Agglomeration economies and growth in Italian local labour systems. 1991-2001

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Abstract

In the recent years a vast body of literature has analysed the role of agglomeration economies on industry location and growth. Such literature has, however, paid not too much attention to the wider scenario where such phenomena are rooted, that of an ongoing process of structural change which is transforming our economies from manufacturing to service ones.
The main objective of this paper is to assess the role of a large set of potential determinants of the process of local agglomeration of economic activity distinguishing between manufacturing and service sectors and also to analyse the issue of spatial association of the local growth process.
We focus on the case of Italy making use of a very ample database on socio-economic indicators for 784 Local Labour Systems and 34 sectors over the period 1991-2001. Our database covers both the manufacturing and the service sectors so that the whole economic system is considered.
Our econometric results show that local growth in Italy is not a homogeneous process. On the contrary, it is characterized by significant differences across macro regions and especially across sectors. Among the most important determinants of local industry growth, it is worth mentioning the negative influence of specialisation externalities on labour dynamics at the local industry level. Moreover, we have assessed the effects of other determinants of local growth like diversity externalities, human capital, social environment and network externalities. Finally, the presence of spatial autocorrelation is detected for the aggregate economy and also in several sectors and therefore dynamic spatial models have been estimated.

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1. Introduction

Over the last decade a vast body of literature has addressed the issue of the influence of externalities on local growth (starting from Glaeser *et al.*, 1992 , until Henderson, 2003, to mention just a few). Such literature has, however, paid not too much attention to the wider scenario where such phenomena are rooted, that of an ongoing process of structural change which is transforming our economies from manufacturing to service ones[1]. Such a process has insightful implications for the analysis of the geography of economic activities. In fact, the spatial distribution and functioning of the industrial economies have been shaped by the characteristics of prevailing levels of production and distribution technology, modes of work organization, labour and capital mobility. All these features are currently dramatically changing due to the relocation and de-verticalisation of mass production industries followed by the development of new service activities, the transformation of cultural and leisure activities from pastimes into economic business, the emerging role of information and communications technologies.

These trends are modifying both the economic geography of local production systems and the manner in which these are linked to a broader economy. Economic landscapes are increasingly being shaped by a complex mixture of forces operating simultaneously at a global, national and local level with a common denominator: the structural shift from manufacturing to services in the most developed economies. The main signal of such phenomenon in space being the fact that urban areas are losing manufacturing to become more service oriented.

The main aim of this paper is to analyse local economic performance, as expressed by employment dynamics, both in the service and in the manufacturing sectors. Thanks to a large set of variables and data we attempt to explain some of the differences in the economic performance of sectors[2] by assessing the role of several potential determinants of local employment dynamics.

In particular, we aim at introducing a useful classification of determinants in order to present a general setting for testing different potential explanatory scenarios. Such a classification includes the usual distinction among specialisation-Marshall externalities, coming from the scale of local own industry activity, and urbanization-Jacobs economies, due to cross-fertilization enhanced by the scale or diversity of activity outside the own industry. Moreover other important phenomena are

[1] Most analysis have in fact concentrated on manufacturing sectors alone. The main notable exceptions being those of Combes (2000b) for France who considers 42 service sectors and, more recently, Almeida (2001) for Portugal who analyses 32 sectors. Dekle (2002) also considers the service sectors but at a very aggregated level.

[2] The analysis of differences across areas, but just in the manufacturing, has been mainly pursued in Usai and Paci, 2003.

included both at the local industry level (scale and competition effects) and at the local level (population size effects, human and social capital, among others).

The use of spatial econometric techniques, moreover, allows us to avoid placing artificial bounds to agglomeration economies. We, therefore, do not consider our geographical units as isolated closed economies[3] by taking into account the possibility of some externalities crossing borders.

The paper is organised as follow. In the next section we briefly survey the literature background. In the third section the databank is presented along with a descriptive picture of the phenomenon under examination. In the fourth section the theoretical underpinnings are presented. In the fifth section we discuss the main econometric results. In the last section some concluding remarks are proposed.

2. Some theoretical and empirical issues

In the last decade, the influence of regional externalities on local economic growth has been under recurrent investigation. Glaeser *et al*. (1992) were the first to focus on employment growth as a proxy for local economic performance and to study its dynamics at both the city and the sectoral level. The empirical analysis was based on the discrimination between static externalities, associated with cost efficiencies or pecuniary externalities, and dynamic externalities, related to knowledge spillovers. Static externalities are those which affect industry localization[4], but not growth. Since then, the debate about dynamic externalities has mainly focused on two competing theories[5]: those of Marshall (1890)-Arrow (1962)-Romer (1986) (MAR) and of Jacobs (1969).

The main difference between these theories concerns the effects of specialization (the degree to which a location specializes in one industry) and diversity (the range of different industries in a location). The MAR framework maintains that most spillovers occur among firms in the same industry. Specialized locations with high levels of industry concentration should experience more innovation and faster growth. In contrast, Jacobs posits that the most important knowledge take

[3] Especially in the United States, most studies, (Glaeser *et al.*, 1992, and Henderson *et al*., 1995) have relied on the city as the geographic unit of analysis, so they had necessarily to consider them as economic islands.

[4] Marshall identified three causes (1) specialized labor forces and the generation of new ideas, arising from face-to-face communications and human capital accumulation, (2) the availability of specialized inputs and infrastructure, (3) economies of mass production. In Marshall's view, firms tend to co-locate with their buyers and suppliers, which creates positive externalities arising from transportation, communication, and coordination efficiencies.

[5] In fact Glaeser *et al*. (1992) included also Porter's arguments in contrast to Jacobs' and Marshall's ones. According to Porter (1990) urban areas which are very specialized may convey a boost on growth thanks to competitive effects.

place across different industries. Jacobs' theory predicts that industries will innovate more and grow faster in locations with greater diversity. Empirical tests addressing this debate have produced conflicting results.

Glaeser *et al.* (1992) finds that both competition and diversity fostered industry growth and innovation, while specialization discouraged them. The evidence collected for other countries, mainly in the European Union, seems to support these findings. It should be noticed that the common feature of such studies is that they analyse short time spans and that, due to lack of data, they focus on employment dynamics as a proxy of productivity growth. For the case of Italy, Usai and Paci (2003), at the local labour system level found a positive effect on growth played by diversity and a negative one by specialization. In the Netherlands, at the city level for just top industries, Van de Soest *et al.* (2002) found similar results. Combes (2000) for France, and Almeida (2003), for Portugal, are the only two previous contributions who examine both the manufacturing and the service sector. Such a choice proves insightful given that, although on average, there is a positive role for diversity and a negative one for specialization, such externalities are different across sectors.

These results conflict with those of Henderson *et al*. (1995) who reported positive effects for both diversity and specialization externalities for high tech industries whilst for mature industries just MAR spillovers are found. Similar results have been also reached by Forni and Paba (2002), who found that specialization and variety matter for growth in most manufacturing sectors even though they show that each industry needs its own variety in terms of input-output relations. These interesting outcomes are, though, subject to Combes' critique (2000a), according to which the simultaneous inclusion of a specialisation index and of total employment among the regressors introduces a positive bias on the specialisation coefficient[6]. The positive effect of specialisation is therefore questioned.

More compelling is the contribution of more recent studies (Cingano and Schivardi, 2003, Dekle, 2002, and Henderson, 2003) which manage to avoid some typical flaws affecting the aforementioned studies. Such flaws depending on the idea that employment growth may be used as a proxy of productivity changes which, in fact, may prove unrealistic when:

a) local capital stock is not constant along time (Dekle, 2002).

b) productivity shocks induce a negative impact on employment growth because demand elasticity is low and production does not expand enough simultaneously (Combes and Overman, 2004)

[6] As a matter of fact, this was also the case in Glaeser *et al.*'s paper. But in this case the specialization coefficient is already negative and the elimination of the bias would just possibly reinforce that result.

c) the sources of externalities and agglomeration influence labour supply (Dekle, 2002 and Cingano and Schivardi, 2003)

d) capital and labour have a high degree of substitutability and technological change is labour saving.

As a matter of fact recent empirical studies (Dekle, 2003 and Cingano and Schivardi, 2003) have cast serious doubts on the idea that changes in productivity reflects proportional variations in employment. In particular such studies, by using TFP measures for productivity growth, show that specialisation may prove positively linked to economic performance whilst diversity is not[7]. Similar results are found by De Lucio *et al.* (2002), who report no effect of diversity on labour productivity growth and an interesting U-shaped curve for specialisation effects. Finally, Henderson (2003), through the estimation of plant level production functions in a panel context, finds that localization/MAR scale externalities have strong productivity effects in high-tech but not in machinery industries. Again he finds no evidence of urbanization economies from the diversity of local economic activity outside the own industry and limited evidence of urbanization economies from the overall scale of local economic activity. He also studies the spatial extent of externalities and finds that they are quite localized within the own county, so that there are not external benefits from plants in other counties in the MSA. Similarly, Cingano and Schivardi (2003) find that there is no effect on TFP played by neighbourhood specialisation calculated at a higher level of territorial aggregation.

The use of TFP measures is an obvious notable improvement by these studies, which, however, have to accept some inconvenience in terms of data availability. In particular, Dekel (2002) and De Lucio *et al.* (2002) have to move from the city or the local labour system level typical of these studies to a more aggregated level, that is administrative regions, where labour market and good markets not necessarily coincide. On the contrary, Henderson (2003) and Cingano and Schivardi (2003) are able to keep a very disaggregated level of analysis, that of metropolitan areas and counties in the former and that of Local labour systems in the latter. The acknowledged problem being that they rely on samples of plant data which bring about serious problems of selection bias.

Another interesting issue raised in the literature is whether the role of externalities varies with respect to some concurrent economic phenomena. Glaeser *et al.* (1992), for instance, suggested that there might be an industry life cycle in which externalities are only important in the early development stages. Similarly, Krugman (1991, p. 62) indicated that as an industry develops, it

might become less dependent on pooled labor, specialized inputs and knowledge spillovers. Moreover, externalities that foster the initial development of a location might not be the same that affect its subsequent growth (Duranton and Puga, 2002). In other words, the nature of externalities is not independent from product cycle: experimental activity is initially found in large diverse urban areas (Jacobs externalities); but traditional production, which is more standardized, can be more decentralized in smaller more specialized urban areas with lower costs (Marshall externalities). This line of interpretation has been used both by Combes (2000) and Usai and Paci (2003) to make sense of some differences in results among sectors in the former case and among regions in the latter case.

Most importantly for the purposes of this paper, the role of externalities may be very different across industries and most of all between the two macro-sectors: manufacturing and service. The reason is, as argued by Krugman and Venables (1995)[8], that goods which are essentially non-tradable (such as service) have to be produced close to customers, leading activities to remain spread out. On the contrary, tradable goods, such as manufacturing, can enjoy agglomeration economies by locating where it is more convenient and therefore be more concentrated in space.

This view, according to Desmet and Fafchamps (2003), may have interesting dynamic implications. As transport costs fall, goods became tradable, allowing production to take advantage of agglomeration economies by concentrating. However, if transport costs continue to drop, those agglomeration economies may go beyond a threshold where activities start spreading back out to less congested areas. If this is a sensible picture, given that service sectors have a non tradable nature, they are more spread out. But with transport costs falling there should be an increase in concentration. On the contrary manufacturing goods are eminently tradable and they have been for a long time. As a result of transport costs therefore they should become less concentrated.

Finally, the dynamics of the service sectors is linked to the evolution of the economy and in particular of the manufacturing compound. One can distinguish two possible effects linking the dynamics of the two macrosectors. On the one hand, service firms may substitute manufacturing firms as the latter rely more and more on the market, due for instance, to decreasing transaction costs. There is, therefore, an inverse relationship. On the other hand, at the same time, as long as the two macro-sectors are complementary, especially because the manufacturing sector is a buyer of service sectors, the two dynamics may be positively related. However, one should bear in mind that

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[7] Most importantly, Cingano and Schivardi (2003) show that within the same sample, if one uses employment growth as the dependent variable specialization effects became negative.

[8] See also Baldwin and Martin (2004) about the effects of tradability, transaction costs and capital mobility on the growth dynamics within a centre-periphery model.

service sectors are extremely heterogeneous: for example business services may follow a altogether different dynamics and localisation process from family services.

On the one hand, business services are, on average, locally concentrated near the firms to which they sell their products. This is usually explained by referring to intangible aspects of localised knowledge which need day by day and face to face contacts to facilitate exchanges of essential information. On the other hand, family services are usually more spread out. As regards their dynamics, however, we may also find important differences according to other characteristics. For example, some services may prove to have some inferior goods characteristics, as for example transport goods which are substituted by durable goods, such as private cars. Their diffusion being decreasing with income as a result. Conversely, some other services have a luxury goods nature, such as culture and tourism, and their general consumption increases with income. The complexity of the nature of the two macro-sectors and of their relationship is bound to be reflected in our results.

3. The data and the descriptive analysis

Our empirical analysis makes use of a very ample database on socio-economic indicators for the Italian Local Labour Systems (LLS). LLS are 784 groupings of municipalities identified by ISTAT by means of commuting data from the population census: the geography of where people live overlaps the geography of where people work, that is local labour market and local good market coincide (Sforzi, 1997). This high level of geographical breakdown appears particularly fruitful for the analysis of local growth since the production activities have, by construction, a high degree of self containment that makes it easier the identification of the explanatory factors at the local level. The information on local labour systems is also disaggregated with respect to 34 sectors at the 2 digit ATECO 91-ISIC 3 level. In particular we distinguish between 21 manufacturing sectors (including building) and 13 service sectors (excluding the public sector for which data is available only for 1991). The data, which consists mainly of units of labour and number of firms and plants, refers to the ten-year period between the two census of 1991 and 2001.

The employment dynamics at the aggregate level in Italy during the nineties is positive with a gain of more than one million units of labour and an average annual increase of 0.7% (see Maps 1-3 and Table 1). The positive trend for the whole country is confirmed in all geographical areas but the Islands, while the highest aggregate increase is obtained in North East and Centre South (1.1% annual growth).

The aggregate trend hides a highly differentiated pattern at the sectoral level. In particular the manufacturing sector has reported an average employment fall of 0.6% per year, while the service sector has increased by 1.5% per year. The employment growth in the service sector is strictly related to a process of structural change and outsourcing, common to all advanced economies. As pointed out by the literature, from the eighties to nowadays a large number of manufacturing firms, in order to improve their productivity in the core business, has moved some auxiliary internal activities to external service firms. This is the case of several service activities related to cleaning, accounting, engineering, marketing, security, etc.

A remarkable feature of this general employment growth has been its considerable variety in terms of spatial distribution which goes beyond the usual North-South pattern. Indeed some important qualifications emerge from the data especially among Northern regions. Considering the macro sectors, we can see from Table 1 that the North-East is the only growing area both in manufacturing and service sector. The growth of the Northeast comes mostly from the localisation in that area of growing services sectors such as real estates and computer activities and the tourist activities (hotels and restaurants). The one of the North-East is a recent story of industrial and service development based on local networks of small and medium dynamic firms and plants scattered throughout the area. This is the widely studied development model of the “industrial districts” (see, among many others, Brusco, 1982; Piore and Sabel, 1984).

On the other hand, the North-West presents the deepest fall (-1,4%) in manufacturing employment that is compensated by the highest grow in the services (1.8%). This area represents the development history of the Italian industrial system of large heavy industries with Turin, Milan and Genoa as main metropolitan centres, giving rise to the so-called “industrial triangle”; in the last years of the nineties the structural change process has been really strong.

If we consider the performance of individual Local Labour System it turns out that, very often, successes and disasters are the result of idiosyncratic shocks affecting certain sectors which are (or become) prevalent in certain regions. Therefore among the top ten best performing LLS we find areas both in the South (mainly in Puglia and Basilicata) and in North (especially in Veneto). For instance the highest employment grow is recorded at Melfi in Basilicata where the multinational car maker Fiat played the role of the so called “large developer” by building a plant for the production of vehicles, thanks to the financial and fiscal incentives available to the Objective 1 regions of the EU. Most worst performing LLS are in the South (especially in Calabria and Sicilia).

In Table 2 we turn our attention to the employment dynamics across the 34 sectors we are considering. There is as much variability from sector to sector as from one area to another one. The best performing sectors are among services, above all *Real estate activities* (10% annual average

growth rate) and the *Computer services* (6.7%). Some services have, nevertheless a negative dynamics: *Retail trade* (which is the most important sector in terms of quota of employees), *Post and telecommunication*. The worst performing sectors are among manufacturing, primarily *Wearing apparel* (-3.4%) and the upward related sector of *Textiles* (-2.6%) and also the transport industries. Only few manufacturing sectors have shown a positive performance: *Rubber and plastic* (+1.9%), and *Metal products* (+1,3%). The employment dynamics in the *Building* sectors is also positive (1.4%)

Finally, as for the problem of spatial dependence, there are contrasting outcomes (see Table 3). At the global and macro-sectors level we find evidence for the presence of spatial autocorrelation already detected from the visual inspection of the previous maps. The Moran index for the whole country and for the manufacturing, building and services sectors indicates that the dynamics of employment in a local labour system is influenced by the performance of nearby areas. At the same time, when employment growth is disaggregated by sectors, the occurrence of spatial dependence is more differentiated. As a matter of fact, in only 24 sectors out of 34 there appears a positive and significant spatial dependence.[9] More precisely, we detect spatial association in 9/13 service sectors and in 14/20 manufacturing industries.

4. The estimation framework

The reduced form which is estimated is based on the idea that employment dynamics can be affected by three families of potential externalities differentiated with respect to their level of idiosyncraticity. In other words, we differentiate between externalities which are specific for a certain local industry, those which are characteristic at the local level and those which are specific for a certain industry.

We, therefore, agree with recent literature (Dekle, 2002 and Cingano e Schivardi, 2003) that employment growth regressions are able to provide interesting information on the reduced form relation between local conditions and employment but not, on a clear-cut basis, on productivity growth. We have seen that this is because of four possible problems concerning the constancy of local capital stock, the demand elasticity, the effects of agglomeration on labour supply and the degree of substitutability among factors. We believe that in our sample only the first hypothesis may be thought of as realistic whilst it appears clear that local externalities affect labour supply and therefore create identification problems. Moreover the combination of events of high demand

elasticity and low factor substitutability appears rather unlikely in Italy in the early nineties, a period characterised by diffused reorganisation and restructuring at several levels of the production chain and, most importantly, by stagnating demand.

We therefore decompose factors affecting employment dynamics at the local industrial level into three major groups: (1) local industry level, (2) local level, (3) industry level. Let us discuss the various phenomena which are going to be considered as potential determinants of the performance of local industrial employment.

(1) Local industry level

At the local industry level one finds the most debated factors, that is specialisation or Marshall externalities (*SE),* diversity or Jacobs externalities *(DE)* and scale effects and/or the degree of competition (*SC*).

In general, the specialisation or Marshallian externalities capture the advantages gained by firms producing similar products within a bounded geographical location. Marshall externalities are measured by means of an index of relative production specialisation. This variable measures static pecuniary and localisation externalities such as the availability of suitable supplies of labour force, primary and intermediate goods (Ellison and Glaeser, 1999), the provision of specific goods and services (Bartelsman *et al.,* 1994) and the availability of specific infrastructures and networks. Moreover, this specialization index should also take into account dynamic spillovers coming from the intra-industry flows of localised knowledge which occurs among similar firms located in the same area (Henderson *et al*., 1995).

Marshall externalities are usually contrasted with diversity externalities in the production activities (also known in the literature as Jacobs or urbanisation externalities; Jacobs, 1969). In this work they are measured by the inverse of the Herfindal index applied to employment in all sectors except the one considered. Such externalities are expected to positively influence local growth under the hypothesis that a firm located in a certain area can benefit from the presence in the same area of a wide range of other firms operating in different sectors since it can enjoy fruitful inter-industries exchanges and cross fertilisation.

Moreover we consider the number of employees per firm as a proxy for economies of scale which may affect labour dynamics (O' hUallachàin and Satterthwaite, 1992).

Finally, among local and sector specific variables, an Herfindal index is included to assess the degree of local competition (Porter, 1990, Glaeser *et al*. 1992) following Mion (2004) for the

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[9] The unexpected presence of negative and significant spatial dependence in *Gas and oil industry* may be due to the

computation methodology. In such a way we are able to distinguish between the two effects – scale economies and competition - defining two different indicators and including both of them in the estimated equation (as in Combes, 2000b).

(2) Local level

Employment changes at the local industrial level may be due to some features which characterise the whole local labour system. Local factors may refer to a large set of socio-economic phenomena which influence firms performance in the area. We have classified them as follows: network externalities (*NE*), human capital (*HK*), social capital (*SK*) and labour supply (*LS*).

The first class of network externalities (*NE1*) are intended to take into account the influence of the size of the economic system, measured by the population density (resident population in each LLS per Km^2) where a firm is located (Ciccone and Hall, 1996). In practice one expects a positive effect on local growth when a larger population density implies a higher local demand and the availability of a wider supply of local public services. The closeness of buyers may have both a static and a dynamic effect, the latter being related to the fact that this may facilitate early perception of market needs. At the same time the increasing size of the local economy may imply diseconomies of scale setting in when congestion effects prevail giving rise to pollution and higher competition on the factor markets meaning higher factors costs.

We have also included a second proxy for network externalities (*NE2*) which focuses on the supply side taking into account the presence of small firms within the local economy. The idea is that a larger share of small plants may induce firms to find outside their optimal production scale through cooperation and integration with other firms at the local level. This stimulates the creation of local externalities. The opposite happens with large firms which are more vertically integrated and therefore are less involved in local networks.

The role of human capital in facilitating innovation activities and information spillovers and therefore growth is examined by means of a proxy to measure the availability in the local area of labour forces with a high levels of education (share of population with a university education). A higher availability of well educated labour forces represents an advantage for the localization of firms thus fostering local growth.

Another important local element which may encourage innovation activities and smooth the process of knowledge diffusion is social capital. In this case it is not an easy task to find the proper indicators for such a complex and intangible phenomenon (Helliwell and Putnam, 1995). To

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extremely dispersed and polarised structure of this sector.

measure the degree of trust in the local society we include an index of the propensity to cooperate among firms based on the number of inter-firms agreement and participations in consortia surveyed by the industrial census at the provincial level. The idea is that a higher degree of propensity to cooperate among firms in a certain area helps local growth since it facilitates knowledge diffusion, decreases transaction costs and enables firms to take advantage of local externalities.

Finally, we accept the idea that externalities may affect the labour supply (Cingano and Schivardi, 2003) and therefore we try to include this possible effect by inserting an indicator of its size. Such an indicator is given by the participation rate (labour forces over population age 15-65).

Other potential local externalities may be those related to natural endowments and other geographical factors. They should however have more a static rather than a dynamic effect. We have nevertheless tried to take these into account by means of local fixed effects, in the panel regression. However, they prove to have too a strong collinearity with the other local indicators and have been therefore removed in the basic regressions reported here.

(3) Industry level

The growth rate of employment in a local industry may also be affected by factors which are idiosyncratic to each production sector while they are common to all areas. These factors can capture , for instance, the technological progress and opportunities within each industry at the national level. In our econometric estimation they are proxied by the sectoral fixed effects in the panel regressions.

5. The econometric results

The econometric analysis is based on a simple equation, as it is usually done in this literature, where the growth rate at the local industry level is represented by labour dynamics, due to the lack of data on output at the local industry level, and it is affected by the three components of the technology growth rate described in the previous section:

$$log(L_{ijt+1}/L_{ijt}) = \chi_1 SE_{ijt}+\chi_2 DE_{ijt}+\chi_3 SC_{ijt}+\chi_4 COMP_{ijt}+\beta_1 NE1_{it}+\beta_2 NE2_{it}+\beta_3 HK_{it}+\beta_4 SK_{it}+\beta_5 LS_{it}+ FE_j$$

5.1 Econometric strategy

Unlike previous studies, in this work we attempt to simultaneously consider different factors which are bound to affect local economic growth thanks to the broad perspective suggested by our

theoretical framework. Actually, in the search of the best specification we do not apply the usual general to specific approach which consists of a sequence of deletions of variables which are found not significant from a statistical point of view. On the contrary, we carry out an analysis of parameter stability with respect to different subsections of our main sample. In other words we apply the same general specification to sub samples identified with respect to geographical and sectoral features to establish if there is any difference in the value, sign and significance of the estimated coefficients.

The main differences with respect to our previous work on Italy (Usai and Paci, 2003; Paci and Usai 2004) are that the present paper: (i) includes the entire market economy (manufacture plus services); (ii) sectors are considered at a higher level of aggregation (2-digit instead of 3-digit) in order to increase the probability of finding non-zero observations in the local industry; (iii) the growth process is considered over a longer time period 1991-2001.

Indeed, one of the crucial point in the analysis of highly specialised sectors in small areas is that often we deal with a too small number of firms (or even null) and this makes more problematical the econometric analysis. Therefore, in order to test the robustness of our findings we have tried to control for the potential causes of distortion. More specifically, in some estimations we have excluded all local industry observations with a zero number of firms both in the initial and final year.

To take into account the risk of variables omission with respect to the industry dimension we include sectoral fixed effects. We have also tried to control for local fixed effects but they turn out to generate problems of multicollinearity given the simultaneous presence of several explanatory variables specific to each area. It is important to remark that all our regressors are exogenous to the local industry employment growth rate since they refer to the beginning of the period considered.

5.2 Aggregate regressions

Let start with the analysis of aggregate estimations based on a dataset with two-dimensions: the geographical and the sectoral ones. The results of GLS estimation with cross section weights and fixed effects to control for sectoral differences are reported in Table 4.[10]

The first interesting result is the absence of specialisation externalities: the coefficient of SE is negative and highly significant in all sub-set considered. This outcome confirms previous studies

[10] In the panel estimations it is not feasible to deal with the problem of spatial association due to technical storage limits imposed by Spacestat for such large datasets. Spatial association is dealt with in the sectoral estimations where we find that most results are, nevertheless, robust with respect to the presence of spatial autocorrelation.

for the US (Glaeser *et al*., 1992), France (Combes, 2000b) and Italy (Cunat and Peri (2001), Forni and Paba, 2000; Cainelli *et al*., 2001; Usai and Paci, 2003). The absence of Marshallian externalities at the local labour system level can be partly explained by the strong reorganization processes of the highly specialized local systems induced by the economic stagnation of the nineties. Moreover, we may also note that most specialised systems in Italy operate in traditional and mature sectors and that the negative relationship between initial specialisation and employment growth can be explained by the life cycle of products (Duranton and Puga, 2001) where the mature products are now re-located in low-wages countries.

On the other hand, we find robust evidence for the positive and significant role played by the diversity externalities (DE). The presence of a differentiated range of production activities appears to foster local growth for the whole economy and also, once we split the sample, for the macro areas (except North-East and Center-South).

As for the average firm size (SC), the results are mixed. The presence of a positive effects of economies of scale appears for the North West and East while a negative effects is prevailing in the Mezzogiorno and North Centre regions. The competition index (COMP)is always negative and significant signalling that a competitive environment encourages the growth of the local industry.

As far as local specific determinants are concerned, the size of the local system, measured by population density (NE1), is not statistically significant in all samples.

A positive role of network externalities, represented by the presence of small firms (NE2), is shown for all areas. These results are in accordance with the Italian production structure characterised by systems of small and medium sized firms.

The indicators referring to the different qualities of capital (human, social) show interesting composite results. First, university education (HK) emerge as relevant and positive determinants of local growth (Lodde, 2000 and Di Liberto, 2001) for the whole country while the sings change for the geographical breakdown. Indeed, university education influences negatively employment growth in the north west based on a more traditional industrial structure where the amount of schooling of the labour forces is less crucial. Secondly, the importance of social capital is suggested by the coefficient of the variable which measures cooperation among firms (SK) which is positive and statistically significant, as expected, in most areas. Finally, the presence of a large labour supply (proxied by the participation rate) exerts a positive influence on employment dynamics.

All these results reinforce the idea that - especially in a period of negative business cycle like the one considered - a production system based on a diversified network of small flexible firms, willing to cooperate and characterized by well educated labour forces is a crucial asset to promote local employment growth.

5.3 Sectoral regressions

In this section we turn the attention to the analysis of employment growth in each sector based on a cross-section estimation of the equation above. In this case we are also able to face directly the problem of spatial association. As we have remarked before, the employment growth in a region may be influenced by employment dynamics in the nearby areas introducing a possible bias in regressions which do not take into account this possibility. In order to deal with this problem we have applied the following estimation procedures:

i. OLS estimation with SpaceStat to assess for the presence of spatial autocorrelation based on the LM tests;

ii. if no autocorrelation, the LS estimates are efficient and consistent; we have used the OLS White robust Standard errors estimations which allows us to correct for the heteroschedasticity;

iii. if spatial autocorrelation is detected, we need to correct by including a spatial lag dependent variable. In such a case it is necessary to use Maximum Likelihood (ML) estimation instead of LS, introducing spatial lag dependent variables up the contiguity level necessary to correct for the presence of spatial autocorrelation.

The results of sectoral regressions are reported in Table 5. In 15 out of 34 sectors we have detected spatial autocorrelation and therefore a ML estimation has been performed with the inclusion of first order contiguity spatial lag dependent variable. For two industries the inclusion of the second order spatial lag has been required to get rid of the spatial autocorrelation and the same happens for the aggregate estimation of industry and services sectors. The spatial lagged variables have proved always positive and significant meaning that in several industries the employment dynamics is positively influenced by the development processes taking place in the contiguous areas. Thanks to this procedure spatial autocorrelation has been controlled for in all sectors. The sectoral results show that the impact of local characteristics differs significantly in manufacturing and service sectors.

Some remarks can be emphasized. As regards specialisation externalities, the coefficients appear mostly negative and statistically significant both for service and manufacturing industries. There is only one case where specialisation is enhancing employment in this period, that is the Hotel and restaurant.

Diversity externalities shows contrasting results. A positive and significant influence on employment dynamics is detected in 5 sectors, mainly in services, while the coefficient is negative and significant in 19 sectors. This evidence contrasts with previous findings where diversity

externalities were found mainly positive. As for this indicator, we believe that more evidence should be collected in order to disentangle those effects which are truly cross-fertilisation spillovers (and therefore more dynamic in nature) and those which due to input-output relationships (and therefore with more static consequences)[11].

As regards the variable which measure scale internal economies and competition effects, as expected, we record a high variability across sectors. A positive and significant sign is found mostly in the manufacturing sectors (basic metals, printing, petroleum, rubber etc) signalling, most probably given the selection of industries, economies of scale at work. Interestingly, a positive role is found also for some service sector, notably in retail trade, where a process of strong concentration has been going on in the last decade. The competition index is mostly negative and significant: this means that employment dynamics is enhanced by a competitive environment.

As for the other determinants we may notice that human capital, that is the availability of employees with a university degree, turns out to be important especially in the services sectors. The effect of social capital is in general not statistically significant. As for the size of the economy results are ambiguous. In 15 sectors there are negative and significant effects whilst in other 5 (1 in manufacturing and 4 in services) the effect is positive. As regards the indicator concerning labour supply this prove to be mostly positive especially in the service sectors.

6. Concluding comments

This paper tries to put the issue of local economic performance in a scenario of an ongoing process of structural change which is transforming the economies from manufacturing to service ones. It is argued that such a process has insightful implications for the analysis of the geography of economic activities as far as they are different with respect to several forces of agglomeration which can be at work. The main contribution of this paper is, therefore, the analysis of local economic performance, as expressed by employment dynamics, both in the service and in the manufacturing sectors. Thanks to a large set of variables and data we attempt to explain some of the differences in the economic performance of sectors by assessing the role of several potential determinants of local economic dynamics.

Results confirm the existence of a very multifaceted picture when it comes to agglomeration forces operating at very small geographical units. Overall we find that specialisation has negative

[11] See the interesting methodology developed by Forni and Paba (2002) on this aspect.

effects possibly due to the specific critical period we are analysing but also to a process of restructuring which substitute labour with other factors.

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Appendix. Table A.1 Variables description and sources

Variables	Index	Level of aggregation		Sources
		area *	sector	
Dependent variable				
- *Local industry growth*	annual average growth rate of employment (S)	LLS	2-digit ateco91	1991 - 2001 Industrial Census
1. Local and sector specific variables				
- *Specialisation externalities*	index of employment relative specialisation (S)	LLS	2-digit ateco91	1991 Industrial Census
- *Diversity externalities*	inverse of Herfindhal index for employment (S)	LLS	2-digit ateco91	1991 Industrial Census
- *Scale effects*	number of employees over number of plants (S)	LLS	2-digit ateco91	1991 Industrial Census
- *Competition*	Herfindhal (S)	LLS	2-digit ateco91	1991 Industrial Census
2. Local specific variables				
- *Network externalities*				
Population density	number of resident population (100000) / Km^2	LLS	-	1991 Population Census
Small firms	quota of workers in firms with less than 50 employees (S)	LLS	-	1991 Industrial Census
- *Human capital*	population with university education / pop age > 24 (S)	LLS	-	1991 Population Census
- *Social capital*	quota of firms with inter-firms agreements (S)	province	-	Industrial Census Long Form
- *Labour supply*	labour forces over population age 15-65 (S)	LLS	-	1991 Population Census

(S) means that the indicator has been standardised to the national value

Table1. Employment growth in macro regions 1991-2001

	Employees (000)		*Annual average % variation*		
	1991	***2001***	***Total***	***Industry***	***Services***
North West	4672	4922	0,52	-0,87	1,91
North East	3220	3592	1,09	0,48	1,73
Center North	1612	1741	0,77	0,12	1,42
Center South	1390	1548	1,08	-0,13	1,71
South	1703	1821	0,67	0,20	0,99
Islands	901	894	-0,07	-0,51	0,17
Italy	**13499**	**14518**	**0,73**	**-0,19**	**1,52**

	Regions
North West	(Piemonte, Valle d'Aosta, Liguria, Lombardia)
North East	(Trentino, Veneto, Friuli, Emilia Romagna)
Center North	(Marche, Umbria, Toscana)
Center South	(Lazio, Abruzzo, Molise)
South	(Campania, Puglia, Basilicata, Calabria)
Islands	(Sicilia, Sardegna)

Table 2. Employment growth at the sectoral level 1991-2001

	Sectors	*Employees(000)*		*Annual average variation*	*Share on total employment (2001)*
		1991	*2001*		
01	Food, beverages and tobacco	476	452	-0,52	3,11%
02	Textiles	404	310	-2,65	2,14%
03	Wearing apparel	419	298	-3,41	2,05%
04	Leather and footwear	244	206	-1,69	1,42%
05	Wood products, except furniture	186	179	-0,38	1,23%
06	Paper	89	84	-0,58	0,58%
07	Printing and publishing	196	175	-1,13	1,21%
08	Coke and refined petroleum products	29	25	-1,48	0,17%
09	Chemicals and chemical products	239	206	-1,49	1,42%
10	Rubber and plastic	179	217	1,93	1,49%
11	Non metallic mineral products	276	254	-0,83	1,75%
12	Basic metals	170	139	-2,01	0,96%
13	Fabricated metal products	615	701	1,31	4,83%
14	Machinery	541	599	1,02	4,13%
15	Office, computing and electrical machinery	233	231	-0,09	1,59%
16	Radio, tv, communication equipment	140	108	-2,60	0,74%
17	Medical, precision and medical instruments	118	126	0,66	0,87%
18	Motor vehicles, trailers and semi trailers	215	173	-2,17	1,19%
19	Other transport equipment	144	108	-2,88	0,74%
20	Furniture, recycling and other	315	315	0,00	2,17%
21	Building	1333	1530	1,38	10,54%
	Industry (subtotal)	**6561**	**6436**	**-0,19**	**44,33%**
22	Motor vehicles trade and repair	491	458	-0,70	3,15%
23	Wholesale trade	903	1022	1,24	7,04%
24	Retail trade	1913	1677	-1,32	11,55%
25	Hotel and restaurant	734	859	1,57	5,92%
26	Transport services	584	578	-0,10	3,98%
27	Auxiliary transport and travel agencies	189	326	5,45	2,25%
28	Post and telecommunication	348	290	-1,82	2,00%
29	Financial intermediation and insurance	570	590	0,34	4,06%
30	Real Estate activities	83	234	10,36	1,61%
31	Renting of machinery and personal goods	20	30	4,05	0,21%
32	Computer and related activities	181	355	6,74	2,45%
33	Research and development	43	55	2,46	0,38%
34	Other professional services	879	1608	6,04	11,08%
	Services (subtotal)	**6938**	**8082**	**1,53**	**55,67%**
	Total	**13499**	**14518**	**0,73**	**100,00%**

Table 3. Moran test on spatial autocorrelation of employment growth among LLS

Normal approximation. Sectors with significant spatial autocorrelation are not shaded

		First order spatial contiguity	
	Sectors	**Standardized Z values**	**Probability level**
01	Manufacture of food, and beverages.	3.9	0,0
02	Industry of textile	2.6	0.0
03	Clothing industry	4.0	0.0
04	Industry of leather and shoes	3.1	0.0
05	Working of wood	7.7	0.0
06	Industry of paper and pulp	2.0	0.0
07	Printing, press and publishing	0.8	0.3
08	Gas and oil industry	-1.7	0.0
09	Chemical Industry	-0.9	0.3
10	Rubber industry	0.5	0.6
11	Metallurgy, primary processing of non ferrous metals	3.6	0.0
12	Metallurgy of iron and steel	1.4	0.1
13	Industry of metal products	2.7	0.0
14	Manufacture of mechanic equipment	1.3	0.1
15	Manufacture of office machinery and computers	2.3	0.0
16	Manufacture of electronic equipment	1.4	0.1
17	Manufacture of precision equipment	0.8	0.3
18	Automotive industry	-0.3	0.7
19	Other land transport industry	0.3	0.6
20	Industry of furniture, recycling	2.9	0.0
21	Building	12.6	0.0
	Industry (subtotal)	**7.2**	**0.0**
22	Motor vehicles trade	0.7	0.4
23	Wholesale trade	3.8	0.0
24	Retail trade	7.1	0.0
25	Hotel and restaurant services	9.3	0.0
26	Transport services	3.0	0.0
27	Auxiliary transport and travel agency services	0.3	0.7
28	Telecommunication services	1.8	0.0
29	Financial services, insurance	4.3	0.0
30	Property renting	7.6	0.0
31	Renting of personal goods	-0.0	0.9
32	Computer services	2.1	0.0
33	R&D	0.9	0.3
34	Other professional and entrepreneurial services	7.6	0.0
	Services (subtotal)	**16.6**	**0.0**
	Total	**10.9**	**0.0**

Table 4. Econometric results for macroregions

Dependent variable: employment growth in the local industry; annual average 1991-2001
Estimation method: GLS (cross section weights) with industry fixed effects; White robust standard error
Panel estimation by LLS and sectors
Level of significance: a=1%; b=5%; c=10%

Variables			***Italy***	***North-West***	***North-East***	***North-Centre***	***Center-South***	***South***	***Islands***
Local and industy specific variables	*SE*	*specialisation externalities*	-3.86 [a]	-2.86 [a]	-3.00 [a]	-2.66 [a]	-5.65 [a]	-6.94 [a]	-6.00 [a]
	DE	*diversity externalities*	0.98 [a]	1.25 [a]	-0.22	1.16 [a]	0.92	2.81 [a]	2.11 [b]
	SC	*scale effect*	0.05	0.08 [a]	0.36 [a]	-0.39 [a]	0.23	-0.28 [a]	-0.23 [b]
	COMP	*competition*	-9.48 [a]	-12.42 [a]	-9.44 [a]	-2.49 [a]	-4.51 [a]	-8.38 [a]	-9.57 [a]
Local specific variables	*NE1*	*population density*	0.00	0.01	0.01	-0.01	0.04	0.02	-0.00
	NE2	*small firms*	0.49 [a]	0.31 [a]	1.11 [a]	0.55 [b]	0.67 [c]	0.69 [b]	0.03
	HK	*human capital*	0.59 [a]	-0.92 [a]	0.00	0.75 [a]	0.50	1.32 [a]	0.46
	SK	*social capital*	0.04 [c]	0.03 [c]	0.19 [a]	-0.09	0.15 [b]	-0.01	-0.28
	LS	*labour supply*	0.53 [a]	0.48 [c]	0.16 [c]	1.63 [a]	1.97 [b]	1.76 [a]	0.64
		n. observation	22286	4354	4309	3262	1753	5253	3355
		Adj. R2	0.09	0.11	0.11	0.09	0.10	0.11	0.12
		S.E of regression	15.77	13.37	13.76	13.68	16.55	19.14	16.64

Note: we have excluded local industry with zero employees in both 1991 and 2001

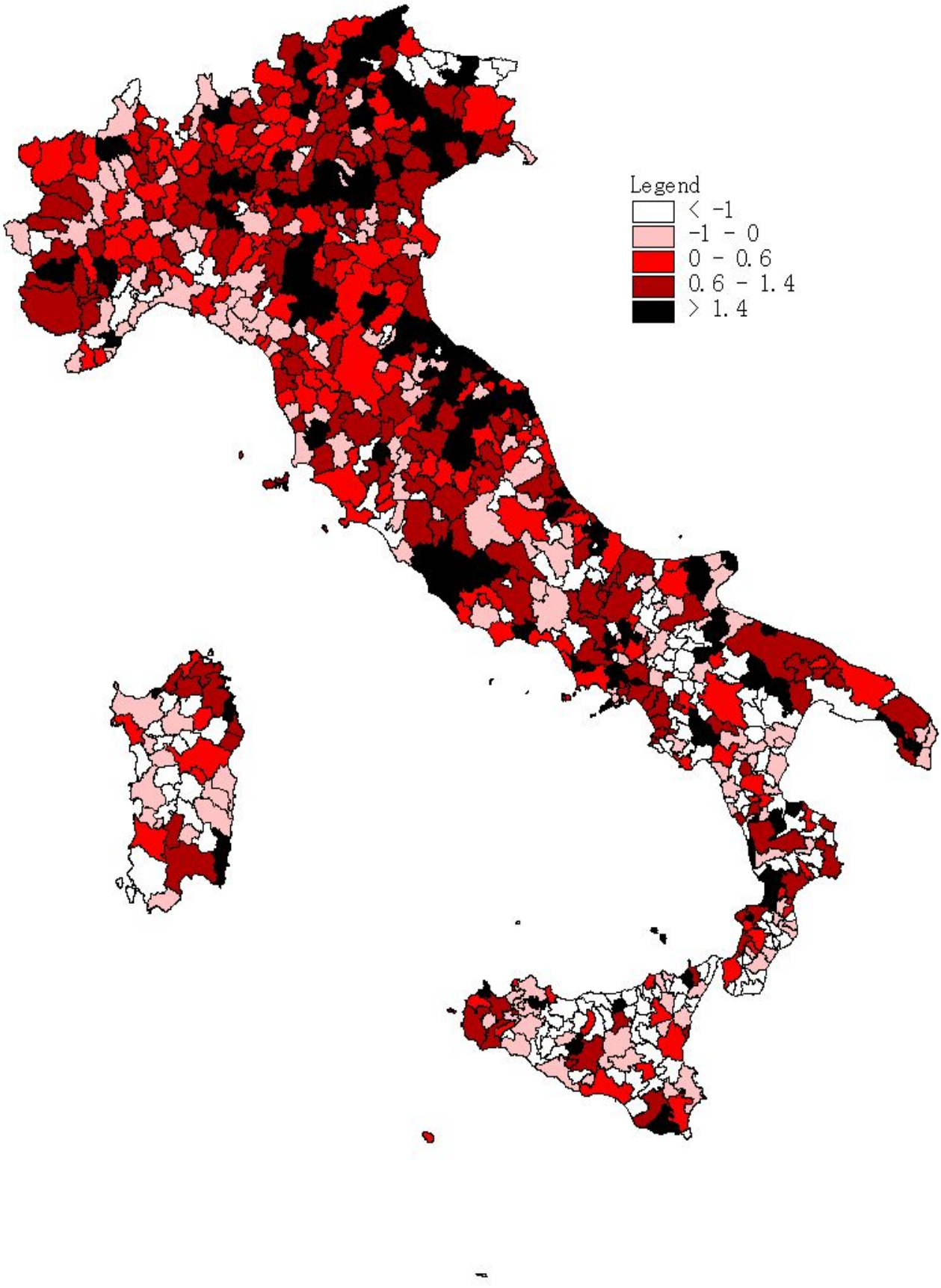
Table 5. Econometric results for sectors

Dependent variable: emploiment growth in the local industy. Annual average 1991-2001 Cross-section estimation by LLS Level of significance: a=1%; b=5%; c=10%

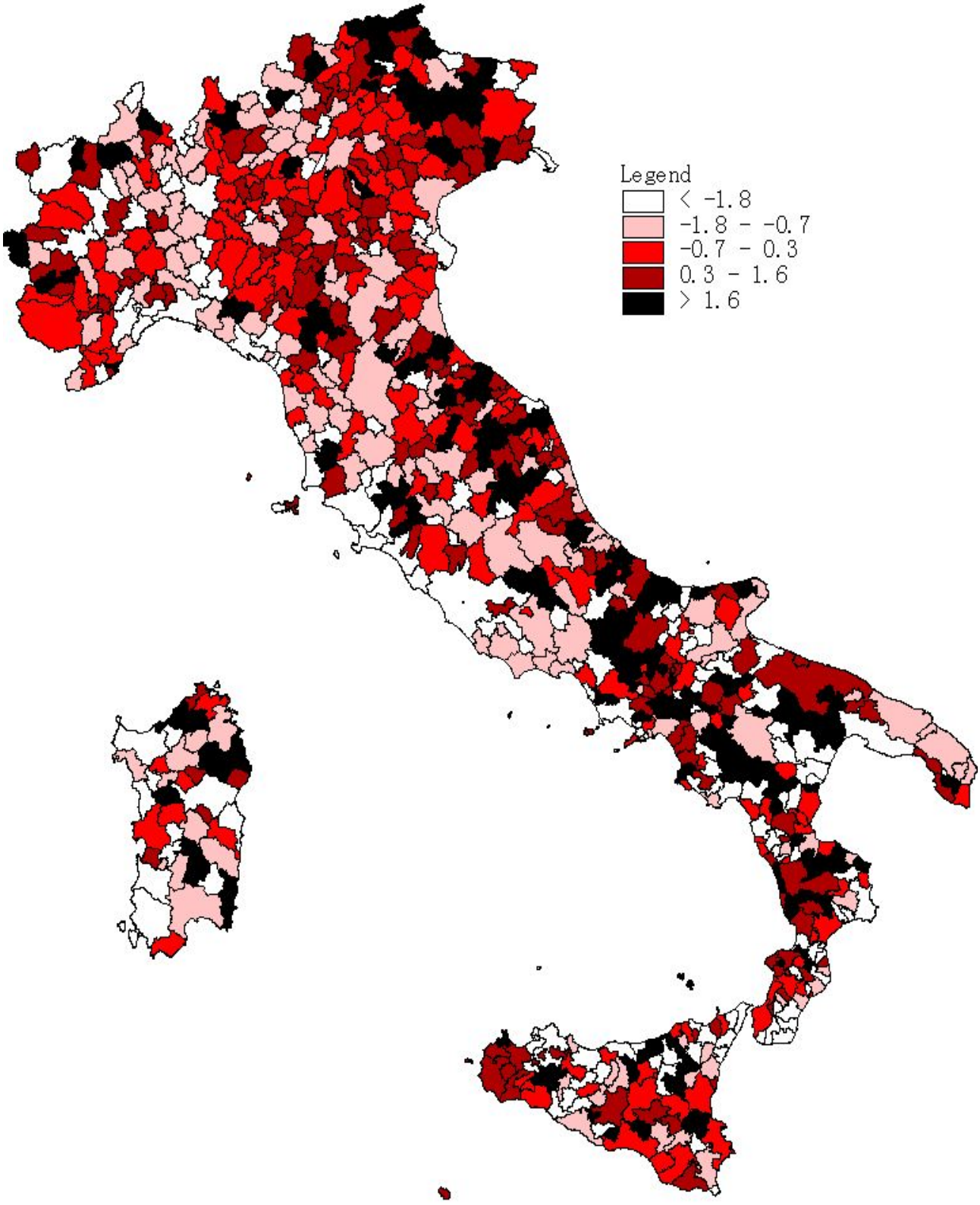
Estimation Method; ML: Maximum Likelihood, OLS-W: Ordinary Least Squares Estimation-White robust Standard Error Constant is included

Code	Sector	Estimation method	Obs.	Specialisation externalities	Diversity externalities	Scale effect	Competition	Population density	Small firms	Human capital	Social capital	Labour supply	Spatial lag 1st order	Spatial lag 2 order
01	Food, beverages and tobacco	ML	794	-4.22 [a]	-2.69 [b]	0.67 [c]	-12.33 [a]	-0.05	1.08 [c]	-0.29	-0.25 [c]	-0.73	0.14 [a]	
02	Textiles	ML	747	-21.93 [a]	-25.57 [a]	4.76 [a]	-58.60 [a]	0.03	3.86	-8.29 [c]	-0.56	1.65	0.19 [a]	
03	Wearing apparel	OLS-W	773	-2.19	-1.82	2.14 [b]	-21.90 [a]	0.37 [c]	3.74	-0.32	-0.36	2.97		
04	Leather and footwear	ML	602	-20.12 [a]	-43.49 [a]	0.37	-71.76 [a]	-1.83 [c]	1.84	-5.90	-1.75 [c]	-5.53 [c]	0.11 [a]	0.15
05	Wood products, except furniture	ML	784	-1.38 [b]	-0.00	0.64 [a]	-14.41 [a]	-0.12	-1.92 [a]	-1.18 [c]	0.00	0.85 [c]	0.18 [a]	0.16
06	Paper	OLS-W	489	-24.47 [a]	-13.03 [c]	2.88 [a]	-65.36 [a]	-2.65 [a]	-6.08	-7.02 [c]	-1.94 [b]	-22.01 [a]		
07	Printing and publishing	OLS-W	740	-41.58 [a]	-7.13 [c]	16.62 [a]	-31.81 [a]	-0.30	2.08	4.35 [c]	-0.03	-6.03 [b]		
08	Coke and refined petroleum products	OLS-W	367	-35.11 [a]	-33.71 [a]	7.76 [b]	-92.56 [a]	-1.03	11.57	3.81	1.25	-7.83		
09	Chemicals and chemical products	ML	596	-31.41 [a]	-10.75 [c]	4.68 [a]	-70.91 [a]	-1.46 [c]	-7.89 [c]	-14.34 [a]	-2.11 [c]	-5.90 [c]	0.10 [b]	
10	Rubber and plastic	OLS-W	619	-33.60 [a]	-17.33 [a]	4.67 [a]	-58.41 [a]	-1.42 [a]	-4.14	-8.28 [b]	0.52	-0.04		
11	Non metallic mineral products	OLS-W	781	-11.40 [a]	-7.06 [b]	2.05 [a]	-19.04 [a]	-0.64 [a]	0.13	-3.02 [b]	-0.29	2.18		
12	Basic metals	OLS-W	466	-27.34 [a]	-9.48 [c]	2.65 [a]	-76.45 [a]	-3.44 [a]	-3.75	-5.86	-2.69 [a]	-30.08 [b]		
13	Fabricated metal products	ML	784	-3.00 [a]	5.26 [a]	-0.43 [c]	2.52	-0.10	-0.63	-1.36 [b]	-0.03	0.55	0.15 [a]	
14	Machinery	OLS-W	737	-21.12 [a]	-13.50 [a]	4.72 [b]	-46.38 [a]	-1.35 [a]	-0.74	-2.96	-0.48	-2.27		
15	Office, computing and electrical machinery	OLS-W	695	-28.53 [a]	-1.77	2.25	-67.86 [a]	-1.43 [b]	1.08	-9.96 [a]	-2.08 [a]	-2.82		
16	Radio, tv, communication equipment	ML	682	-31.09 [a]	-5.47	7.55 [a]	-47.82 [a]	-1.24 [c]	-0.18	-4.42	-0.04	-1.05	0.18 [a]	
17	Medical, precision and medical instruments	ML	742	-36.30 [a]	-11.38 [a]	5.08 [a]	-46.56 [a]	-1.10 [c]	0.46	0.19	0.83	2.85	0.13 [a]	
18	Motor vehicles, trailers and semi trailers	OLS-W	366	-26.58 [a]	0.46	9.69 [a]	-83.24 [a]	-3.32 [b]	-7.14	0.58	-2.57 [c]	-15.49		
19	Other transport equipment	OLS-W	454	-27.35 [a]	-14.24 [a]	4.83 [a]	-59.25 [a]	-1.37 [c]	-1.65	6.26 [c]	-1.53	-12.57		
20	Furniture, recycling and other	OLS-W	778	-21.86 [a]	-6.33 [c]	3.17 [b]	-35.97 [a]	-0.36	-2.56	-6.19 [a]	-0.76 [c]	1.09		
21	Building	ML	784	-8.56 [a]	-0.08	-0.99 [a]	1.61	-0.06	0.69 [c]	0.12	0.03	-0.28	0.26 [a]	
22	Motor vehicles trade and repair	OLS-W	784	-2.02 [a]	0.35	-0.55	-12.34 [c]	-0.09 [a]	0.70 [b]	0.55 [b]	0.00	0.46 [b]		
23	Wholesale trade	ML	784	-10.20 [a]	3.82 [a]	-0.11	-7.48 [b]	0.40 [a]	1.44 [a]	1.16 [c]	0.03	0.80 [c]	0.11 [a]	
24	Retail trade	ML	784	-1.93 [a]	0.58 [c]	1.70 [a]	-20.45	-0.01	0.79 [a]	0.71 [a]	-0.02	0.53 [a]	0.12 [a]	
25	Hotel and restaurant	ML	784	1.89 [a]	1.26 [a]	0.30	-15.15 [a]	-0.01	0.61 [b]	0.92 [a]	-0.01	0.63 [a]	0.27 [a]	
26	Transport services	OLS-W	784	-9.14 [a]	0.37	-0.07	-6.19 [c]	0.27 [a]	1.17 [b]	0.79 [c]	0.05	0.13		
27	Auxiliary transport and travel agencies	OLS-W	757	-49.44 [a]	-23.06 [a]	15.63 [a]	-55.67 [a]	0.77 [b]	-2.49	4.79 [c]	-1.39 [c]	0.79		
28	Post and telecommunication	OLS-W	784	-2.13 [a]	-0.20	-0.11	1.47 [b]	0.17 [a]	0.03	0.19	0.14 [c]	-0.23		
29	Financial intermediation and insurance	OLS-W	784	-13.73 [a]	0.34	0.92	-8.00 [c]	0.01	-1.12	2.65 [a]	0.05	0.37		
30	Real Estate activities	ML	717	-32.91 [a]	-11.41 [a]	-7.06 [a]	-43.98 [a]	-0.75 [c]	-6.31 [a]	-0.96	0.96 [c]	2.50	0.08 [b]	
31	Renting of machinery and personal goods	OLS-W	713	-47.90	-35.49 [a]	2.26	-47.19 [a]	-0.75 [b]	4.28	4.66 [b]	0.00	0.48		
32	Computer and related activities	OLS-W	770	-52.80 [a]	-10.53 [a]	1.21	-38.97 [a]	-0.29	0.82	9.57 [a]	0.66 [c]	-0.28		
33	Research and development	ML	663	-51.43 [a]	-22.59 [a]	5.00 [a]	-55.19 [a]	-0.66	-1.69	-0.14	0.24	-15.70 [a]	0.09 [a]	
34	Other professional services	ML	784	-9.09 [a]	2.16 [a]	-0.08	-10.47 [c]	-0.04	0.35	4.13 [a]	0.07	0.20	0.12 [a]	
	Industry	ML	784	-3.80 [a]	3.38 [a]	-0.04	0.65 [c]	-0.13 [b]	0.28	-0.76 [a]	0.01	0.39 [c]	0.25 [a]	0.33
	Services	ML	784	-2.46 [a]	1.52 [a]	0.87 [b]	-14.19 [b]	0.02	0.72 [a]	0.92 [a]	0.06 [c]	0.73 [a]	0.19 [a]	0.23

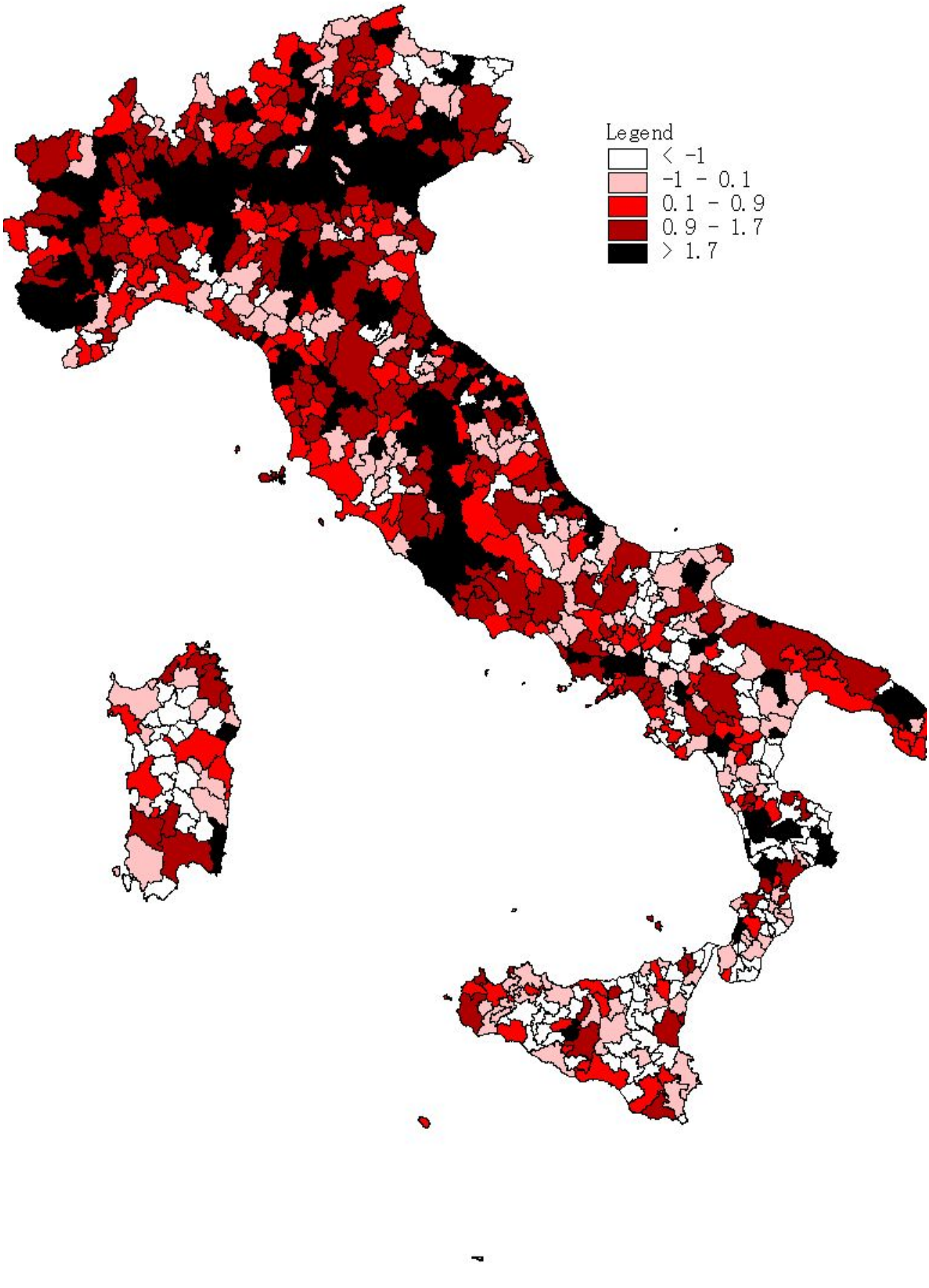
Map 1. Employment Dynamics in the Local Labour Systems in Italy (1991-2001)



Map 2. Employment dynamics in Industry in the LLS in Italy (1991-2001)



Map 3. Employment dynamics in Services in the LLS in Italy (1991-2001)



Map 4. Spatial association in total employment growth in the Italian LLS (Moran scatterplot 1991-2001)