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Structural Change And Economic Convergence Across The Eu-15 Regions: Can The Agricultural Sector Play A Role?

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Abstract

Economic and agricultural convergence across the EU regions has for a long time attracted the attention of economists and more so in the recent decade following the EU enlargement. Empirical contributions have referred explicitly or implicitly to the Solow's model of economic growth testing absolute and conditional β-convergence. The recent literature suggests that the prevailing neoclassical and sectoral approach is not suitable to face the implication of structural change on economic convergence whose understanding is key within the current process of significant marginalization of agriculture and partly of industry in favour of the service sector. In this context the aim of the paper is the understanding the size and evolution of this change, the way in which it has affected aggregate economic convergence and if the agricultural sector has influenced the process despite its small and decreasing contribution to total GDP comparing the results from the neoclassical and Paci, Pigliaru approach

1. Introduction

Economic convergence across European regions has recently become the object of renewed interest partly due to the enlargement process of the EU to the East. From the scientific point of view, the empirical literature has directly or indirectly referred to Solow's one-sector growth model (Solow, 1956) (See also, Brasili, Oppi, 2003; Dall'Erba, Le Gallo, 2003; Fingleton, 2003).

Following the contribution of Sala-i-Martin (1996), such works were initially focused on the estimation of the β-absolute convergence. The functional form of the estimated model predicts that the average annual growth rate of labor productivity is a function of a constant and of the productivity level in the initial year (Barro, Sala-i-Martin, 1990, 1991, 1992).

According to the neoclassical hypothesis, the growth rate of per-capita income is negatively correlated to the initial level of per-capita income during the adjustment process. In the long term, the assumed closed economies sharing the same structural parameters, in terms of preference, technology, and exogenous technical progress, and converge toward a single stationary state (Bernini Carri, Sassi, 1999).

At the basis of this process are typical neoclassical assumptions related to the nature of the production functions and, in particular, to the negatively sloping curve of marginal productivity of capital. According to the assumption of diminishing marginal productivity, for each additional unit of invested capital, there will be an increase in production; however, the intensity of the production growth reduces with the accumulation process. An investor, therefore, faced with the decision of where to allocate his resources, will choose to invest in those economies in which the level of capital employed is the lowest, in order to obtain the highest returns (Sala-i-Martin, 1996). Consequently, the peripheral regions, starting from a level of accumulation, production, and development lower than those that are wealthier should develop at a relatively higher pace (Sassi, 2005).

Following the analysis by Mankiw et al. (1992), the empirical literature has focused on the estimate of the conditional β-convergence, which is the possibility of different stationary states, through the introduction in the regression equation of:

-a vector of independent variables that reflect the structural gaps across the economies in the initial year (Barro, Sala-i-Martin, 1991); or

-of the clubs of convergence, that is sub-groups of economies whose initial conditions are sufficiently close to the converge toward the same long term equilibrium (Bernard,

Durlauf, 1996; Brasili, 2005; De Long, 1988; Durlauf, Johnson, 1995; Friedman, 1992; Islam, 2003; Mankiw, Romer, Weil, 1992; Quah, 1993a, 1993b, 1996a, 1996b, 1996c, 1997).

In these works, an important school of thought concentrates on the convergence in the agricultural sector. This is partly due to the renewed interest of the EU for such an objective that is understood as fundamental for the achievement of economic and social cohesion. The prevailing empirical approach is a sectoral one (See, for example, Gutierrez, 2000, 2002; Bernini Carri, Sassi 2003). This approach, although allowing us to highlight extremely interesting aspects, does not let us to approach some issues with significant policy implications among which include the effects of structural change.

In recent years, the EU regions have faced an intensification in the process of structural change towards service economy that has caused a gradual and significant reduction of the relative importance of agriculture and, although on a smaller scale, of industry. It is therefore important to understand the dimensions and characters of such a structural change, and if this has affected the aggregate convergence process across the European regions. Within this process, it is also necessary to understand the role of the agricultural sector in order to verify if, as expected by the EU (European Commission, 2006), it has promoted economic convergence.

The neoclassical approach, as better clarified in the methodology section, recognizes the possible impact of the structural differences between the economies on convergence. However, they are considered in the initial year and not as a change over time.

In regards to the policy prescriptions, the issue is extremely important because it implies that the public intervention should be aimed at making the structural parameters equal at the regional level, creating and reinforcing the free market and the free mobility of production factors across regions. Specific interventions to promote convergence are not considered necessary because regional disparities are physiological in a system facing an intense development process. Such divergences represent a transitory phenomenon because the growth will spread from the initially advantaged areas to the rest of the economies (Garofoli, 1992). The process of integration and the breakdown of barriers taking place in the EU reflect this view (Cellini, 1997). The elimination of possible obstacles to the free market, in fact, is understood as a way for speeding up the process of closing the gaps of the returns on production supporting convergence. The structural changes do not affect aggregate convergence, because according to the neoclassical view, there is a continual equality of the rate of return on factors across sectors.

Some theoretical and empirical approaches, in contrast with this vision, clearly demonstrate the importance of structural change on the regional growth rates. Lewis (1954) and Kaldor (1966, 1968), for example, foresee such possibilities in the case of incomplete market integration, when the marginal factors productivity is not equal across the different sectors.

Aggregate convergence is associated with a complex of structural dynamics also in the literature based on the "technological gap" hypothesis as explicative of the differentials in growth rates (for a critical analysis, see Fagerberg, 1994). This school of thought even goes so far as to suggest the necessity of specific government institutions supporting the structural change that is understood as a prerequisite for a faster growth and convergence.

In this context, the present work aims to understand the dimensions and evolution of structural change in the EU-15 and the way in which this has affected economic convergence. The analysis refers to the time period from 1980-2001, to the three sectors of agriculture, industry, and services, and to a sample of 80 regions at a NUTS2 level representative of the EU-15, and is organized in two parts.

First of all, the focus is put on the evolution of the sectoral composition and specialization of the regions, with specific attention given to the role of agriculture in relation to the other sectors. The study later analyzes the relationship between economic convergence and structural change in order to give a preliminary interpretation to the sectoral contribution to the convergence process. The issue is addressed by comparing the results from the models of Barro and Sala-i-Martin (1995) and that of Paci and Pigliaru (1997). The former estimates the role in the process of convergence of a hypothetical growth rate in which, the sectoral values are weighted by the initial share of the sectoral labor standard units. The Paci and Pigliaru approach, instead, removes the typically neoclassical assumptions at the basis of the constant weighting coefficients introducing a variable that expresses the structural change in the estimated equation.

The empirical analysis is preceded by a methodological section and followed by conclusions.

2. Sample and Methodology

Data has significantly influenced the composition of the sample and the time period considered. Convergence is by nature a long term process. Because of this, we attempted to extend the time series of the explicative variable, which is the value added to the basic prices per standard labor unit, as much as possible. Thanks to the compilation of data from a previous project (Arfini et al. 2005) and its updating with the most recent information from

the EUROSTAT source, the analysis refers to the period from 1980-2001. However, this data made it possible to consider only 80 regions.[1]

As previously underlined, the empirical analysis refers to the specialization of the regional economies and to the role of structural change in the convergence process.

The analysis of the state and the evolution of the sectoral composition of the regions is based on two indicators. The first is represented by the sectoral share of the value added:

$$Q_{ji,t} = \frac{x_{ij,t}}{\sum_j x_{ij,t}} \tag{1}$$

where $x_{ij,t}$ is the value added in the sector *j* of region *i* at time *t*.

This indicator allows us to understand the sectoral contribution to the total value added underlining the significant traits and their evolution from 1980-2001.

However, the indicator does not allow us to understand if over time the regional productive structures have become less or more similar. In order to analyze the aspect a specific indicator has been introduced. It is the index of *Krugman* or *K-index* in the version developed by Midelfrat-Knarvirk et al. (2000). It is defined as the sum over all sectors of the absolute value of the difference between:

a) the share of sector *j* in region *i*'s total value ($Q_{ij,t}$); and

b) the share of the same sector on total value added of all other regions ($\overline{Q}_{ij,t}$):

$$K_{i,t} = \sum_j \left| Q_{ij,t} - \overline{Q}_{ij,t} \right| \tag{2}$$

$K_{i,t}$ ranges between zero and two and increases with the degree of specialization; i.e. it is higher the more a region's production structure differs from that of the other. $K_{i,t}$ takes value zero if region *i* has a sectoral structure identical to the rest of the EU and takes maximum

[1] The regions in the sample are: be21 – Antwerpen; be22 – Limburg, be23 - Oost-Vlaanderen; be25 - West-Vlaanderen; be32 – Hainaut; be34 – Luxembourg; be35 – Namur; dk – Denmark; ie – Ireland; es11 – Galicia; es12 - Principado de Asturias; es13 – Cantabria; es21 - Pais Vasco; es22 - Comunidad Foral de Navarra; es23 - La Rioja; es24 – Aragón; es3 - Comunidad de Madrid; es41 - Castilla y León; es42 - Castilla-la Mancha; es43 – Extremadura; es51 – Cataluña; es52 - Comunidad Valenciana; es53 - Illes Balears; es61 – Andalucia; es62 – Murcia; es7 – Canarias; fr1 - Île de France; fr21 - Champagne-Ardenne; fr22 – Picardie; fr23 - Haute-Normandie; fr24 – Centre; fr25 - Basse-Normandie; fr26 – Bourgogne; fr41 – Lorraine; fr42 – Alsace; fr43 - Franche-Comté; fr51 - Pays de la Loire; fr52 – Bretagne; fr53 - Poitou-Charentes; fr61 – Aquitaine; fr62 - Midi-Pyrénées; fr63 – Limousin; fr71 - Rhône-Alpes; fr72 – Auvergne; fr81 - Languedoc-Roussillon; fr82 - Provence-Alpes-Côte d'Azur; fr83 – Corse; it11 – Piemonte; it12 - Valle d'Aosta; it13 – Liguria; it2 – Lombardia; it32 – Veneto; it33 - Friuli-Venezia Giulia; it4 - Emilia-Romagna; it51 – Toscana; it52 – Umbria; it53 – Marche; it6 – Lazio; it71 – Abruzzo; it72 – Molise; it8 – Campania; it91 – Puglia; it92 – Basilicata; it93 – Calabria; ita – Sicilia; itb – Sardegna; nl11 – Groningen; nl12 – Friesland; nl13 – Drenthe; nl21 – Overijssel; nl22 – Gelderland; nl23 – Flevoland; nl31 – Utrecht; nl32 - Noord-Holland; nl33 - Zuid-Holland; nl34 – Zeeland; nl41 - Noord-Brabant; nl42 – Limburg; pt11 – Norte; pt15 - Algarve.

value of two if it has no sectors in common with the rest of the EU. Dividing the K-index by two[2], we obtain the measure of the difference between a) and b) in terms of a percentage.

$$D_{i,t} = \frac{K_{i,t}}{2} * 100 \qquad (3)$$

The analysis of the sectoral differences between aforementioned points a) and b), indicated as sectoral components of the K-index, made it possible to understand the role of each sector on the disparities across regions. The study of the variation between the initial and final years of such components permitted us to bring to light the dynamic of such disparities.

Furthermore, following from Midelfart-Knarvirk et al. (2000), we compared the variation of the real and forecasted K-index between the initial and final years. This latter indicator was obtained projecting to the final year the initial year's value added of each sector in each region on the basis of the sectoral average growth rate of the whole sample.

The expected variation, therefore, was purified of any effect of regional differentials between the sectoral growth rates. The comparison of the change in real and expected values in the K-Index allowed us to highlight this latter differential.

2.1. Structural Change and Convergence

The analysis of the role of structural changes in the convergence process was developed starting from the Solovian model. An explanation of the capacity of the model was examined by means of the approach developed by Paci and Pigliaru (Paci, Pigliaru, 1997).

The starting point was the estimate of the absolute β-convergence. Following Sala-i-Martin (1991, 1992) and Sala-i-Martin (1995), the neoclassical hypothesis of convergence was analyzed through a non-linear cross-country regression of a version of the traditional Solow equation, that is:

$$\frac{1}{N}\ln\left(\frac{y_{i,T}}{y_{i,0}}\right) = \alpha - b\ln\left(y_{i,0}\right) + \mu_i \qquad \mu \cong N\left(o, \sigma_\mu^2 I\right) \qquad (4)$$

where y is the total value added for standard labor units, N is the number of years within the time period [0, T], μ the stochastic error, α the constant and b the convergence coefficient that, if estimated with the negative sign, confirm the hypothesis of the absolute β-convergence.

In this context, Barro and Sala-i-Martin (1995) introduce a hypothetical growth rate ($S_{i,0}$) defined as:

[2] The Krugman index was divided by two in order to consider both positive and negative deviations.

$$S_{i,0} = \frac{1}{N} \ln\left(\frac{\bar{y}_{i,T}}{y_{i,0}}\right) \tag{5}$$

with

$$\bar{y}_{i,T} = \sum_{j=1}^{n} l_{ij,0}\, y_{ij,0}\left(1+\gamma_j\right) \tag{5a}$$

where $l_{ij,0}$ is the share of the standard labor units in sector *j* in region *i* in the initial year and γ_j is the average growth rate of the sample of the sector *j* during the entire time period considered.

In region *i*, $S_{i,0}$ would be equal to the real growth rate ($\frac{1}{N}\ln\left(\frac{y_{i,T}}{y_{i,0}}\right)$) if, under the assumption of constant sectoral shares over time, each sector in that region would develop in the time interval [0, T] to the average growth rate of the whole sample ($\gamma_{ij}=\gamma_j$). The potential systematic differences between the two growth rates, in the above cited work by Barro and Sala-i-Martin, are explained by differentials of per-capita incomes in the initial year ($y_{i,0}$). Therefore, the equation of the hypothesis of convergence becomes estimated by the following equation:

$$\frac{1}{N}\ln\left(\frac{y_{i,T}}{y_{i,0}}\right) = \alpha - b\ln\left(y_{i,0}\right) + S_{i,0} + \mu_i \tag{6}$$

Paci and Pigliaru (1997) argue that the improvement of the estimated *b* coefficient deriving from the introduction of $S_{i,0}$ pointed out by Barro and Sala-i-Martin is not sufficient to conclude that the significance of the convergence coefficient is robust to the economic structural differences. They underline that one of the central hypotheses at the base of the equation (6) is the constancy of the weighted coefficient ($l_{ij,0}$) that is based on the typical neoclassical assumption of continual equality of the rate of marginal return on factors between sectors over time. Since the assumption is difficult to support, such modifications can have a strong systematic influence on the regional growth rates. To take the structural changes into account, Paci and Pigliaru introduce in the equation (4) a different hypothetical growth rate defined as:

$$M_{i,T} = \frac{1}{N}\ln\left(\frac{\overline{\overline{y}}_{i,T}}{y_{i,0}}\right) \tag{7}$$

with

$$\overline{\overline{y}}_{i,T} = \sum_{j=1}^{n} l_{ij,T}\, y_{ij,0}\left(1+\gamma_j\right) \tag{7a}$$

where $l_{ij,T}$ is the share of the standard labor units allocated in the sector *j* in the region *i* in the final year *T*.

Therefore,

$$M_{i,T} = S_{i,0} + Z_{i,T} \tag{8}$$

with $Z_{i,T}$ as the proposed measure by Paci and Pigliaru of the effect of the structural change on the hypothetical growth rate, or in other terms, the component of $M_{i,T}$ refers to the real variation of sectoral weights at a regional level.

This indicator allows us to better define the existence of the β-convergence. As underlined by Paci and Pigliaru (1997), the difference at the regional level ($R_{i,T}$) between the real and hypothetical growth rates depends on the "regional effect," that is on the difference between the regional and the average growth rates of the productivity in the individual sectors. Solow's model is appropriate if and only if the size of such a difference is negatively correlated to the productivity of labor in the initial year. In this case, in fact, in the poorest regions the sectoral productivity grows more rapidly with respect to the average of the sample.

The analysis of the contribution of the individual sectors to the growth process focuses on the relationship between the overall labor productivity dynamics and the economic structure expressed by the share of employment in the three sectors.

The issue has been widely debated in literature. Starting with the two sector model of Lewis (1954), the literature has underlined the positive impact on the productivity rate of growth of the reallocation of labor from the sectors in which productivity is lower towards those in which it is higher. To examine this aspect, following Fagerberg (2000), the following equation has been estimated for each sector:

$$\frac{1}{N}\ln\left(\frac{y_{i,T}}{y_{i,0}}\right) = \alpha + \beta\ln(y_0) + \varphi\left(l_{i,j,T} - l_{i,j,0}\right) + \mu_i \tag{10}$$

The results allow us to give a preliminary interpretation as well of the indirect effects of the technical progress in one sector on the others.

3. Results

3.1 Structural Change

The output sectoral composition analysis of the regions shows typical post-industrial features (Table 1 and Figure 1). From 1997-2001, the service sector contributes more to the total production with an average value of approximately 68% with some regions over 80%.

Industry follows the service sector with an average contribution of almost 28%, and finally there is agriculture with about 4%. The traits of this configuration became more evident over time with a convergence of the weight of agriculture in the individual regions towards the average value.

The structural differences (both in whole and as measured by the K-index) were reduced in the considered time period because of this dynamic (Fig. 2). If on average between 1980 and 1984, the 9.35% of the productive structure of the sample regions was not aligned with that of the sample, between 1997 and 2001, that value was reduced to 7.37%. The spatial representation of the K-index shows how the aggregate data hides interesting regional trends. While during the first five year period, the majority of regions was characterized by lower than average regional disparities, in the later period, particularly the regions in the central strip of land (Spain, southern France, and northern Italy) are those that take on values that are higher than the average to this because of an increase in the K-index.

Table 2 highlights that the indicator of the structural differences is significantly affected by the service and industry components. The correlation of this indicator to the agriculture component is weak and the intensity of this correlation reduces significantly over time. The spatial representation of the sectoral specialization proposed in Figure 3 also confirms this. A sector specialization is assigned to each region when the sectoral component of the K-index is higher than 0.10. In the initial three years, the majority of European regions in the sample presents on average an agricultural specialization. They are the territorial units geographically located in the central strip of Europe and in central and southern Italy. In the final three years, the geography of agricultural specialization has changed significantly. It is limited to some French regions and some regions in southern Italy. In the majority of the other regions, the agricultural specialization is combined with the industrial and only in a few of them with the service specialization.

Crossing the results of Figure 2 with those of Figure 3, one observes that the differences arise mainly in regions specialized in industry and services.

The evolution of the structural differences highlighted by the K-index can be influenced by two main forces: sectoral output growth rates and the sectoral distribution of the production factors. Coeteris paribus, the major and minor regional dissimilarities in the final year will depend in the first case on the presence or lack of sectors with growth rates higher than the average, while in the second case from different changes in the sectoral allocation of productive factors in the various regions. This last effect can be understood analyzing the expected and real variations of the K-index (Figure 4).

In the case of an expected increase in disparities, the real disparities have been lower than the expected and vice versa.

In any case, the observations, except for a few exceptions, fall around the 45% line. This means that the difference between the real and expected variation of the K-index is low. The regional allocation of the production factors across sectors therefore does not seem to have significantly changed during the time period. The evolution of the K-index would seem to be tied more to the sectoral growth disparities suggesting a declining importance of the structural change in the evolution of the levels of labor productivity and therefore on the process of convergence.

3.2 The Convergence Process and Structural Changes

The estimate of the absolute β-convergence confirms a process of *catching up* between the considered European regions (Table 3: Equation A) between 1980 and 2001. The coefficient of the initial labor productivity is significant, has a negative sign and a high value. The quality of the complete estimate results satisfactory although there are some problems of autocorrelation between residuals (Durbin-Watson test) typical of these models and that, in part, could be explained by the presence of effects connected to spatial relationships. In that sense, a dummy variable that distinguishes the northern regions from the southern regions was introduced in the regression equation. This, however, was not particularly relevant. The result should not suggest the absence of an influence of the spatial relationships, but the need for further analyses aimed at identifying groups of regions more appropriate as on the other side recently suggested by the empirical literature.

With the introduction of the hypothetical growth rates $S_{i,0}$ and $M_{i,T}$, into the equation for the estimate of the absolute convergence of the coefficient *b* maintains its value around 2%[3] and doesn't lose its significance (Table 3: equation B and C). The two conditional variables, instead, show a high probability of error that is such to make insignificant their contribution to the explanation of the convergence process.

[3]The estimated *b* coefficients remain constant around 2% confirming "the magic 2%" hypothesis of Quah (1997) that is the trend according to which not only the poorest economies will reach the richest, but also that it will happen within a few years. The literature shows that the uniformity of the rate of convergence can depend on the use of heterogenous units under the assumption that they were generated by an identical stocastic process instead of the convergence process (Canova, Marcet, 1995; Pesarant, Smith, 1995). The literature suggests various possibilities for overcoming such a problem. One of these consists of the estimation of b by means of an NLS regression. If, however, the coefficient of convergence is negative, the estimated parameter will have an infinite value that is tied to the logic of the Monte Carlo analysis. Alternatively, the use of non parametric techniques is recommended.

On the contrary, the variable explaining the structural change as proposed by Paci and Pigliaru ($Z_{i,T}$) is significant, presents a relatively high coefficient, and its sign indicates a inverse relationship with the real growth rate. The coefficient of partial correlation[4] is nevertheless very low (5.3%) suggesting a limited contribution of the variable to the explanation of the convergence process. The results seem to confirm the empirical evidence pointed out from the comparison between the real and expected variations of the K-index and is in strong countertrend with the results obtained by Barro, Sala-i-Martin and Paci and Pigliaru.

Specifically, the variables related to the structure and structural change do not impact the relevance of the convergence coefficient thus confirming the neoclassical interpretation of the convergence process. The issue is also confirmed in light of the negative relationship between $R_{i,T}$ and labor productivity in the initial year as illustrated in Figure 5 and in Table 4. The latter, in particular, underline that only change in the weight of employment of the service sector is statistically significant in explaining the real growth rate of labor productivity, to which moreover it is negatively correlated, even though the partial correlation coefficient is very low and suggests an even more limited additional explanation capacity.

In order to support convergence, the presence of sectors with high rhythms of production growth seems to be most important. In the light of this, we can give a first interpretation to the role of agriculture. Between 1980-2001, the agricultural sector supported the overall growth rate of economic productivity in a significant way[5] (Figure 6), but such a contribution derives from a strong reduction of the standard labor units against a stationary trend of output (Figure 7 and 8). On the contrary, in industry and above all in services production presents high growth rates combined with a standard labor units trend stable in the former sector and increasing in the latter. In such a context, the trend that characterizes most of all the poorest economies to the loss of the agricultural specialization and to associate it with that of industry but in particular that of services (Figure 3) would seem to represent one of the main causes of the process of convergence pointed out by the analysis.

4. Conclusions

[4]The coefficient of partial correlation r^2 is obtained as follows: $r^2= (R-R_i)/1-R_i$
R and R_i are respectively the coefficient of correlation of the equation with and without the structural change variable.

[5] Specifically, starting from the second half of the 1990s, labor productivity in agriculture increased at more sustainable rates than those of the other sectors.

This analysis underlines the typical post-industrial character of the regional economies of the EU-15 with the agricultural sector that in terms of value added has an even more marginal role. All the regions analyzed share this trend. In the industry and service sectors, the tendency was the opposite. However, these sectors show a different weight across the territorial units that sometimes are also significantly different.

Although agriculture has a limited contribution to total value added, intended as the share of the value added of the sector greater than average, characterizes the majority of the regions and is for this reason that the aforementioned process of convergence across agricultural economies is at the basis of the reduction of the structural differences pointed out between 1980 and 2001.

The comparison between the real and expected K-index has put into evidence that, across the analyzed regions, from 1980 to 2001 the allocation of the production factors across sectors seems not to have undergone relevant changes. This underlines a progressive reduction of the capacity of the influence of the structural change on the evolution of the labor productivity levels and, therefore, on the convergence process. This aspect is confirmed by the estimation of the β-convergence that contradicts the results emerged in the works of Barro and Sala-i-Martin (1995) and Paci and Pigliaru (1997). With the introduction of the variables expression of the hypothetical growth rate and the structural change, the coefficient of convergence remains significant, while $S_{i,0}$ and $M_{i,T}$ present a very high probability error. The significance of $Z_{i,T}$ is accompanied moreover from a limited contribution to the whole explanation capacity of the regression function.

This suggests, on the one hand, the validity of the neoclassical interpretation of the phenomenon of convergence and, on the other hand, the need to understand the impact of other variables on the process under analysis.

With regards to the first issue, we must underline how the intensity of convergence and the factors affecting this process are significantly influenced by the composition of the sample and the time period considered. In this sense, a recent study conducted by Lanzafame (2006) referring to Italian regions and therefore comparable in terms of the sample with that of Paci and Pigliaru (1997) arrives at results in line with those that we have achieved. The only difference in the two studies is the time period: the first being from 1972-1996 and the second being 1970-1992.

With reference to the determinants of the convergence process, the developed analysis underlines the need to consider not only the role of technical progress, but also other

variables like those tied to public interventions. The neoclassical relation between the initial income level and its growth rate, in fact, must be interpreted taking into account the fact that the regions in three of the eight considered countries, Spain, Ireland, and Portugal, take part, together with those of Greece, in the area of cohesion.

Those are regions where, starting from the 1990s, the labor productivity increased significantly and income disparities were reduced also thanks to the support of cohesion policy (European Commission, 2004). This introduces an interesting prospective of analyses aimed at verifying with accuracy the role of public intervention and of the market forces in influencing the convergence process. The need emerges even in light of the although limited negative impact exerted from the structural change on convergence. This proves how such a process is more complex and less automatic than postulated in the Solow growth models (Paci, Pigliaru, 1997).

In regards to this, the analysis has underlined a negative effect on the growth rate of the sample regions deriving from the reallocation of workers towards the service sector, even though $Z_{i,T}$ does not contribute in a significant way to explain the convergence process. This contradicts the part of the literature that assumes the rapid progress in technology, research and development, and the progressive deregulation at the basis of the positive influence of the service sector on productivity growth and on convergence (Gouyette, Perelman, 1997).

The analysis, moreover, has highlighted the importance, for the objective of *catching-up*, of the presence of sectors characterized by high rhythms of output growth. In this context, the weakness of the agriculture emerged. In this sector, the output is stationary over time, whereas in industry and especially service sectors the output is increasing. Specifically, the growth of the service sector seems to follow a widespread development model and equalize the income disparities across regions favoring in the poorest economies a process of marginalization of the agricultural role.

The weak condition of agriculture, at least in the short and medium run, will become more accentuated especially under the effect of the CAP reform that is causing a reduction of productions at basic prices of the agricultural sector. The trend should be in part attributable to an “accounting effect” tied to decoupling and to the introduction of a single payment for farms that is no longer calculated in the production accounts even participating in the formation of the farmers’ net income. It is a significant production change estimated on average of about 3% with comprised values between 9 and 12% for Germany, Denmark, and the United Kingdom where the coupled interventions were totally eliminated (ISMEA, 2006).

In this context, the role of rural development policies becomes important. Without the two

pillars of the CAP, many areas (especially rural areas) could increase their problems, not only economic, but also social and environmental, with possible negative implications on the process of growth and thus cohesion.

A final consideration concerns the methodology adopted that suggests a further direction of analysis. The availability of time series for the data set adopted, in fact, allows the application of other econometric approaches, among which the panel and dynamic specifications, that could suggest advancements not only of econometric nature but also interpretive of the role of the structural change in the process of economic convergence.

Table 1: Share of the sectoral value added on average-5 year averages- percentage values

	1980-84	1997-01
Agriculture	7.86	4.18
Industry	32.00	27.90
Services	60.14	67.92

Figure 1- Share of sectoral value added over the total

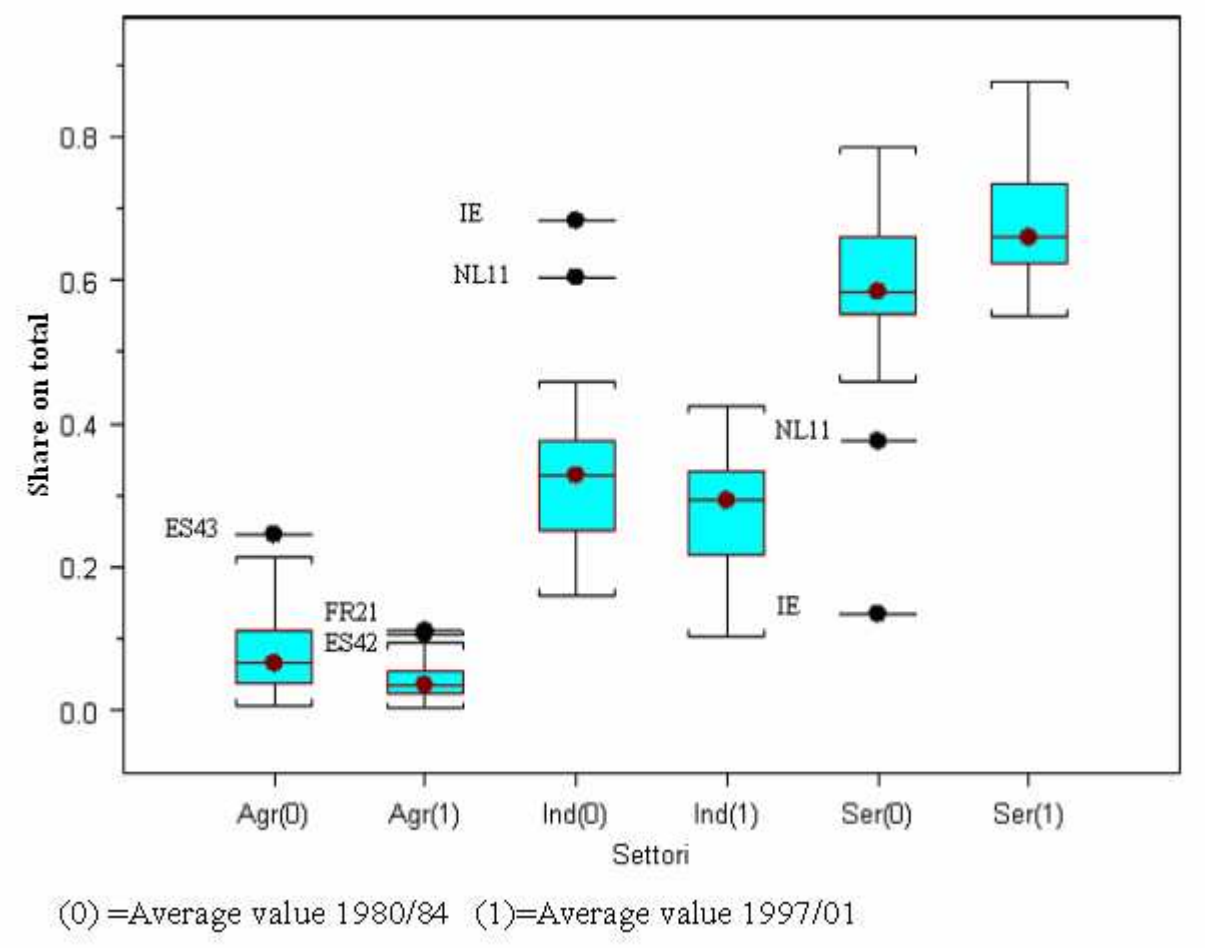
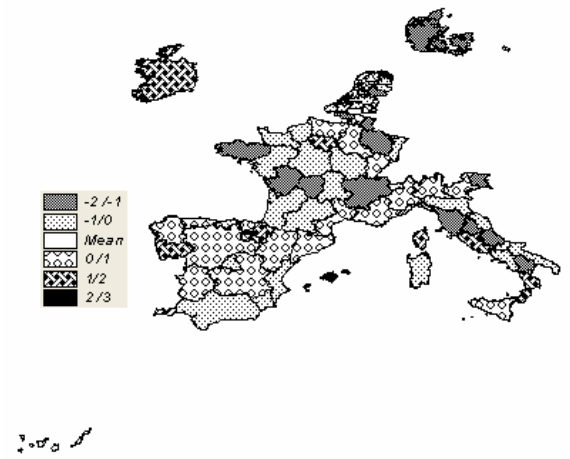
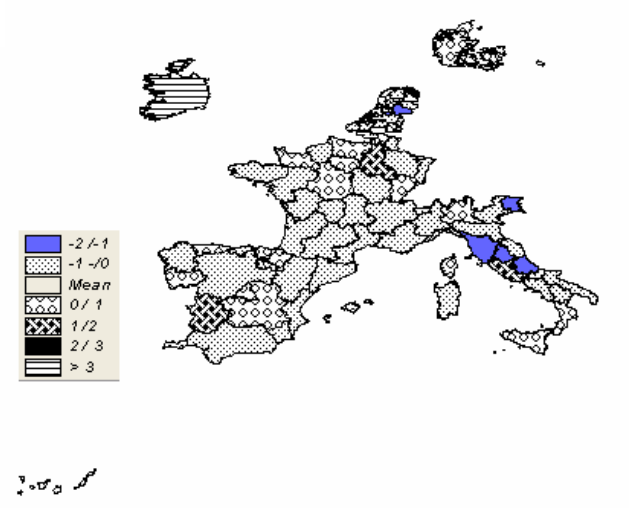


Figure 2- Spatial representation of the standard deviation of the average 5-year values of the K-index and its percentage variation between 1980/84 and 1997/01

a. 1997/01 (average7.37)



b. 1980/84 (average 9.34)



c. %Variations of the K-index, 1980/84 – 1997/01

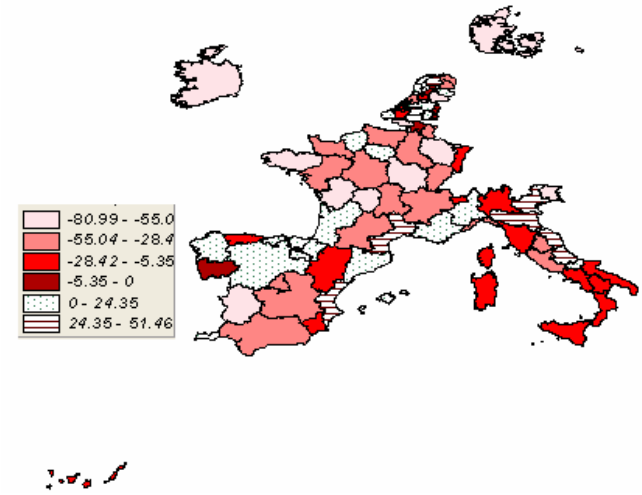


Table 2. Correlation between the K-index and the sectoral shares (average data from 1980-84 and1997-01)

	1980-84	1997-01
Agriculture	0.4511	0.1639
Industry	0.8732	0.8953
Services	0.9443	0.9527

Figure 3. Spatial representation of Specialization, 1997/01 and 1980/84

a. 1997/01 b. 1980/84

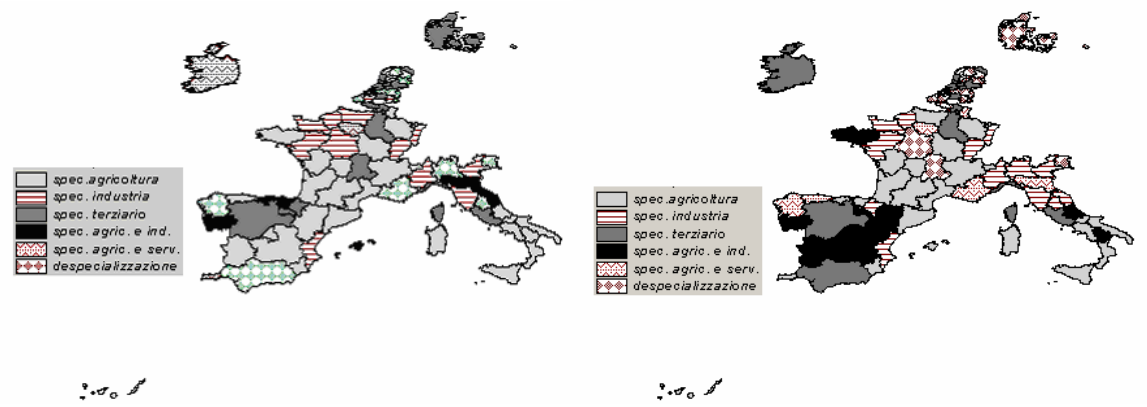


Figure 4. Real and expected variations of the K-index at the regional level, 1980/84 and 1997/01

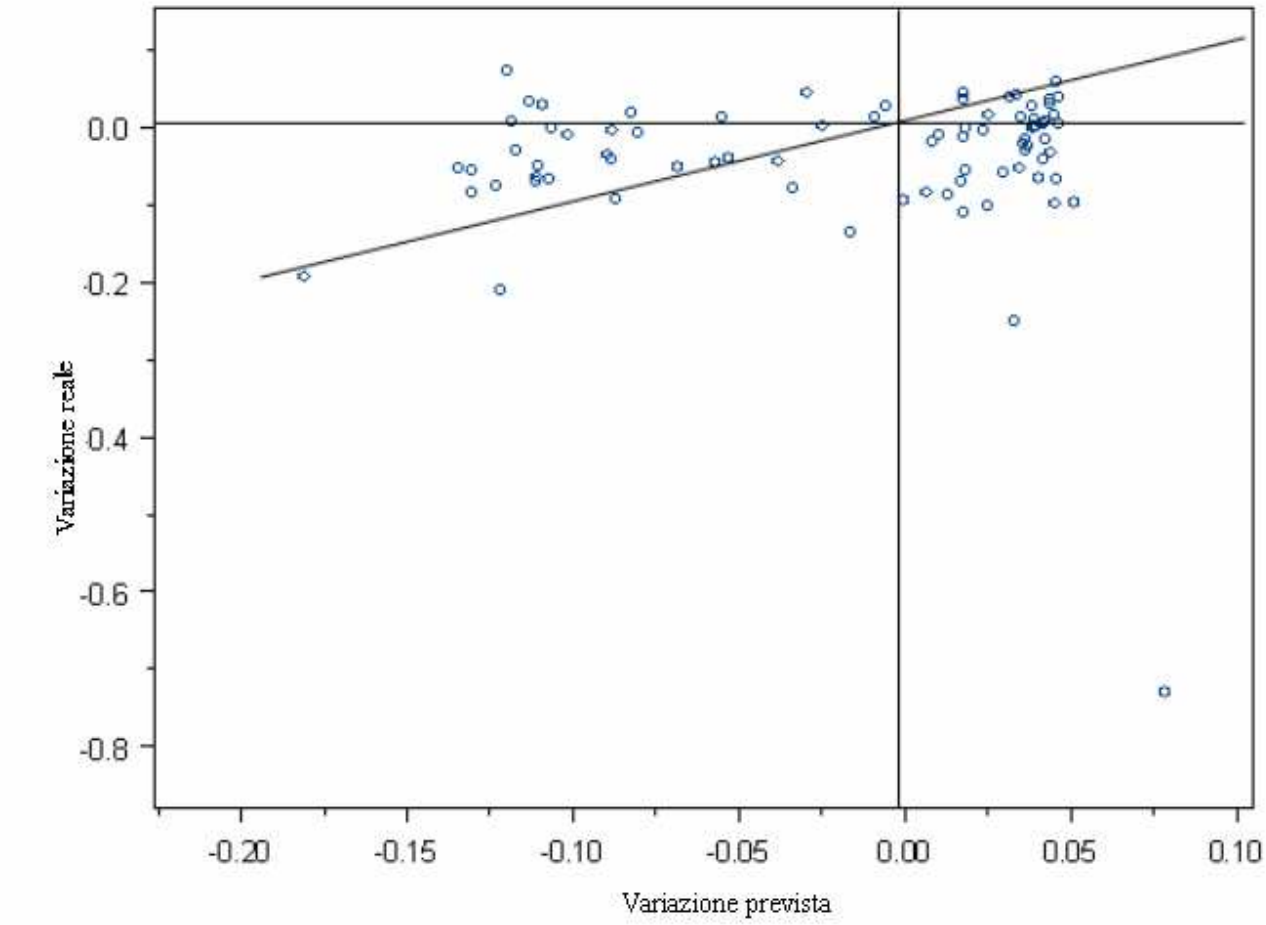


Table 3. Real growth rate and structural change*

		Constant	$ln y_0$	$S_{i,t-T}$	$M_{i,t}$	$Z_{i,t}$	Adjusted R^2	F-test	Durbin-Watson
A	coeff. t p-value	-0.0195 -2.7703 0.0070	-0.0207 -8.7288 0.0000				0.4876	76.19 (0.0000)	1.3297
B	coeff. t p-value	-0.0181 -2.4237 0.0177	-0.0206 -8.5368 0.0000	0.1060 0.6155 0.5400			0.4835	37.98 (0.0000)	1.3226
C	Coeff. t p-value	-0.0208 -2.7438 0.0076	-0.0210 -8.5285 0.0000		-0.0638 -0.4732 0.6374		0.4825	37.83 (0.0000)	1.3237
D	Coeff. t p-value	-0.0215 -2.9577 0.0041	-0.0226 -9.2610 0.0000	0.2518 1.4431 0.1531		-0.8605 -2.6736 0.0092	0.5217	29.73 (0.0000)	1.2413
E	Coeff. t p-value	-0.0241 -3.3775 0.0011	-0.0227 -9.2267 0.0000			-0.7153 -2.3235 0.0222	0.5149	42.94 (0.0000)	1.2449

*OLS Estimate
(..) p-value

Figure 5. Comparison between $R_{i,T}$ and initial year income on a regional basis

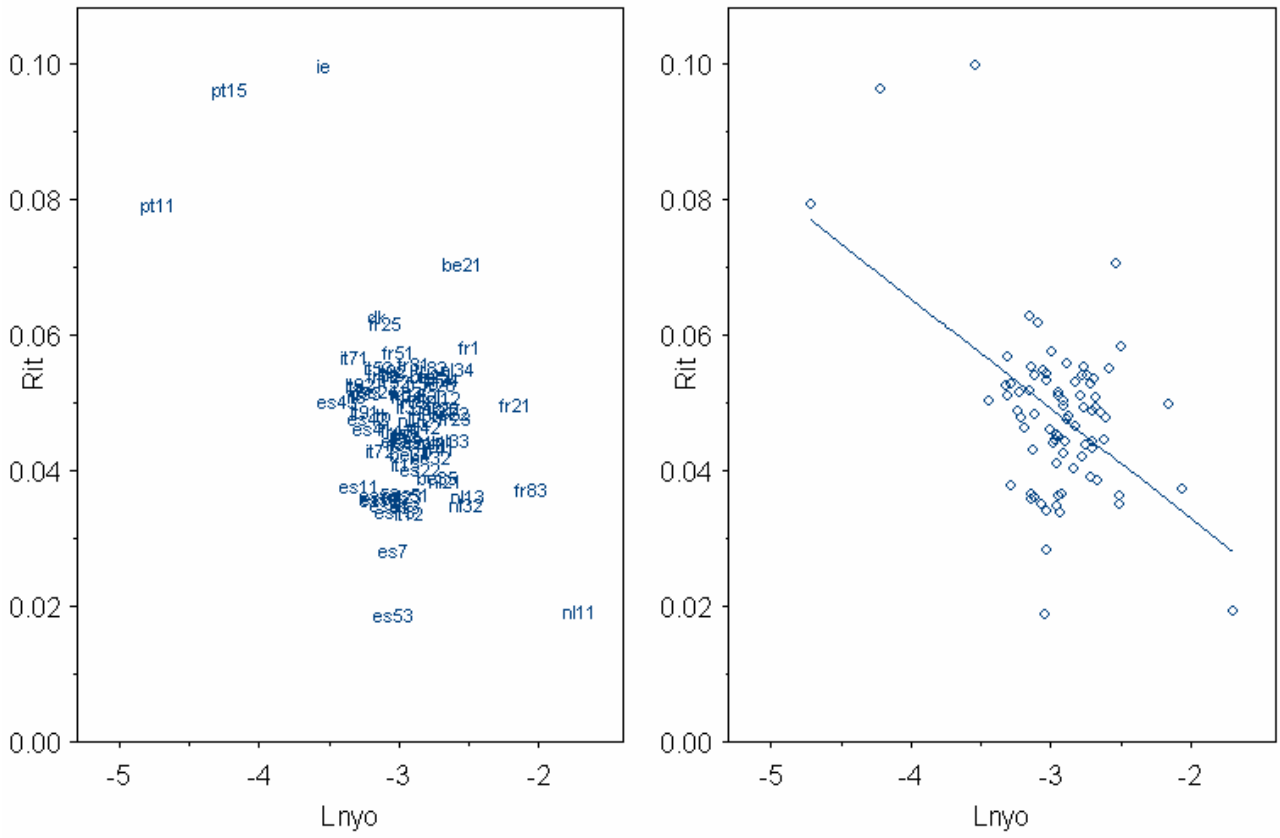


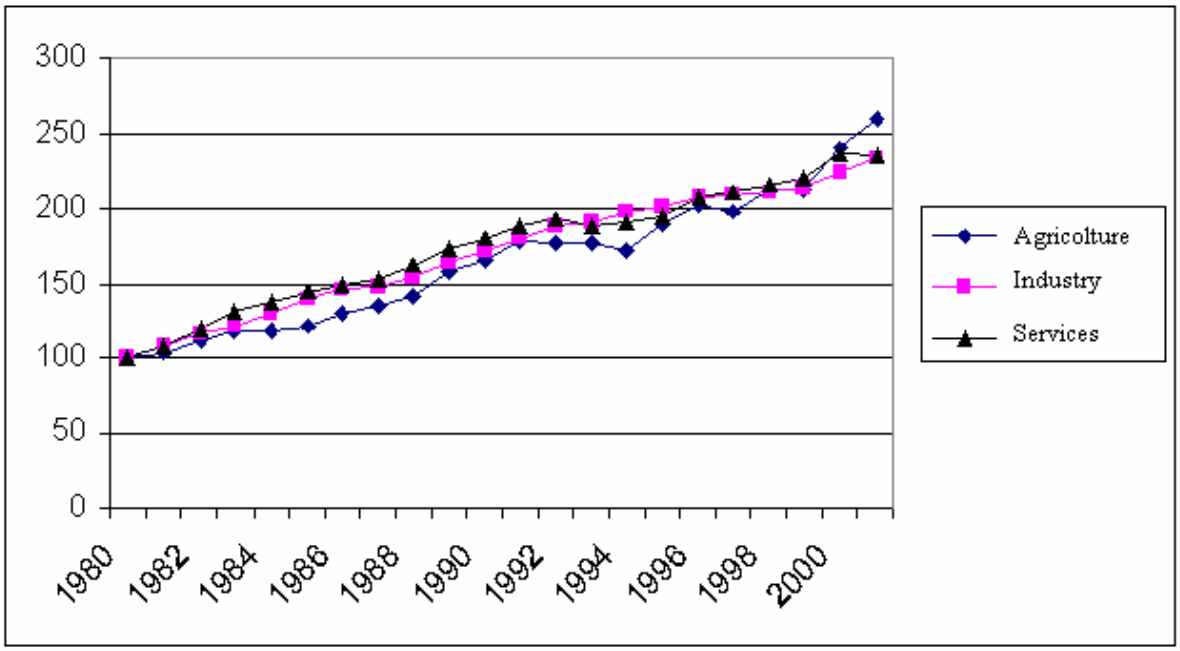
Table 4. Real growth rate of labor productivity and sectoral structural change

		Constant	$ln y_0$	$l_{A,t}\ l_{A,t-T}$	$l_{I,t}\ l_{I,t-T}$	$l_{S,t}\ l_{S,t-T}$	Adjusted R^2	F-test	Durbin-Watson
F	coeff. t	-0.0220 -3.0975	-0.0197 -8.1642	-0.0102 -1.6891			0.4995	40.4273 (0.0000)	1.2499

	p-value	0.0000	0.0000	0.0952					
G	coeff. t p-value	-0.0254 -3.0933 0.0028	-0.0224 -8.4135 0.0000		-0.0081 -1.3758 0.1729		0.4934	39.4781 (0.0000)	1.3253
H	coeff. t p-value	-0.0196 -2.8685 0.0053	-0.0226 -9.2583 0.0000			-0.0239 -2.3577 0.0200	0.5281	43.1015 (0.0000)	1.2837

*OLS Estimate
(..) p-value

Figure 6. Sectoral labor productivity, 1980-2001 (1980=100)



* Labor expressed in standard labor units

Figure 7. Sectoral value added, 1980-2001 (1980=100)

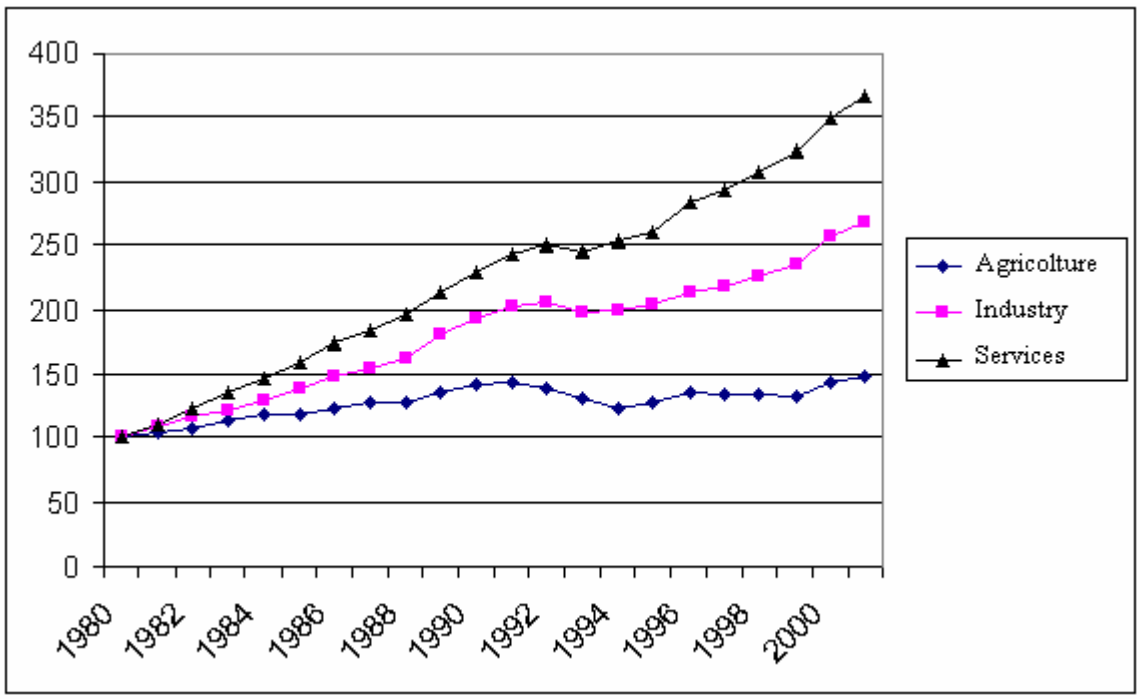
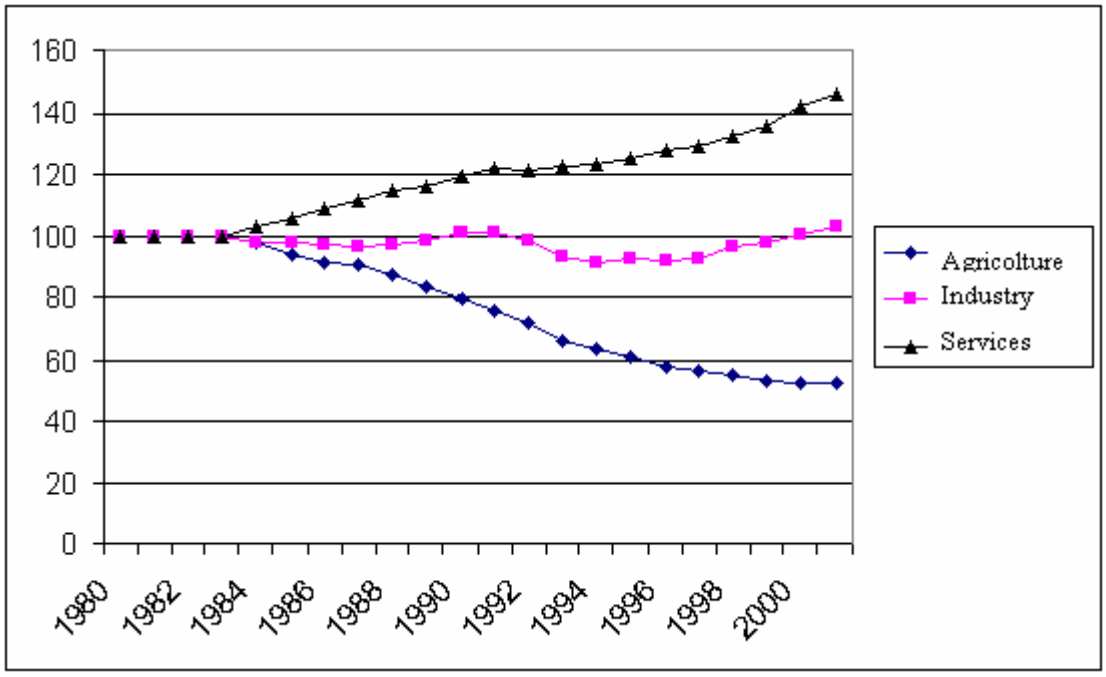


Figure 8. Sectoral standard labor units, 1980-2001 (1980=100)



References

Arfini F., Bernini Carri C., Brasili C., Donati M., Fanfani R., Gutierrez L., Mazzocchi M., Montresor E., Sassi M., *Study on the Cap's contribution to EU economic and social cohesion*, Final report, European Commission-DgAgri tender, Contract n. 30-CE-0009355/00-51, Bruxelles, 2005.

Barro R.J., Sala-i-Martin X., *Economic Growth and Convergence across the United States*, Working Paper 3419, National Bureau of Economic Research, Cambridge, 1990.

Barro R.J., Sala-i-Martin X., "Economic Growth in a Cross-Section of Countries", *Quarterly Journal of Economics*, 106, 2, 1991.

Barro R.J., Sala-i-Martin X., "Convergence", *Journal of Political Economy*, 100, 1992.

Barro R.J., Sala-i-Martin X., *Economic Growth*, McGraw-Hill, New York, 1995.

Bernard A.B., Durlauf S.N., "Interpreting Tests of the Convergence Hypothesis", *Journal of Econometrics*, 71, 1996.

Bernini Carri C., Sassi M., *I sistemi agricoli territoriali dell'UE tra processi di convergenza e tipologie di crescita,* Working Paper, 2, Università degli studi di Pavia, Dipartimento di Ricerche Aziendali, 1999.

Bernini Carri C., Sassi M., "The Process of Economic and Agricultural Convergence across the EU Regions: a Parametric and Non-parametric Approach", *Politica Agricola Internazionale*, 1, 2003.

Brasili C. (ed), *Cambiamenti strutturali e convergenza economica nelle regioni dell'Unione Europea,* CLUEB, Bologna, 2005.

Brasili C., Oppi M., "Convergenza economica delle regioni europee ed allargamento ad Est", *Politica Economica*, 3, 2003.

Canova F, Marcet A., The Poor Stay Poor: Non Convergence Accross Countries and Regions, CEPR Working Paper, 1265, 1995.

Cellini A., *I processi di convergenza tra le regioni dell'Unione Europea,* Osservatorio economico e finanziario della Sardegna, 1997.

Dall'Erba S., Le Gallo J., *Regional Convergence and the Impact of European Structural Funds over 1989-1999: a Spatial Econometric Analysis*. Discussion Paper, Regional Economics, Applications Laboratory, 2003.

De Long J.B., "Productivity Growth, Convergence and Growth Comment", *American Economic Review*, 78, 1988.

Durlauf S.N., Johnson P.A., "Multiple Regimes and Cross-Country Growth Behaviour", *Journal of Applied Econometrics*, 10, 1995.

1.1. European Commission, Un nuovo partenariato per la coesione convergenza competitività cooperazione. Terza relazione sulla coesione economica e sociale*, scaricabile al sito* http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/cohesion3/cohesion3_it.htm, 2004.

European Commission, *Study on the impact of community agricultural policies on economic and social cohesion*, scaricabile al sito http://ec.europa.eu/regional_policy/sources/docgener/studies/pac_en.htm, 2006.

Fagerberg J., "Technology and International Differences in Growth Rates", *Journal of Economic Literature*, XXXII, 1994.

Fagerberg J., "Technological progress, structural change and productivity growth: a comparative study", *Structural Change and Economic Dynamics*, 11, 2000.

Fingleton B., *European Regional Growth,* Berlin-New York, Sprinter, 2003.

Friedman M., "Do Old Fallacies Ever Die?", *Journal of Economic Literature*, 30, 1992.

Garofoli G., *Economia del territorio,* Etas, Milano, 1992.

Gouyette C., Perelman S., "Productivity, Convergence in OECD Service Industries", *Structural Change and Economic Dynamics*, 8, 1997.

Gutierrez L., "Convergence in US and EU Agriculture", *European Review of Agricultural Economics*, 27, 2, 2000.

Gutierrez L., "Why is Agricultural Labour Productivity Higher in some Countries than Others?", *Agricultural Economics Review*, 3 (1), 2002.

Islam N., "What have we learnt from the convergence debate", *Journal of Economic Surveys*, 17, 3, 2003.

Ismea, *Rapporto annuale 2006. Evoluzione del sistema agroalimentare italiano*, Ismea, Roma.

Kaldor N., "Productivity and growth in manufacturing industry: a reply", *Economica*, 35, 1968.

Kaldor N., *Causes of the slow rate of growth in the United Kingdom*, Combridge University Press, Cambridge, 1966.

Lanzafame M., "Disparità regionali e specializzazione produttiva in Italia", *Scienze Regionali*, 5, 1, 2006.

Lewis W., "Economic development with unlimited supply of labour", *Manchester School*, 22, 1954.

Lucas R.E., "On the mechanics of economic development", *Journal of Monetary Economics*, 22, 1988.

Mankiw N.G., Romer D., Weil D.N., "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics*, 107, 2, 1992.

Midelfart-Knarvik K.H., Overman H.G., Redding S.J., Venables A.J., *The Location of European Industry*, European Commission, Directorate-General for Economic and Financial Affairs, Economic Paper, 142, 2000.

McCombie J., "What still remains of Kaldor's low?", *Economic Journal*, 91, 1981.

Murat M., Pigliaru F., "International trade and uneven growth: a model with intersectoral spillovers of knowledge", *Journal of International Trade and Economic Development*, 7, 1988**.**

Paci R., Pigliaru F., "Structural Change and Convergence: an Italian Regional Perspective", *Structural Change and Economic Dynamics*, 8, 1997.

Paci R., Pigliaru F., "European Regional Growth: Do Sectors Matter?", in Adams J., Pigliaru F. (eds.), *Economic Growth and Change: A Comparative Analysis*, Edward Elgar, Cheltenham**,** 1998**.**

Pesaran M.H., Smith R., "Estimating Long-Run Relationship from Dynamic Heterogeneous Panels", *Journal of Econometrics,* 68, 1995.

Quah D.T., "Empirical Cross-Section Dynamics in Economic Growth", *European Economic Review*, 37, 1993a.

Quah D.T., "Galton's Fallacy and Tests of the Convergence Hypothesis", *Scandinavian Journal of Economics*, 95, 1993b.

Quah D.T., "Empirics for Economic Growth and Convergence", *European Economic Review*, 40, 1996a.

Quah D.T., "Twin Peaks: Growth and Convergence in Models of Distribution Dynamics", *Economic Journal*, 106, 1996b.

Quah D.T., "Regional Convergence Across Europe", *European Economic Review*, 40, 1996c.

Quah D.T., *Empirics for Growth and Distribution: Stratification, Polarization and Convergence Clubs*, Discussion Paper 324, Centre for Economic Performance, LSE, 1997.

Sala-Martin X.X., "Regional Cohesion: Evidence and Theories of Regional growth and Convergence", *European Economic Review*, 40, 1995.

Sala-i-Martin X., "The Classical Approach to Convergence Analysis", *The Economic Journal*, 106, 1996.

Sassi M., "L'approccio parametrico alla convergenza economica", in Brasili C. (ed), *Cambiamenti strutturali e convergenza economica nelle regioni dell'Unione Europea,* CLUEB, Bologna, 2005.

Sassi M., "Agricultural convergence and competitiveness in the EU-15 regions", Contributed paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12-18, 2006

Solow R.M., "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, 70, February, 1956.