EMPIRICS OF THE METROPOLITAN PRODUCTIVITY PATTERNS IN EUROPE

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Abstract - *This paper focuses on the main European metropolitan areas and builds empirics on their evolution over the process of economic integration these last twenty years. These metropolitan areas are acknowledged to be the main engines of economic development in Europe, and to concentrate larger and larger shares of population, activities, R&D resources... Different theoretical frameworks have grounded these cumulative dynamics. Recently, regional and development policies have also based their action on these areas, through the concept of polycentricity for instance. The paper rests thus on a database of the forty main European cities over the period 1975-2000, disaggregated in twenty sectors of activity. First of all, the paper analyses the processes of convergence in terms of productivity or sectoral similarities at work between the different metropolitan areas as well as the evolution of their specialization in terms of value added or employment. An analytical framework is outlined thereafter, based on the rates of growth of productivity and employment, which allows us to define a dynamic view of this convergence process, and to map the dynamic comparative advantages of sectors in our metropolitan areas. In addition to the in-depth analysis of the cities, the results of these different steps show that the metropolitan areas are the main vectors of the process of European integration; a standard model of the metropolitan area seems to emerge as a result of this process.*

Keywords : METROPOLITAN AREAS, EUROPEAN INTEGRATION, URBAN GROWTH DYNAMICS, CONVERGENCE, SPECIALIZATION

JEL classification : C10, O18, R11, R12.

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1. INTRODUCTION

This paper is designed to build empirics on the dynamics of the main European metropolitan areas over the process of economic integration between 1975 and 2000. This empirical analysis is basic to the understanding of the territorial dynamics in Europe. Cities are indeed the engine of growth and development of the economies; they are the more advanced elements of the economies, and concentrate more and more important shares of the population, of the production, of the R&D resources and innovation capacities… But they are also more and more considered as the core of the regional policies, somewhat in contradiction with the traditional policies oriented towards peripheries. The introduction gives some rationale for this increasing role devoted to the metropolitan areas, and underlines the different dimensions of the empirical knowledge to be built on their evolution to highlight territorial dynamics in Europe.

The European Union is one of the more rich and developed part of the world, yet one also in which the larger regional disparities exist, which could threaten its economic and social cohesion and its whole project of integration. There are thus good reasons for helping lagging regions to catch up. The First Report on Cohesion (1996) is explicit on the elements at stake: "imbalances do not just imply a poorer quality of life for the most disadvantaged regions and the lack of life chances open to their citizens, but indicate an under-utilization of human potential and a failure to take advantage of economic opportunities which could benefit the Union as a whole". Two principles characterize thus the economic and social cohesion policy implemented by the European Commission to reduce regional imbalances: equity and efficiency (Ottaviano and Thisse, 1999); unfortunately, the regional policies implemented through the structural funds have appeared to be ineffective (Brackman *et al.*, 2005) and the objective of efficiency not met.

Since the signature of the Treaty of Rome, the geographic dimension of the integration process has indeed constantly been underlined. The European integration is an ongoing process which continuously combines territorial enlargement and deepening of the economic integration (Fisher and Nijkamp, 1999). These two dimensions have strong implications on the territorial dynamics in Europe. The successive enlargements have resulted in increasing disparities across countries and regions (which are worsened with the entry of the Central and Eastern economies, but given the lack of data available regarding the historical analysis made in the paper, this last enlargement will not be considered). The deepening – factor and capital mobility, market and monetary integration – has given more reality to these disparities. But for the Commission free mobility of goods and services, factors and capital should induce an acceleration of the growth across the Community and ensure the real convergence of income per capita, which stands as the basic criteria of the evaluation of disparities (EC, 1996). The catch up process is perhaps not always fast enough, and economic or regional policies should create the condition of its

acceleration. The latter has continuously gained in importance, to account for the third of the budget of the Commission. Traditionally, the regional policy of the structural funds has provided financial support to the peripheral regions, and developed their infrastructures. But the European integration has set up complex regional dynamics the structural fund policy has been unable to counter; on the contrary unexpected consequence of the policy have emerged which have deepened the existing disparities. Opposite dynamics appears to prevail at the level of the nations and at the level of the regions. The convergence process of the national economies of the E.U. coexists with a process of divergence *between* the regional European economies, and even more *within* the different nations. In fact, some particular regions, the metropolitan areas, seems to have benefited from the process of integration and to be coupled with the convergence process arising at the national level, when the other regions are decoupled from this trend.

Many empirical works attest of this decoupling. After the initial works of Barro and Sala i Martin (1991) or Sala i Martin (1996) suggesting the convergence of regional per capita incomes, more and more evidences have shown that the speed of the regional convergence process in Europe was slowing down, or even reversing (Armstrong, 1995, Graham and Hart, 1999, Boldrin and Canova, 2000, Brackman *et al.*, 2005). The European regional policy has been unable to counter the huge cumulative processes of concentration fed by the initial disparities in sizes of local markets and the related externalities. In fact the questioning of the *a priori* hypothesis of convergence implicit in the European construction and the acknowledgement of the existence of these divergence forces are recent, and rests on the developments of the 'new economic geography' born from the seminal works of Krugman (1991). Analytically, the consideration of increasing returns in the economic activity has allowed Krugman (1991) or Krugman and Venables (1993) to evidence the possibility of occurrence of regional divergence in the process of economic integration, and concentration or specialization as emergent properties of economic activities. As a result, regional policies implemented through the structural funds have appeared to be ineffective. The process of economic integration has triggered complex territorial dynamics in Europe: the process of convergence of the member states seems to mirror – or to be driven by – the process of convergence of the metropolitan areas, which have strongly benefited from the policies. On the contrary the peripheral regions were deprived of the resources in terms of social capital or institutional capabilities necessary to build on the structural funds subsidies (Morgan, 1997). The emergence of the global knowledge based economy has fostered this process of divergence. The importance of R&D, the need for specialized innovation services, have led firms to favor spaces with strong scientific and technological potential, where relevant information and research capabilities can be found, resulting in an archipelago economy (Veltz, 1993, 1996).

The European regional policy has inferred new strategies from these elements. The role of innovation as the key of competitiveness and of reduction of regional disparities has been acknowledged by the Sixth Report (1999), and

the role of urban systems as engines of regional development by the Third Report on Economic and Social Cohesion (2000).

Additionally, the acknowledgement of the contemporaneous nature of the economy (knowledge economy, agglomeration externalities….) has resulted in the definition of the "networked polycentrism" in the European Spatial Development Perspective (1999), whereby development is structured on the basis of an urban network. The reinforcement of a balanced and networked system of metropolitan areas is now presented by the Commission as the unique strategy of spatial development allowing combining efficiency and cohesion. The paper will not try to test the decoupling between the centers and the peripheries, but will evidence the hypothesis of mirroring and question how the process of convergence is translated in terms of sectoral change to highlight the nature of the 'polycentrism' or archipelago economy defining the European landscape. Indeed, is the European integration inducing the emergence of 'specialized industrial district' like the ones characterizing the USA, the standard regarding economic integration, or diversified metropolitan areas ? Following the seminal work of Krugman (1991), different conjectures have been raised regarding specialization processes in the European scene, and different empirical studies have been conducted (Midelfart-Knarvik *et al.*, 2000, Amiti, 1998, Brülhart, 1996). The consequence of this process has been analyzed by another body of literature, which has contrasted local spillovers arising from MAR or Jacobs effects (Glaeser *et al.*, 1992). MAR spillovers are due to the specialization of a given area in a single industry, while Jacobs spillovers arise with the variety and diversity of local industries.

The paper builds empirics on this basic issue of structural change though the evolution of the intra and inter specializations of metropolitan areas. There is a general agreement regarding the positive effects of agglomeration on growth and development, but the related knowledge externalities will be very different according the nature of the agglomeration – specialized or diversified (Glaeser *et al.*, 1992, Henderson *et al.*, 1995) – and some details on the European case is provided by the paper.

The understanding of the nature of the dynamics of the metropolitan areas is thus pivotal for the future of Europe, as these areas can be regarded as its engines of growth and development, both from the facts and from the policies implemented. Is there some convergence between the leading and lagging cities over these last 25 years? What about specialization and the nature of the future European landscape? The coexistence of convergence in per capita income and of sectoral convergence between the metropolitan areas, defined as 'structural convergence' by Wacziarg (2001), would have important implications; it has thus to be highlighted. The section 2 will present the database used and a first analysis of the convergence processes of the European metropolitan areas and of the evolution of the specialization overtime. Section 3 will rank the cities in a specific analytical framework built from Camagni and Cappellin (1985); it develops an alternative approach focusing on the economic history of the European regions deeply involved in structural change, i.e. the metropolitan

areas. These two sections rest on the implementation of statistical and graphical devices which evidence the complex sectoral and territorial dynamics at work in the European scene. They provide arguments for defending the existence of structural convergence amongst the metropolitan areas. Section 4 concludes.

2. THE EUROPEAN METROPOLITAN AREAS : DATA AND CONVERGENCE ISSUES

The 'stylized facts' attached to the post-seventies act indeed as the indication of deep structural change in the European economy, underlined by complex sectoral and territorial dynamics (Armstrong, 1995, Boldrin and Canova, 2000, Brackman *et al.*, 2005). The empirics of regional dynamics have evidenced important disparities and a high degree of mobility of regions overtime, with relevant movements of catching-up and falling behind (Quah, 1996). But clearly, the analyses focusing on the aggregate growth process cannot grasp these complex developments, and the theoretical framework going with the usual developments on convergence is at odds with the evolving disparities of the regional growth paths. The following develops an alternative approach focusing on the economic history of the European regions deeply involved in structural change, i.e. the metropolitan areas, as emphasized previously. Clearly, the analysis will not propose an exhaustive picture of the process of change, at least because of the lack of relevant database. But some monitoring variables, which encapsulate the regional productive structures, will help to depict these histories and highlight the convergence as well as the structural change issues in the European landscape.

The 'stylized facts' to be evidenced by the regional empirics of growth should have three dimensions : geographical, sectoral and temporal. The analytical frameworks developed should allow to grasp these three dimensions of change, to catch the distortions of the sectoral as well regional growth regimes through the analysis of the evolution of the productive structure of the economies considered, i.e. the qualitative changes affecting production, and produces new insights on the notion of convergence. The empirics rest thus on a database of the main European metropolitan areas over the period 1975 – 2000, disaggregated in twenty sectors of activity, which will allow the deal with the analytical issues raised. The database, provided by Cambridge Econometrics, contains information on different variables: population and working population, compensation per employee, in constant prices (1990 euro), gross value added, in constant prices (1990 euro), employment.

The database has been completed by Cambridge Econometrics from the economic variables available in the Eurostat databases at the Nuts3 level, allowing an analysis of the European cities or metropolitan areas. The statistical definition of the cities is a difficult issue; the Cambridge Econometrics has chosen to focus on the functional regions, defined as the territory over which different types of locality interact to create a functioning urban system (ERECO, 2001). Implicitly the cities are considered as the core of local economic interactions, allowing to draw evidences regarding the evolution of the specialization of the areas; the Nuts 3 level used to define the metropolitan

area appears thus to be a good compromise regarding the issues raised by the paper. The geographical and sectoral disaggregation definitions are given in the following table.

Table 1 : Cities. Codes and countries

Amsterdam	Am	Nd	Dublin	Db	Irl	Lille	Li	Fr	Paris	Pa	Fr
Athina	At	Gr	Dusseldorf	Ds	Bd	Lisboa	Lb	Pt	Roma	Rm	It
Barcelona	Ba	Sp	Edinburgh	Ed	Uk	London	Lo	Uk	Rotterdam	Rt	Nd
Berlin	Be	Bd	Frankfurt	Fr	Bd	Lyon	Ly	Fr	Stockholm	Sk	Sw
Birmingham	Bir	Uk	Geneve	Ge	Ch	Madrid	Md	Sp	Strasbourg	Sb	Fr
Bologna	Bo	It	Glasgow	Gl	Uk	Manchester	Mn	Uk	Stuttgart	St	Bd
Bordeaux	Bd	Fr	Hamburg	Ha	Bd	Marseille	Mr	Fr	Torino	To	It
Bruxelles	Br	Be	Helsinki	He	Su	Milano	Mi	It	Utrecht	Ut	Nd
Cardiff	Ca	Uk	Kobenhavn	Kb	Dk	Munchen	Mu	Bd	Wien	Wi	At
Den Haag	Dh	Nd	Koln	Kl	Bd	Oslo	Os	Nw	Zurich	Zu	Ch

Table 2 : Sectors. Nomenclatures and codes (Eurostat, Nace-Clio RR17)

1	Agriculture	34	Paper And Printing Products
11	Total Energy And Manufacturing	39	Other Manufacturing
4	Fuel And Power Products	6	Construction
2	Ferrous And Non-Ferrous Metals	12	Total Market Services
36	Non-Metallic Mineral Products	61	Distribution, Lodging & Catering
35	Chemical Products	7	Transport & Communications
38	Metal Products	8	Financial Services
385	Transport Equipment	9	Other Market Services
31	Food, Beverages And Tobacco	13	Non Market Services
32	Textiles, Clothing And Footwear	10	Total

2.1. Convergence issues

This part builds descriptive statistics to highlight the empirics of regional growth on the European economy. The first issue to be raised regards the economic variables to use to measure the regional disparities and their evolution. The two commonly adopted measures in empirical works are labor productivity and gdp per capita. The first refers to the characteristics of the productive structure of the economy, as reflected by its fundamentals, when the second is also affected by additional elements reflecting the socio-economic structure of the economy, i.e. mainly unemployment and participation rates, and does not follow necessarily the same trend (Paci, Saba, 1998). Thus, improvements in the economic performance of lagging cities, following for instance decentralization or policy measures, could result in convergence in terms of productivity but not necessarily in output per capita, as a consequence of the disequilibria of the labor markets. The two variables are thus not perfect substitutes, as sometimes assumed in the literature, and highlight different aspects of the regional dynamics.

Are the regional disparities growing or vanishing in the European economy? A first set of evidence can be built from the analysis of the dispersion in the distribution of regional productivity or gdp per capita overtime. The decrease of the measure of this dispersion, e.g. here the coefficient of variation, is labeled s-convergence. The Figures 1 reports the results regarding convergence of the indexes related to productivity and gdp per capita; it plots the coefficient of variation of the log of the variables against time.

*Figure 1 : Productivity and GDP per capita : **s**-convergence*
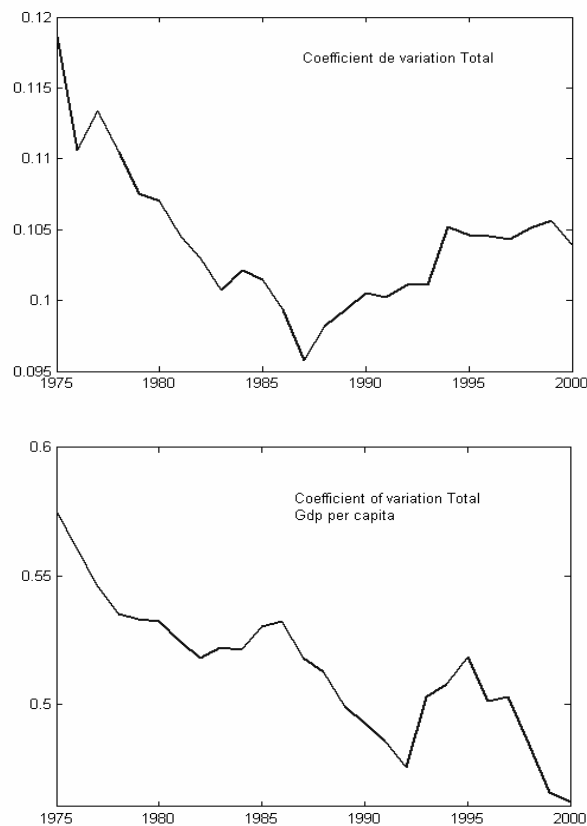
The results are highly contrasted with the usual findings of European regional convergence. The evidences of s-convergence support decreasing disparities after 1975, when the opposite is usually asserted in the empirical literature: decrease before the crises, increase after. The trend increases however slightly in the end of period. The evolution of the dispersion of the regional gdp per capita is interesting; the decrease of the metropolitan disparities is an indication that the economic process sustains socio-economic improvements in the catching up cities.

The following figure regards indeed the coefficient of variation of the compensation per employee; the difference between the leading and lagging cities has been dramatically reduced during the period of analysis. A European standard seems to emerge in the main European cities; the socio-economic improvements concern thus employment growth, but also quality of life in the catching up cities.

Figure 2 : Coefficient of variation of the compensation per employee
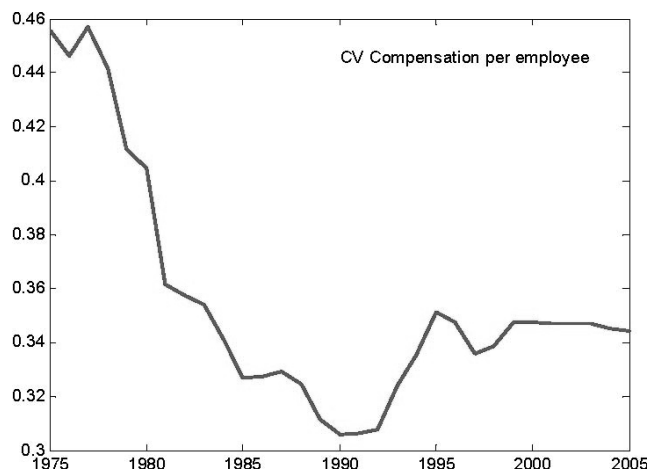
2.2. Specialization

How this general process of convergence between the main European cities is translated in terms of structural change? As already emphasized, different conjectures have been raised regarding specialization processes in the European scene after Krugman (1991), and different empirical works implemented (Midelfart-Knarvik *et al.*, 2000, Amiti, 1998, Brülhart, 1996). Amiti (1998) evidences an increase of regional specialisation in manufacturing over the period 1968 – 1990, with an acceleration since the eighties. To our knowledge, all empirical works support this result, but the geographical focus is generally limited to the Nuts2 level; the works include exhaustively all the European Nuts 2 regions contained in the geographical perimeter of analysis they consider. Moreover, the analysis is generally restricted to manufacturing. Regarding our focus on metropolitan areas, this restriction is not relevant.

This paper will thus not consider the general geographical setting addressed in these papers, but the dynamics at work in the selected European cities, which are also the engines of growth and development of the European economy. The levels of desegregation considered in this work regarding geographical and sectoral levels are usually not addressed in the literature, but are certainly the most significants regarding European or contemporaneous economic dynamics. Indeed, as already emphasized, metropolization is the territorial embodiment of globalization.

Competition and specialization are for Cuadrado-Roura and Rubalcaba-Bernejo (1998) the main characteristics of the European city system; as they underline, specialization is, first and foremost, a fact, a historical fact. The specialization process, when related to the competitive dynamics of cities, helps according the authors to explain the differences between the cities. But still, different controversies have been developed in the literature, mainly related to the MAR (after Marshall, Arrow, Romer) vs. Jacobs opposition. The first upholds the intra-sectoral spillovers as engine of local growth, when the other defends inter-sectoral externalities, the most important knowledge transfers would find their sources outside the industry. Jacobs (1969) defines a city as "a settlement that consistently generates its economic growth from its own local economy". The "MAR or Jacobs" externalities consider the growth of local areas. The MAR approach should predict that the industries have to geographically specialize, and that specialized cities growth faster because of increased knowledge spillovers. The Jacobs approach should predict that higher growth is to be found in diversified cities. The metropolitan areas constitute multisectoral industrial structure where intersectoral externalities enhance diverse knowledge bases to be accessed and recombined (Jacobs, 1969), fostering growth and development. The contemporaneous evolution of the innovation process towards a "cross-border systems of innovation" – the creation of resources as the result not of the mere adding of technologies, but of the fusion of different technologies in a new (Imai, Baba, 1989) – should work in favor of Jacobs. Convergence between the selected European cities should, if it exists, thus go with structural convergence towards decreased specialization.

The empirical analysis of the evolution of specialization in the European metropolitan system implies the construction of dedicated indices. Several indices have been built after Krugman (1991), Kim (1995) for the USA or Midelfart-Knarvik *et al.* (2000) for Europe among the most important contributions. The following builds on these contributions; here "Europe" means the aggregation of the metropolitan system, and the European dynamics is restricted to the dynamics of the system in terms of specialization. The relative evolution of the cities in the system, more than the absolute value of the indices, is thus interesting in our case.

After Midelfart-Knarvik *et al.* (2000), the sectoral activity level will be considered as the basic level of activity : $x_i^k(t)$ can measure the employment or the gross value added of the sector k in the city i at time t depending the variable of analysis chosen; the two will be dealt in the following. Its share in the activity level of the city will be given by :

$$v_i^k(t) \equiv x_i^k(t) / \sum_k x_i^k(t)$$

$v_i^k(t)$, the share of the sector k in the total activity of the metropole i, is the basis of the analysis of specialization.

The range of the standard deviation of the $v_i^k(t)$ of each city i across the cities is decreasing, from 0.0515 to 0.0412 ; the system is somewhat converging towards a common value. The measure of specialization follows the Krugman analysis. For each city, $v_i^k(t)$, the share of the sector k in the total activity of the metropole i, is computed; correspondingly, $\overline{v_i^k}(t)$ the share of the same sector in the activity of all other cities of the sample is also computed (in terms of employment and value added, constant prices €1990). The difference between the sectoral structure of the city i and all other cities is thus measured taking the absolute values of the difference between these shares, summed over all sectors.

$$K_i(t) = \sum_k abs(v_i^k(t) - \overline{v_i^k}(t)) \quad \text{with} \quad \overline{v_i^k}(t) \equiv \sum_{j \neq i} x_i^k(t) / \sum_k \sum_{j \neq i} x_i^k(t)$$

where $K_i(t)$ stands for the Krugman specialization index.

The following figures summarize the evolution overtime (Ki(2000) – Ki(1975)) of the indexes for the 40 cities considered. Dublin, Glasgow, Kobenhavn, Oslo run as exceptions in a movement of general decrease of the specialization indexes. Despite movement of convergence over time, the difference between the graph evidences more persistent disparities in productivity.

Figure 3 : K-specialisation index: Employment and Value Added
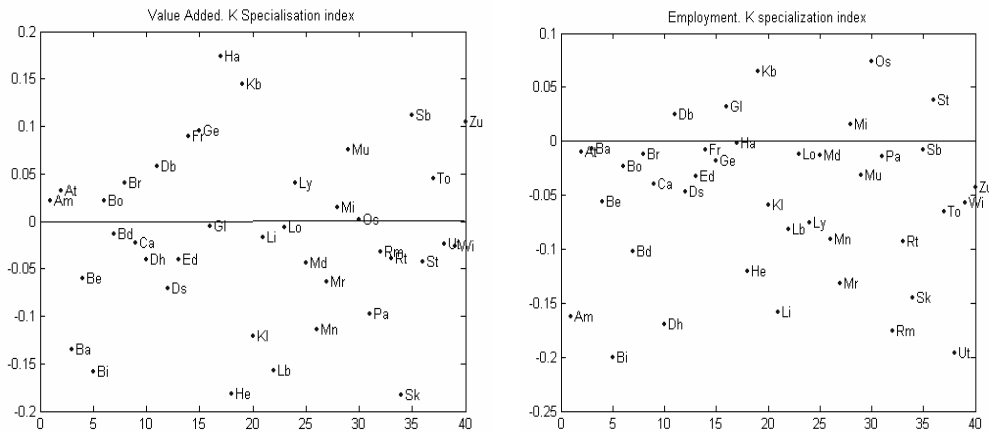
Clearly, the metropolitan areas are converging towards a similar structure in terms of sectoral employment. Nevertheless, the evolution is not mirrored in terms of value added, evidencing remaining differences in economic performances or different speed of technological progress of the sectors.

An index of dissimilarity between the cities has also been built, where the whole set of bilateral comparisons between cities is done for each of the forty

cities of the sample. For each city i, $v_i^k(t)$, the share of the sector k in the total activity is computed correspondingly, $v_i^k(t)$, the share of the same sector in the activity is computed for other cities j of the sample and the bilateral comparison done each year; a summary index Di, summing up over all the cities j, summarizes the situation of each city i :

$$D_{ij}(t) = \sum_k abs\ (v_i^k(t) - v_j^k(t)) \text{ and } D_i(t) = \sum_j \sum_k abs(v_i^k(t) - v_j^k(t))$$

Element by element study of the matrices would be difficult; again the important features are evidenced by a figure. The matrix of the results is thus summarized in the following Figure 4, which presents the mean over the cities of the evolution of the indices between 1975 and 2000 for each city of the sample : *Di*(2000) – *Di*(1975). Kobenhavn is the unique city showing an increase of the employment index, but very near to zero ; all other cities have negative indices, evidencing a general decrease of dissimilarities regarding specialization. The bilateral differences between the structures of activity of pairs of cities are thus decreasing. The result is somewhat contradicting many results usually presented in the literature; the choice of the metropolitan areas as the relevant level to think the regional dynamics in Europe explains this difference. When value added is considered, the result has not the same uniformity than the employment dissimilarity indexes, but still, the general movement is towards a decrease of the indexes overtime.

*Figure 4 : Dissimilarity index, Employment and Value Added*
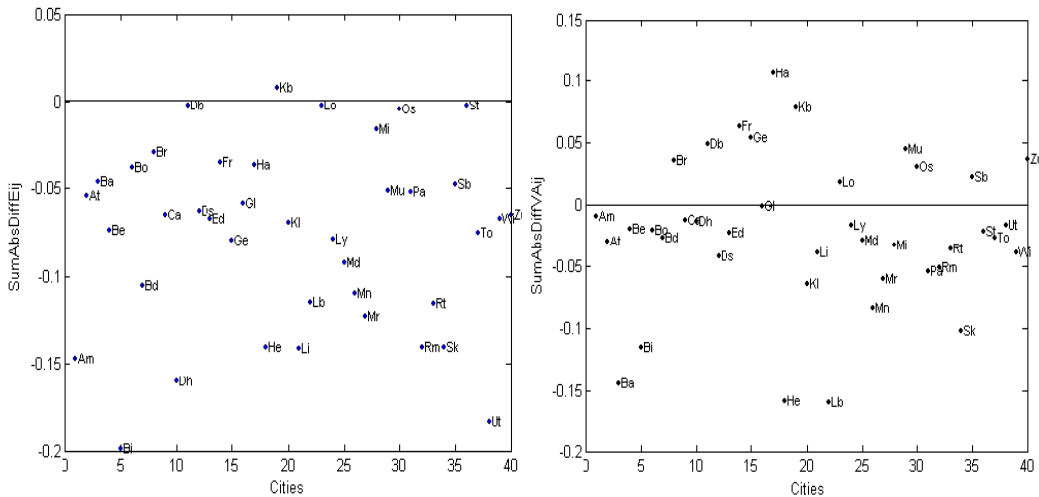
The process of convergence in terms of gdp per capita or productivity evidenced between the European metropolitan areas considered is accompanied by a process of sectoral convergence, particularly important in terms of the structure of sectoral employment of these areas. These co-movements are

termed of structural convergence according the concept defined by Warziack (2001). These co-movements empirically evidenced and tested in a companion paper by Longhi and Musolesi (2007) are not underlined in the literature, although as important as the persistent general disparities between centre and peripheries on which the focus is generally dedicated.

3. AN ALTERNATIVE ANALYTICAL FRAMEWORK

The different results achieved in the previous part support the idea of structural convergence at the European level, when the main metropolitan areas are considered. In the last part we develop an alternative approach to highlight the dynamics at work. The analysis is based on an analytical framework developed by Camagni and Cappellin (1985) and Camagni and Cappello (1997); the framework has been recently used by Cuadrado-Roura *et al.* (2000) to characterize regional productivity patterns in Europe (Nuts2 level).

The empirics of metropolitan dynamics have evidenced important initial disparities and relevant movements of catching-up. The analytical framework developed by R. Camagni and his co-authors will help to build relevant 'stylized facts' attached to the structural convergence in the European metropolitan system, underlining the complex sectoral and territorial dynamics at work. The analytical framework builds up an alternative approach focusing on the economic history of regions, and provides a graphical device. Some monitoring variables, which encapsulate the regional productive structures, will help to depict these histories and give a first insight on the structural dynamics of the economic systems. The monitoring variables considered are the value added (constant prices, €1990), the productivity and employment growth behaviors displayed by the cities or the sectors.
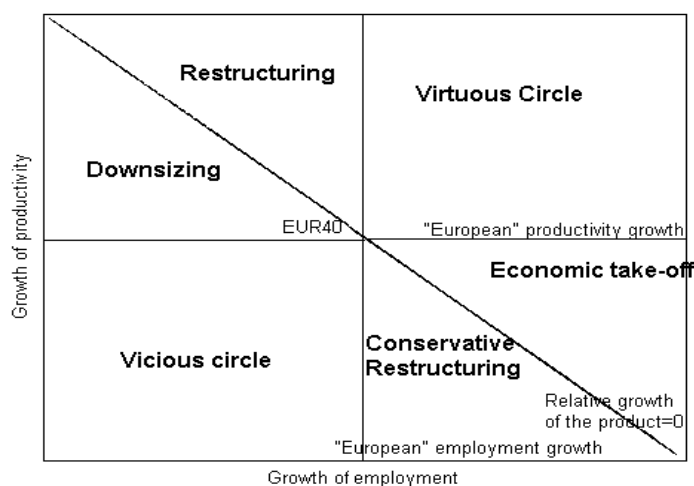

The analytical framework presented below is thus based on the real cumulative rates of growth of annual variation of the productivity and employment variables; the axis represent the European cumulative growth (in

our sense aggregate metropolitan value) ; on the negative 45° line the city growth of the product is equal to the European one (Camagni and Cappello, 1997, Cuadrado-Roura *et al.*, 2000).

Following Camagni and Cappello (1997), the analytical framework evidences six patterns of 'regional' development, which will be applied to the European metropolitan areas.

(i) Virtuous circle : in this first area the rate of growth of the productivity is higher than the European mean, as the employment or product growth.

(ii) Restructuring : the growth of the productivity is important but the growth of employment is lower than the European mean; the relative growth of productivity, which follow good performances in terms of product, is allowed by relative 'effort' on employment.

(iii) Downsizing : in this other phase of restructuring, which could be labelled absolute restructuring (Cuadrado-Roura *et al.*,2000), the relative growth of productivity is the result of a drastic policy on employment, rationalization or restructuring of inefficient production.

(iv) Vicious circle : the relative decrease of employment is not able to restore relative competitivity, and result in bad performance in productivity or product growth; this pattern is the worst one.

(v) Conservative restructuring : the relative low growth of productivity is going with a 'positive' growth of employment, which can involve public policies sustaining relatively non-competitive activities in the local economy.

(vi) Economic take-off : in this pattern, the prevalence of employment performance leads to positive effects on the product; or, according Cuadrado-Roura *et al.* (2000), the aim to facilitate the development of new activities has the capacity here to generate employment.

Figure 5 : Metropolitan aggregate patterns
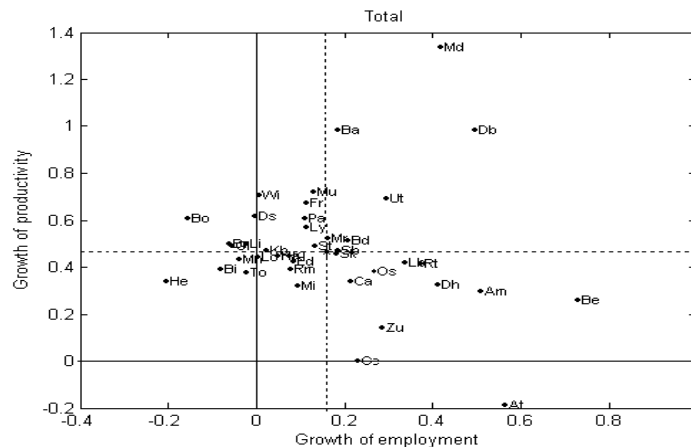
The analysis of the joint behavior of our monitoring variable in the case of the metropolitan areas result in the following pattern; the Figure 5 evidences the similarities and differences on the relative evolution of the European metropolitan areas (here again, European means the aggregate metropolitan pattern).

Different 'clouds' of cities emerge in the framework, displaying the different regimes they follow since 1975. The cities belonging to the "cohesion" group performs quite well; Madrid, Barcelona and Dublin over perform the other metropolitan areas and are located in the 'virtuous circle' region. There is a very concentrated cloud of cities around the "origin", gathering the main capitals of the historical European core center, and two others concentrated clouds on the restructuring and downsizing regimes made of the large industrial metropolitan areas.

### Figure 6 : « National » aggregate patterns
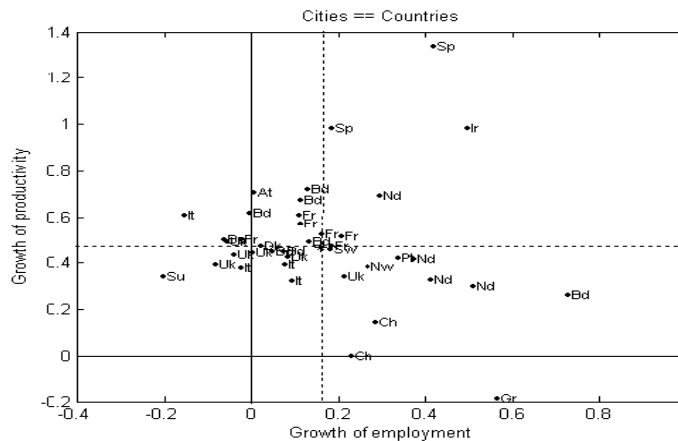
A strong national dependence of the regional trends is evidenced in the framework in the previous figure, where the cities have been represented by their national belonging. In another context, Fayolle and Lecuyer (2000) have shown that "regional convergence depends closely on the national membership". The same result can be deduced in this framework, and give a rationale to the recent findings on convergence, working at the level of the European nation with increase disparities within these nations. Clearly, "national" clouds emerge. The absence of overall regional convergence at the European level is coherent with the metropolization of the economic activity. The metropolitan areas are converging and driving the national processes, but the idea of engine of growth of their regional peripheries they are supposed to play, usually assume in the reports of the European Commission for example, does not seem to be at work. This is at the origin of the heterogeneity of the catching up paths across regions and the deepening of the regional disparities. The cohesion "national" clouds emerge clearly in the framework, as the French

or German ones; the Netherlands crosses two regimes, but appears to perform very well.

The following two figures depict the analytical framework for the aggregate manufacturing and aggregate market services of the cities. Again, the cities of the "cohesion" perform well relative to the other metropolitan areas, far ahead in manufacturing (even if the absolute rate of growth is usually negative), but interestingly, also for the market services.

Figure 7 : Metropolitan patterns in manufacturing and services
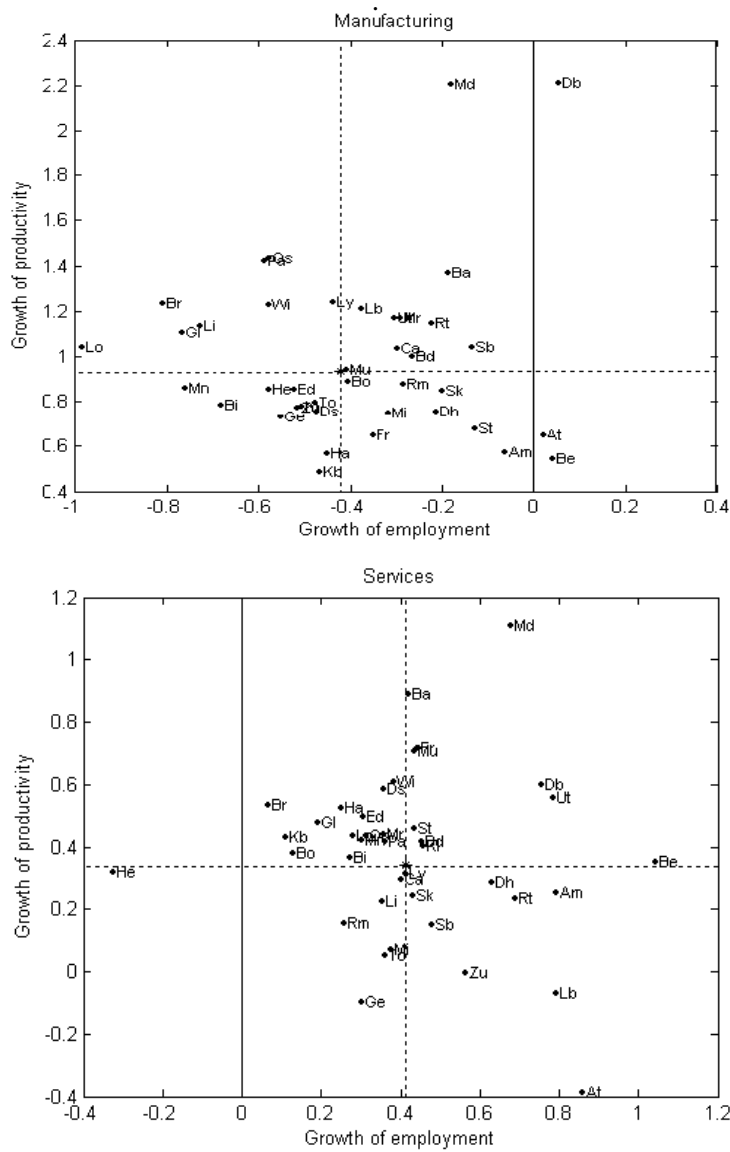
As the two following figures illustrate employment has moved from manufacturing to market services in the period, but still, the product growth roughly equally, evidencing important technological progress in manufacturing. Again, Madrid and Dublin over perform the whole cloud of cities.

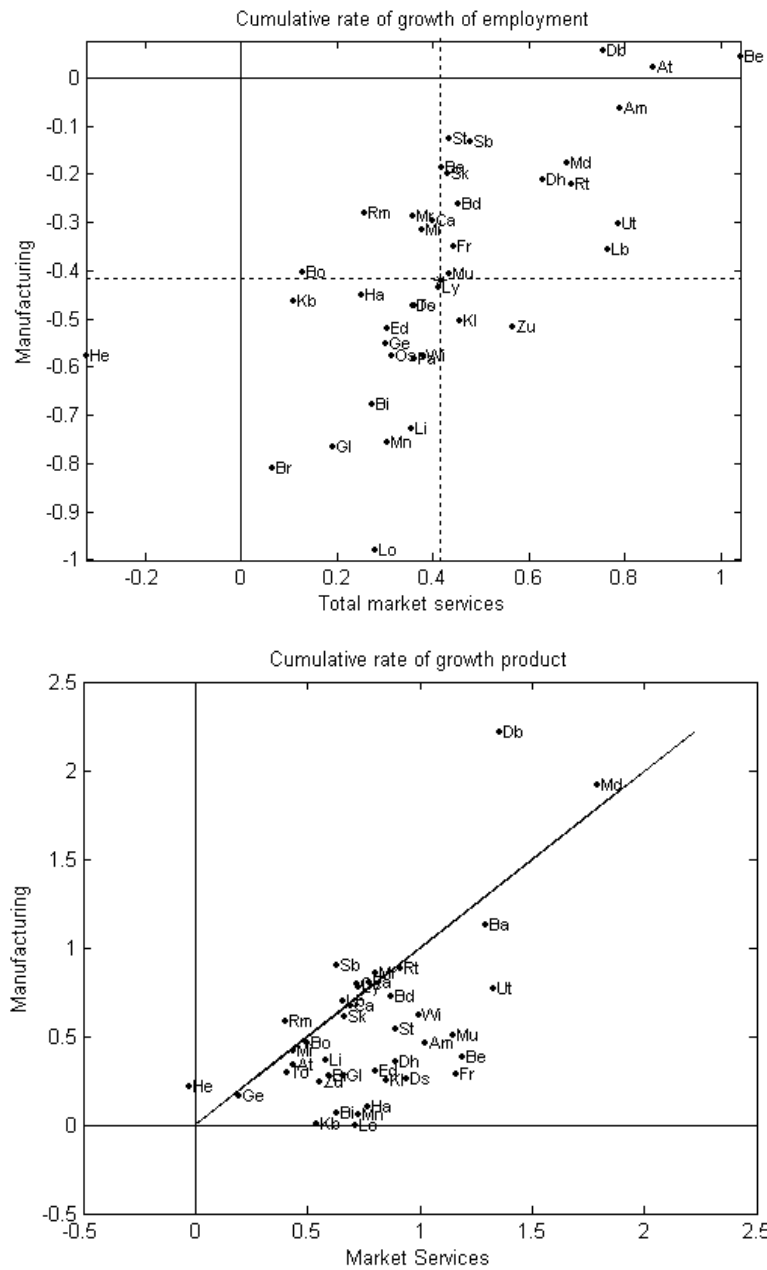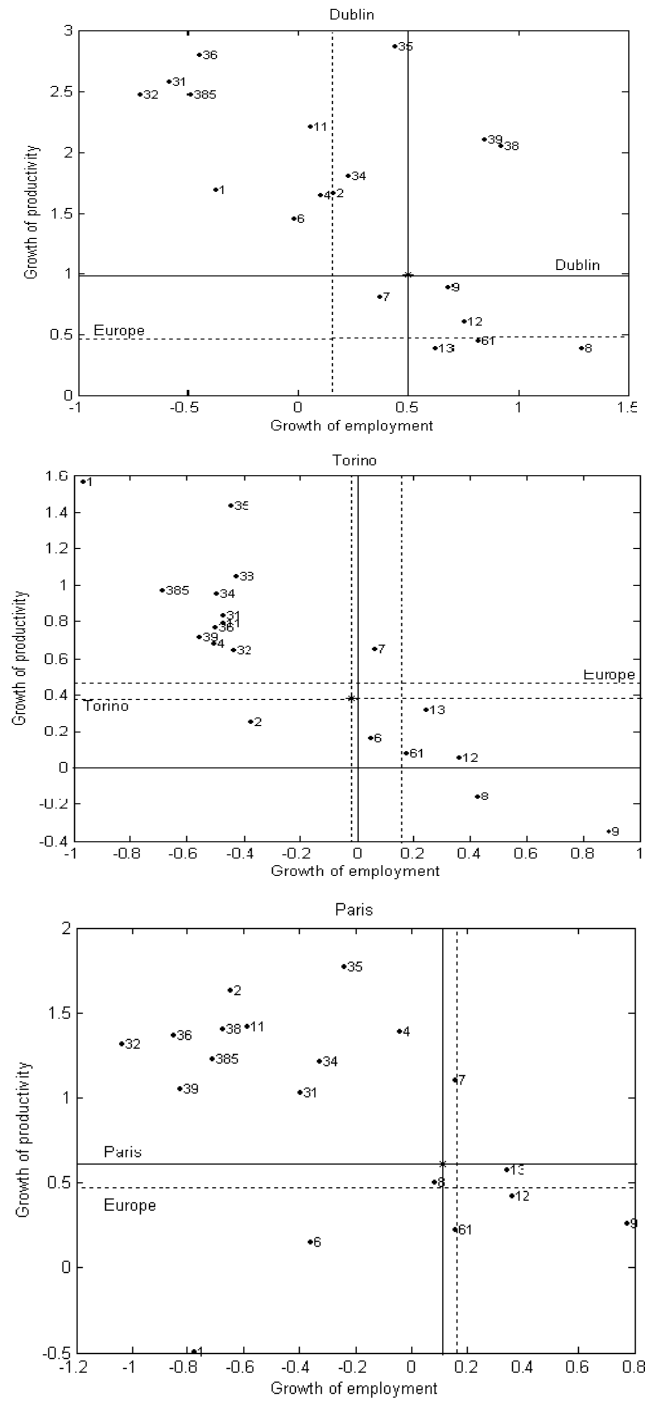***Figure 8 : Cumulative rate of growth. Employment and product***

Figure 9 : Dynamic specialization of selected cities

As it has been emphasized in presenting this empirical analysis, the 'stylized facts' to be evidenced by the regional empirics of growth should have three dimensions : geographical, sectoral and temporal. The analytical frameworks developed in relation to the structural convergence issue should allow to grasp these three dimensions of change, to catch the distortions of the sectoral as well regional growth regimes through the analysis of the evolution of the productive structure of the economies considered, i.e. the qualitative changes affecting production, and produces new insights on the notion of convergence. The last exercise has presented the whole cloud of cities in the framework space, at different aggregate level : gdp, manufacturing, services, the differentiate the growth regimes followed by the cities. In the following, a more disaggregated analysis will be implemented, mapping the whole cloud of sectors in the framework space for each of the different cities.

The resulting clouds will allow investigating the nature of the regimes followed by the sectors within the cities, their coherences or discrepancies. As usual in the framework space, each sector is represented by the real cumulative rates of growth of annual variation of the productivity and employment variables; two systems of axis are now represented : each city (aggregate gdp) is located against the corresponding European mean, and each sector is located in the city framework space. The exercise has been carried out for each city; some examples are given in the following. The framework space attached to each city displays very different 'clouds' of sectors; this is a step towards a representation of the dynamics of the sectoral specialization of the cities, as the monitoring variables represents growth rates. The position of the sectors in the different regimes gives a mapping of their relative comparative advantage (Camagni, Cappello, 1997), and the sectoral clouds the dynamical clusters at work in the area.

The contrast between the cities is straightforward. Dublin performs far better than the European mean, when Torino performs badly relatively to the mean, and Paris is roughly at the European level. Contrary to the usual results in terms of relative efficiency of the hot banana, Dublin stands as a city whose many sectors of activity are located in the 'virtuous circle' regime, and many other in 'positive' restructuring. The sectoral clouds of Torino are in the downsizing or conservative restructuring regimes; despite huge efforts, the city is still in a process of recovery. In Paris, the sectoral clouds appear much dispersed, and cover the whole possible regimes; still, the industrial sectors are located in the restructuring regime.

4. CONCLUSION

The paper has built empirics on the metropolitan dynamics in Europe, and provided several arguments supporting the existence of structural convergence across the main European metropolitan areas. Such an analysis which combines geographical, sectoral and temporal dimensions at the level of cities has been show to be a necessary condition to understand the main issues at stake in the regional dynamics in Europe.

The metropolization of the activity is usually associated to the globalization of the activities; the paper evidences that it is also associated to the process of European integration. Nevertheless, the literature usually focus on the convergence issue between centres and peripheries at important levels of aggregation (Nuts 1 or 2), but more scarcely on the movements in the center, which are basic to understand the regional effect of European integration. The paper highlights two aspects rather neglected by the literature we consider as important issues, the movements between these metropolitan areas, and the related movements in terms of sectoral composition of the metropolitan activities. Regional analysis has indeed to justify the level of disaggregation used to apprehend economic phenomenon. Contrary to the usual finding, a deep process of convergence is evidenced since 1975 in the sample of selected large European cities, which works with a process of diversification of the sectoral activities in the metropolitan areas and a process of structural convergence between the metropolitan areas. The economic integration process seems to have produced a standard model of metropolitan area in Europe; the dynamics at work in and between these areas shape the whole European landscape.

The analytical framework presented has allowed characterizing different growth regimes, across cities in Europe, and across sectors in cities; 'virtuous circle' regimes are usually displayed in the cities of the cohesion. To sum up, the whole process at work in Europe could be labeled as a "metropolitan catching up process", with the quantitative and qualitative aspects such a process implicitly entails.

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LES DYNAMIQUES DE PRODUCTIVITÉ DES MÉTROPOLES EUROPÉENNES : UNE ANALYSE EMPIRIQUE

Résumé - *Cet article analyse l'évolution des principales métropoles dans le processus d'intégration en Europe ces vingt cinq dernières années. Ces métropoles sont considérées comme les moteurs du développement économique, et concentrent des proportions de plus en plus importantes de la population, des activités économiques, des ressources de R&D... Différentes théories ont expliqué ces dynamiques cumulatives. Plus récemment, les politiques régionales ont aussi basé leur action sur ces métropoles, à travers le concept de polycentrisme par exemple. L'article considère une base de données des quarante principales villes européennes sur la période 1975-2000, désagrégée en vingt secteurs d'activité. L'article analyse d'abord les processus de convergence en termes de productivité ou de similitude sectorielle entre les métropoles, et l'évolution de leurs spécialisations en termes de valeur ajoutée ou d'emploi. Un cadre analytique basé sur les taux de croissance de la productivité et l'emploi est ensuite construit qui propose une analyse dynamique de la convergence et des avantages comparatifs des secteurs dans les métropoles. Les métropoles apparaissent de fait comme les principaux vecteurs du processus d'intégration européenne ; un modèle européen standard de métropole semble émerger de ce processus.*