located within that area. Both employers and workers take profit from the agglomeration. Employers have the benefit of an extensive supply of qualified labour that allows them the best adaptation to the cyclical evolution of demand, while workers increase their security because labour demand is not dependent on a small number of firms.

From this, Marshall's main argument is that it is possible to reach internal scale economies in the sectorial agglomeration and external to each single firm that give place to a decreasing average cost function for the firms as a whole. Therefore, geographic concentration of economic activity would depend on a stable specialized labour market, wide provision of the necessary resources for the productive process and a very active spread of information and knowledge on innovations. Certainly, these marshallian external economies require a long maturing process before being manifested in the local industry. So, the competitive advantages would come not only from a more efficient productive process but also from a collective good that reinforces the external economies with a direct industrial nature (that is, intangible assets with local character that are linked to the business culture or the institutional relations).

Later, economic literature has given several views on external economies and diseconomies. Scitowsky (1954) introduced the notions of pecuniary and technological external economies. The first of them, referred to linkages between firms that run through the market, give place to a reduction in input cost and affect profitability, while the second are associated to the knowledge spread between firms that run outside the market and affect the production function. At present, it is

widely accepted that pecuniary external economies are only relevant under imperfect competition. However, technological externalities that lead to firms' agglomeration are due to the existence of communication channels between firms through interchanging relevant information, not only in technological subjects but also in other business fields, such as organization, finance or market information. As the firms have different knowledge, the profits will grow with a greater number of firms, since, as stated by Jovanovic and Rob (1989), the presence of very different knowledge is what encourages innovative activity. As communication quality could be sensitive to distance, firms would tend to concentrate to make information flows easier. However, as Mills (1967) points out, the incentive for agglomeration can be compensated for external diseconomies, as the increase in the land cost and wages are both due to rises in congestion. Therefore, once they arrive at a particular point, agglomerative forces promoted by communication reach their limit.

The analysis on information and knowledge spillovers will have great relevancy in the understanding of forming small industrial sites and analyzing the process of diffusion and industrial development in certain places in the area. Several researchers indicate that the changes identified in organization and industrial structure in recent years emphasize the fact that modern analysis on industrial economy should be based on the study of the process of local co-operation and decentralization of the production process. This way, marshallian analysis on the industrial district has re-awoken the researchers' interest, because it offers economic reasons that justify the presence of concentrations of small firms and the disintegration of some steps in the productive process when the market increases. It will be the external economies that allow the small firms to take advantage of large scale production through the concentration of a large number of small organizations in charge of some stages of the productive process. Becattini's research (1979) has been vital in order to retrieve the marshallian analysis.

As a consequence, the development of an area will not only be identified with the presence of large industrial sites that can even include several regions. It can also be identified through the presence of several local productive systems, located in

medium-size cities, where small firms show an important dynamism, in an innovative and diffusive environment. Therefore, industrialization patterns could easily be the result of the emergence of specialized productive units of a small size as it could be the decentralization of operations form large companies to smaller firms involved in local productive systems. This productive decentralization would be based in the bigger efficiencies of smaller firms. This efficiency would come from the higher dynamism in the spread and generation of innovations, from the ability to adapt to new productive processes, from the co-operation networks between firms, from highly specialized resources and services local markets, from social cohesion and mobility or from better access to relevant information. These relationships between specialization, co-operation and complementariety would form a compact industrial web which would allow substantial savings on costs and reach scale economies for the local system as a whole. In this context, the ability to incorporate new productive conditions or to satisfy specific demands in production or services would be more decisive in the maintenance of the district than the simple calculation of production cost. It could give rise to the *putty-clay geography*[1]: once the process of urbanization has started, there is a strong rigidity of the urban structure.

Recently, the debate on the characteristics of externalities has been enriched with the division of dynamic externalities (associated with the activity growth and the constant flow of knowledge) and static externalities (associated with the concentration or diversification of an area and rather identified with pecuniary externalities). Several of Henderson's contributions have been important in the understanding of these kinds of externalities and their influence on the industrial location and the development of cities. Henderson (1986) states that static localization economies derive from profits obtained by a company through the presence of other firms in the same industry. While static urbanization economies derive from profits obtained by a company through local scale and diversity. When the presence of localization economies is important, cities will tend to specialize to

[1] As Fujita and Thisse (1996) state.

intensify profits from the agglomeration of the same industrial activity. In this case, the size of the city will depend on the dimension of these localization economies and on the associated congestion costs. However, if urbanization economies are dominant, firms will move to bigger and more diversified cities. Henderson states that if increasing returns derive mainly from localization economies, the equilibrium would be formed by different types of urban agglomerations. Each one of them will be specialized in a kind of product. In this case, cities will be different sizes, the bigger the city the bigger the localization economies of the industry in which the urban agglomeration will have specialized in.

Later, Glaeser et al. (1992) also investigated the trend of firms to concentrate in an area. The authors stress the importance of knowledge spread in the growth of US cities. As the industrial agglomerations are often located in urban areas, the authors adopt as analytical tool the city-industry relationship. They propose to identify three different sources of technological dynamic externalities:

- The Marshall-Arrow-Romer (MAR) externalities, defined as intra-industrial externalities in an oligopolistic context. Glaeser et al. state[2] that these authors' opinion is that the local monopoly is more favourable for economic growth than perfect competition. That is because the information flow is restricted and the externalities can be internalized by the firm that innovates. It is expected that this internalization accelerates the innovation and economic growth rate.

- The Porter externalities are also intra-industrial but in competitive markets., because competence stimulates research and fast assimilation of innovation. Porter (1990) considers that firms in a sector will improve their competitiveness when there is intensive competition between them, which occurs when they are geographically concentrated.

- The Jacobs externalities. In this case, it deals with technological externalities of an

[2] Although this has been disputed by other researchers, such as Callejón y Costa (1996).

inter-industrial type. Jacobs (1969) considers that most important knowledge spillovers come from other industrial activities. In this way, it is the variety and the diversity of closely located industries that stimulates innovation and economic growth. They are the effects associated with so-called cross fertilization of ideas. In her opinion, it is also the local competition which accelerates the incorporation of new technologies, because local competition motivates innovation.

In their research, Glaeser et al. deduce that concentration of an industry in a city tend to be associated with a slower growth of this industry and that the specialization of a city tends to reduce the growth rate of its industries. On the other hand, industrial diversity, along with strong competitive environments stimulates employment growth. In this way, they conclude that knowledge spillovers between different industries closely located are more important for growth than intra-industrial externalities. It would be the knowledge spread between sectors that stimulates economic growth.

An alternative view is presented by Henderson et al. (1995). They do not analyze the level of competition in an explicit way. The authors consider that the knowledge flow contains both static and dynamic externalities. In the first case, it would be spillovers of basic information, on the actual conditions of the market. In the second case, it deals with information on the local *know-how* as a whole, which flows between agglomerated firms and which comes from the accumulated stock of knowledge through the numerous interactions and mutual relationships formed over the years. The authors also consider that there are only two types of dynamic externalities: Mar externalities (with the presence of localization economies) and Jacobs externalities (with the presence of urbanization economies).

The outcome of an extensive sample of US cities and metropolitan areas reveals that in the more traditional and mature industries there is a high persistence in employment patterns. The local demand, the industrial tradition and the dynamic intra-industrial externalities are critical to explain the evolution of employment. On the other hand, industrial diversity of a city seems to increase the probability of

attracting newly-developed and highly-advanced technological industries. In these sectors, Jacobs externalities could have an important role, although MAR externalities also seems to retain a critical role in maintaining these industries in a location.

As a result, both the present market conditions and its own history would be determining factors in urban location patterns. In the case of already established industrial locations, the environment constantly promotes innovation. On the other hand, sectors that are less traditional tend to move where they can find a higher diversification, although their stay in these areas will depend on the development of advantages derived from sectorial specialization.

The conclusions reached from this research coincide with the earlier analysis by Jaffe et al. (1993) in that dynamic knowledge spillovers spread slowly, are located in very few highly concentrated areas and occurs mainly within the same sector. The knowledge spillovers need time to mature and become efficient, even in the case of less sophisticated innovations. As a result, to create an effective network of information interchanges is not an easy task. So, to take profit from this type of externalities the existence of sectorial clusters in determined locations is necessary and in this way would favour the agglomeration of economic activity[3].

The analysis conducted later by Costa and Callejón on the Spanish economy maintains that it is not easy to strictly isolate externalities associated with diversity from the effects derived from the size of the local economy, because areas with a greater local demand will also contain a higher productive variety. Only after controlling the levels of economic activity, if productive diversity influences positively the location decisions of the firms in a sector, could variety be considered an externality whose influences would add to the linkage effects derived from the

[3] A research recently conducted by Audrestsch (1998) confirms that the competitive gains are increasingly related with the capacity to innovate and, as the new knowledge are generated and transmitted in a more efficient way in the local proximity, the economic activities based on them have a high inclination to concentrate themselves geographically.

size of other sectors. In their opinion, the previous distinction between dynamic and static externalities will not have enough discriminatory power. The authors suggest an alternative method to identify the static or dynamic character of externalities that affect firms in a certain location. They believe that dynamic externalities are irreversible and they arise from spillovers of technological and other kind of knowledge that increase efficiency permanently in firms. Although the firm that benefits from the external economy would change its location would not loss the effect of the learning accumulated on the production function. On the other hand, static externalities would be reversible and its effect over the profitability would disappear with the source of the externality (for instance, as a result of the lose of local specialized suppliers or in the case of losing the local market). As a consequence, the dynamic effects would be those which could be incorporated in the production function of the firm.

Presentation of the model

Below, we are going to introduce an industrial location model that incorporates the influence of externalities, as were presented in Callejon and Costa's research. However, the unit defined as a region in the European Union is an excessively wide territorial area and also is not homogeneous in dimension to be able to capture precisely the impact of the externalities on the productive location decisions. So, the main objective of the present section is to try to identify some characteristics of the evolution of industrial employment in European regions.

The analyzed model presents the current level of the regional employment in an industrial sector as a function of the historical conditions and of the present conditions of the market. That is, the dependent variable of the model refers to the employment level in the industry-region relationship. The model incorporates variables that, in a territorial area with lower dimension, could represent the productive static and dynamic externalities that influence the evolution of industrial employment. Therefore, some variables identify the current dimension of the sector and other related sectors, while other variables will try to explain historical aspects as the dimension of their own sector in the past, the degree to regional specialization in the sector and the degree to productive diversity. To sum up, it will be tested whether the specialization or the diversity constitutes a better indicator of the intensity of information flows between firms than the size of their own sector. Furthermore, while the variable representative of the diversity level will try to identify externalities of inter-industrial type, the specialization as well as the dimension of the sector in the past will try to capture externalities of intra-industrial character.

The model will try to explain, through the construction and modeling of a panel data, the evolution of the regional employment in the ten industrial activity groups available according to the classification NACE-CLIO of Eurostat. The estimation is accomplished from a sample of 76 European regions, the only ones which have all the necessary data, and the time period covered is from 1980 to 1992. The restrictive

characteristics of the sample selected (as the small number of regions, the excessive geographical dimension, the short time period and the very limited sector disintegration) force us to be extremely cautious in the specification of the model as well as in the interpretation of the results. Since the analyzed individuals are characterized by a double territorial and industrial dimension, the analysis by different sectors and the estimation through panel data would seem advisable. In that way, we will be able to control the individual effects associated with the dual characteristic of the sample and, at the same time, to widen the explanatory capacity of the model and to increase the number of available observations[4]. However, it will also be necessary to contrast that the used instrumental variables are not correlated with the error term. Consequently, the model has been estimated for each one of the analyzed industrial sectors, classifying the data in different sub-periods.

The model to estimate is the following:

$$LE_{it+d} = \alpha + \beta_1 * LE_{it} + \beta_2 * ESP_{it} + \beta_3 * HH_{it} + \beta_4 * LSAL_{it+d} + \beta_5 * LO_{it+d} + u_{it}$$

Therefore, the dependent variable in the model (LE_{it+d}) will represent the logarithm of the employment of the sector *i* in the region *j*, at the end of each sub-period. As far as the explanatory variables is concerned, they identify the following effects:

- LE_{it} : logarithm of the employment, at the beginning of each sub-period, of the sector *i* in the region *j*.
- ESP_{it} : specialization index of the sector *i* in the region *j*, at the beginning of each sub-period[5] .
- HH_{it} : index of not-diversity or productive concentration of the others industrial sectors in the region *j*, at the beginning of each sub-period (that is, of all the activities

[4] As indicated in De Lucio et al. (1996).

[5] Calculated from $ESP_{ij} = | (E_{ij} / E_i) - (E_i / E) |$, being (E_{ij} / E_i) the quotient between the employment in the sector *i* and the total industrial employment of the region *j* and being (E_i / E) the quotient between the total employment of the sector *i* and the level of the industrial employment in the set of the sample.

except from sector *i*)[6] .

- **$LSAL_{it+d}$:** Logarithm of the average wage of industry *i* in the region *j*, at the end of each sub-period[7] .

- **LO_{it+d}:** Logarithm of industrial employment in the other sectors (all the industrial activities except for the sector *i*) in the region *j*, at the end of each sub-period.

The estimated model uses two types of explanatory variables: the historical and the present conditions of the sector. Historical conditions are measured by the level of employment in their own industry, by the regional specialization index in this industry and by the index of productive diversity in the region. On the other hand, the current conditions of the sector are captured by the representative variables of the employment in other sectors and by the average wage, in each one of the regions. The average wage would also be a representative variable of the regional level of the production costs in each sector while the employment in the rest of the sectors would appear as a representative variable of the size of the regional market. However, this last variable would also capture information spillovers coming from other sectors. So, in this case, the greater the employment in other sectors, the greater the probability would be that these spillovers would be important and have a diversified character.

In the mentioned Callejon and Costa's model, the role of the dynamic externalities is deduced from the impact of the size of their own industry and its degrees of specialization and of their economic diversity in the past. It is expected that such effects reflect the importance of dynamic externalities associated with information flows, since the diffusion systems of information between firms need time to form and mature.

[6] Calculated from the Hirschman-Herfindahl's index. That is, $HH_{ij} = \Sigma_{k \in j} (E_{kj} / E_j - E_{ij})^2$.

[7] Calculated as the quotient between salary bulk (expressed in ecus) and the number of earners, from the information included in the REGIO data base. Since the quality of the information is very poor, they have only been able to use two different series of average wage (referred to 1986 and 1990). Each one of the series has been used in closest half of the time distribution of the sample.

However, Callejon and Costa also indicate that it will be convenient to use two different indicators in reference to the importance of their own sector because the level of variable LE_{it} would capture not only the mentioned dynamic externalities but also other territorial effects that are invariant in time and are not external economies. In contrast, the specialization would be related to the facility of the establishment and the quality of knowledge flows. Furthermore, the specialization of an area in one or more sectors could lead to a different type of knowledge accumulation from those which would come from a more diffusive environment.

If these two variables are significant, it would mean that industrial activity benefits from knowledge accumulated by firms themselves over a long period of time. As a consequence, they would express dynamic effects. The greater the employment of their own industry in the past, the greater the probability would be of technological external economies forming in the territory related to the knowledge of their own sector. At the same time, the greater the weight of the sector within the regional economy, the more important the density and efficiency of the information flows between the firms located in the same area.

As far as employment in the rest of the sectors is concerned, it is a variable that would probably capture effects related to the size of the inter-industry links between the firms of the sector. The regional weight of the inputs suppliers and of the output consumers of the sector, would be represented by this variable. However, it would also represent the dynamic effects of the knowledge flows from other industrial sectors.

If the indicator of non-diversity in the productive environment shows a positive sign and turns out to be significant, the productive diversity would not help the location of industrial activities. Therefore, it would be rejected the hypothesis that diversity stimulates the investment coming from the cross fertilization of ideas. However, it is important to stress that the rejection of the role of external economies associated with the diversity could be misleading, since the diversity in activities that are not exclusively manufacturing can also favor firm agglomeration in an industrial sector.

Finally, the negative sign of the indicative variable for the average wage would confirm that firms prefer to be located where the wage costs are lower, though this must be tested to see if the confidence level of the coefficient is similar or smaller than the rest of the explanatory variables. At the same time, it is important to point out that this variable could suffer important limitations, because it derives from previous calculations of the REGIO data base, so the reliability of the results is significantly smaller.

Evaluation of the results

The table below illustrates the results of the estimation for the regional industrial employment level[8] using panel data for each one of the ten industrial sectors and with annual time intervals. The results show a great similarity with those obtained by Callejon and Costa in the Spanish provinces. It can be observed that all the included variables have a significant impact on the location of the industrial activity. The results, therefore, would reinforce the idea of the importance of the information diffusion for the efficiency of the industrial activities.

[8] There have been eliminated the observations in those which the initial level of the regional employment in an industry was inferior to 100 workers, in order to avoiding the possible effects of observations that presented a very atypical behavior. In that way, the sample is constituted by 8.364 observations.

Dependent variable: Industrial employment (LE_{it+d})

Industrial sector	LE_{it}	ESP_{it}	HH_{it}	$LSAL_{it}$	LO_{it+d}	R^2- Adj.
Fuel and power products	0,395 (18,54)	0,317 (30,02)	0,260 (1,21)	-0,088 (-4,31)	0,487 (13,98)	0,9969
Ferrous and non ferrous ores	0,530 (21,40)	0,192 (13,31)	1,951 (2,97)	-0,096 (-2,99)	0,181 (2,35)	0,9881
Non-metallic minerals and mineral products	0,205 (11,89)	0,566 (44,61)	-0,258 (-1,57)	-0,006 (-0,31)	0,849 (33,69)	0,9980
Chemical products	0,351 (15,15)	0,546 (28,74)	-0,678 (-1,87)	-0,085 (-2,23)	0,576 (13,60)	0,9968
Metal products, machinery and equipments	0,127 (8,17)	1,498 (55,98)	-0,064 (-0,58)	0,076 (4,00)	0,894 (41,53)	0,9995
Transport equipment	0,503 (24,22)	0,614 (22,47)	1,451 (3,79)	0,168 (4,86)	0,526 (11,03)	0,9964
Food, beverages and tobacco	0,174 (10,10)	0,579 (43,96)	-0,042 (-0,39)	0,020 (1,32)	0,769 (38,11)	0,9990
Textiles, clothing and leather	0,404 (14,77)	0,686 (19,73)	-0,163 (-0,52)	0,043 (0,87)	0,591 (13,35)	0,9978
Paper and printing products	0,339 (14,59)	0,663 (26,05)	-0,713 (-3,12)	-0,063 (-2,62)	0,829 (21,41)	0,9974
Other industries	0,156 (8,24)	0,832 (40,15)	-0,200 (-1,33)	-0,102 (-4,84)	0,771 (25,15)	0,9982

	Number of observations	F (total)*	F (temporal effects)*	F (regional effects)*	Hausman Test*
Fuel and power products	828	359,92	18,13	12,56	857,54
Ferrous and non ferrous ores	780	143,74	6,38	5,61	325,59
Non-metallic minerals and mineral products	876	488,09	30,14	22,97	5.805,34
Chemical products	780	200,54	10,94	9,72	673,72
Metal products, machinery and equipments	888	734,38	14,24	26,70	408,41
Transport equipment	792	255,65	5,78	10,08	573,57
Food, beverages and tobacco	900	430,68	23,85	26,55	5.603,81
Textiles, clothing and leather	828	261,50	11,90	7,07	442,28
Paper and printing products	804	253,13	34,28	7,14	458,52
Other industries	888	355,49	21,61	16,16	16.311,54

*: Significant at 1% level.

(t-Student into brackets)

The estimations show that the variable with a greater explanatory capacity in the size of regional employment in a sector, will be the specialization rate of the region in this sector. As a result, regional specialization is very significant in all the sectors and it is the explanatory variable that presents the greatest degree of significance in eight of the ten analyzed sectors. It is necessary to remember that, in this model, the regional specialization level has been identified with MAR externalities, that would try to capture the effects related to the knowledge diffusion in their own sector. That is, when the environment is more intensive in knowledge affecting to the firms of a sector, these have greater opportunities in acquiring and using the information flows of the technological, commercial, organizational or other kinds of managerial aspects, that are related to the location of the activity.

On the other hand, the variable that identifies the employment level in their own sector at the initial period also has significant results for all the sectors (the most significant in two of the cases), thus confirming the importance of the historical variables on the evolution of employment.

The third variable of importance is the employment in other sectors. According to the suggested hypothesis, the influence of this variable on employment comes from link effects and also the size of the local market, mainly because of the demand size for intermediate goods. However, this variable could also capture externalities derived from knowledge spillovers associated with the diversity, though the model does not allow to separate both effects.

On the other hand, it's necessary to analyze with careful attention the results of the concentration or non-diversity indicator. This variable could be significant in six sectors, although its confidence level is substantially lower. However, the most characteristic element of such a variable is the change of its sign between the different sectors. In this sense, in four of the six mentioned sectors the variable has a negative sign confirming the presence of externalities of the Jacobs type. If so, the productive diversity would favour the industrial location in some sectors.

Nevertheless, the most significant levels in this variable are obtained in the two sectors where it shows a positive sign.

The variability in the sign of the variable of non-diversity compels us to be careful when interpreting the results, because the restrictive characteristics of the sample selected. Therefore, in European regions the presence of inter-industry externalities associated with the diversity cannot be rejected. Similar results are observed in the case of the variable indicative of the wage cost. In seven of the ten sectors it is very significant, although in two of these cases the variable has a positive sign, the opposite of what would be expected. Though it could be observed an inclination of the wage variable to show a positive sign in the sectors less labour-intensive, the model does not offer a conclusive result. Nevertheless, it seems to be confirmed that the wage cost is less decisive in the determination of the industrial location between European regions.

Below, in order to obtain a greater information on the relevancy of the productive diversity in the industrial employment dynamic within the European regions, it has been calculated the index of geographical concentration of employment (Lj) in the sample of 76 regions for each one of the ten industrial sectors, according to the methodology stated by Fluvià and Gual (1994)[9] :

[9] That is, it has been calculated, for each sector j and in each region i, $L_j=\Sigma_i |s_{ij} - s_i|$, where $s_{ij}= (E_{ij}/E_j)$.

	1980	1985	1992
Fuel and power products	0,51947	0,48781	0,46838
Ferrous and non ferrous ores	0,69451	0,72553	0,66831
Non-metallic minerals	0,40172	0,41732	0,46040
Chemical products	0,41073	0,43086	0,44197
Metal products, machinery and equip.	0,27811	0,29513	0,26259
Transport equipment	0,49679	0,50267	0,47014
Food, beverages and tobacco	0,38653	0,37776	0,38225
Textiles, clothing and leather	0,46356	0,50540	0,57696
Paper and printing products	0,34021	0,32528	0,35208
Other industries	0,23843	0,24015	0,23386

In general, the table shows a moderate trend of increase in the degree of geographical concentration of the industrial activity, mainly in the textile, clothing and leather sector. However, some inflexion could also be revealed in those industrial activities that were already showing a higher concentration level in 1980.

It is more relevant to verify that the non-diversity indicator shows the expected negative sign in the six sectors that, in the previously computed sectorial regressions, had in 1992 a smaller geographical concentration level of employment (with independence of their significant level). At the same time, in these sectors the variable representative of the employment level in the other industrial activities (LO_{it+d}) presents the highest significant levels. Both effects could lead to the presence of inter-industrial externalities.

To sum up, it has been tried to link the evolution of industrial employment in European regions to the degree of specialization and diversity of the territorial area, to their historical conditions and to production costs. The results, obtained from the disintegration in activity groups, seem to confirm that industrial employment has

evolved, between 1980 and 1992, more positively in regions that present a higher degree of specialization in such industries. In this sense, the regional specialization level of an industrial activity would be the most determinant factor in its location. Furthermore, in most of the sectors the degree of regional specialization seems even more important than the own level of the sectorial employment in the past. The importance of the effects of the specific knowledge diffusion in the sector, through direct contact between firms, would seem absolutely confirmed. On the other hand, even though the variable of productive diversity does not appear always with the expected sign, the level of employment in the other industrial sectors shows a significant explanatory power. As a consequence, the size of the local demand of other industrial goods would seem to have a relevant role in location decisions. At the same time, as stated in Henderson et al. (1995), the inter-industrial productive links seem to have the greatest influence on the location decisions of the emerging industrial sectors and on those that have the highest levels of geographical dispersion.

As a consequence, it could be deduced that through territorial external economies it is possible to influence industrial employment and productivity. So, the productive modernization processes can be much better understood if the specific aspects of each region are taken into account. In any case, the results should be interpreted with care, because of the restrictive characteristics of the sample selected and of the model's specification, since the lack of available data prevents us to verify, with greater precision, the presence of localization and urbanization economies.

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