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ITALIAN ECONOMIC DUALISM AND CONVERGENCE CLUBS AT REGIONAL LEVEL

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Title: ITALIAN ECONOMIC DUALISM AND CONVERGENCE CLUBS AT REGIONAL LEVEL

Italian economic dualism and convergence clubs at regional level

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Abstract
This paper compares the long run prediction of convergence clubs introduced by Quah (1996 and 1997) with the actual observed dynamics of the Italian regions during the period 1970-2004. Economic dynamics is described by the evolution per capita GDP and different notions of distance are introduced to compare the trajectories of the regions. In addition, by means of hierarchical clustering methodologies the set of economies are segmented. By using the average distance, the study identifies two main performance clubs resembling the long run prediction of two converge clubs. On the other hand, the distance correlation shows different co-movements between members of the same cluster, indicating a variety of responses to external shocks. In particular the average distance identifies a clear division between a high performance club consisting of regions from the Center North, and a low performance club composed by regions from the South and islands. The presence of a cluster composed by center north regions is substantially confirmed by the distance correlation analysis, suggesting an homogeneous response to external shock. By contrast Southern regions display the same dynamical evolution but difference in co-movements.

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Our analysis provides hints about the fundamentals that link the regions in their process of divergence. In fact the performance clubs pattern we discovered reflects the distribution of economic activities as well as the structural attributes of the regional economies.

1. Introduction

Since the end of WWII, the mainstream in the growth debate has focused on the neo-classical growth model developed by Solow (1956). In this model labor and fixed capital combine within a given technological framework to produce a certain amount of output. Given that input factors bear decreasing returns to scale, each economy will converge to a steady state characterized by a long run stable growth path led by exogenous technical progress.

Here comes the convergence hypothesis: poor countries have a capital labor ratio below their long run optimum, so their rate of return in fixed investment should be higher than in developed countries. Thereby there should be a tendency for poor countries to grow faster than rich ones in order to attain the same level of per capita income.

In this context the persistent income differences among countries are due to lacking factors or to inefficient factor's combination, and policy focus lies on the supply of labor and its level of education, the incentive to invest on the possibility to adopt superior techniques of production. Consequently the only policy implication is to allow market forces to operate as freely as possible, in order to ensure convergence of income per head and economic growth.

Unfortunately, as we will see more in detail for the Italian case, the empirical evidence does not support the existence of convergence, as productivity and income levels of industrialized and developed countries still diverge.

This impasse triggered the adoption of alternative approaches such as the Schumpeterian (Schumpeter 1934), which stressed the function of innovative entrepreneurship and institutions in sustaining growth. Or the Post-Keynesian (Kaldor 1957), placing a great importance to the role of demand and cumulative causation in keeping countries within a development trap or on the contrary in enhancing the propensity to invest via higher revenues, thereby fostering sustained growth. In this analysis there are increasing returns to scale and division of labor, so that different rates of investments can bring to divergent growth paths.

More recently the traditional Solovian model has been challenged by a new approach, the endogenous growth theory which, albeit being closer than the Schumpeterian or the Post-Keynesian analysis to the traditional approach, nonetheless is very critical on market forces possibility to promote optimal resources allocation and sustained growth. This approach stresses the importance of investments in human capital and on the spillovers effect of knowledge capital as sources of endogenous growth, agreeing with the post-Keynesian view that investment might raise the long run growth due to increasing returns. So the process of catching up is determined by technology transfers whose success is related to the absorptive capabilities of an economy, which in turn are affected by institutional and political factors (Abramovitz 1986; Romer 1993).

By the way in the economic literature some other definitions of convergence have been forged. Barro and Sala-i-Martin 1992 introduce the concept of absolute beta convergence (absolute convergence for brevity), based on the presumption of a negative relation between per capita income and economic growth, so that poorer countries would grow faster than the rich ones, reducing the differences in development, and that per capita incomes converge in the long run independently of their structural characteristics and initial conditions. They also introduce the definition of sigma convergence, which is the tendency for the dispersion of per capita income, defined in terms of standard deviations, to decrease over time. So sigma convergence does not only depend on the growth rates but also on the initial gap size. Quah (1993) and Friedman (1992), in the context of Galton's fallacy,[1]

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[1] Galton's fallacy, also called regression to the mean, is the phenomenon consistent to the fact that if a variable is extreme on its first measurement, it will tend to be

pointed out that the concept of beta convergence is irrelevant because the most important thing is to figure out if the dispersion in the world's income distribution has decreased over time. In fact Quah (1993) demonstrated that a negative coefficient in a cross-sectional regression is consistent with a lack of convergence.

The idea that growth is affected by a wide range of factors, other than mere traditional inputs, led to the concept of conditional beta convergence (conditional convergence for brevity), according to which per capita incomes of countries with identical structural characteristics (preferences, technologies, population growth, institutions) converge in the long run independently of their initial conditions. So different growth rates would underline the distance of the economies from their own respective steady states (Mankiw 1995)[2].

In the scope of the conditional convergence, many empirical studies have tried to introduce other aspects in the analysis. Among others, Barro and Sala-i-Martin (1995) limit their study to set of countries believed to have the same steady state, and Mankiw, Romer and Weil (1992) introduce some additional variables as proxy for the steady state itself. Some other examples are the Panel Convergence testing (Phillips and Sul 2009; Apergis *et al.* 2010), the auto correlation function approach (Cagiano and Leone 2009); cross-sectional models and spatial panel models (*inter alias*, Checherita 2009; Carrion-i-Silvestre and German-Soto 2009); simulation equation models (Cracolini *et al.* 2010).

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closer to the average on a second measurement, and at the same time if it is extreme on a second measurement, it will tend to have been closer to the average on the first measurement (Stigler, 1997). This concept was introduced by Sir Francis Galton, who noticed that extreme characteristics in parents are not passed on completely to their children, who rather regress toward a mediocre point (mean) (Galton, 1885).

[2] Actually some authors found that is it possible to have multiple steady states even in the Solow model (Dalgaard and Hansen 2005; Azariadis and Drazen 1990) by taking into account human capital which enjoys increasing social returns to scale after reaching a certain threshold level. Moreover Durlauf and Johnson (1995) challenged the linear specification for convergence implied by the Solow model finding that countries with different initial conditions show different development towards either one or multiple steady states.

More recently Quah (1996, 1997) introduced a methodology, not relying on a theoretical model, for modelling the dynamics of countries' cross sectional distributions, regarding the world growth pattern over the post WWII period. According to him the per capita income at world level evolves into a twin peaks[3] distribution so that there is no convergence process among economies. On the contrary, countries with homogeneous behaviour tend to converge into subsets, the so called convergence clubs: per capita incomes of countries that are identical in their structural characteristics converge in the long run provided their initial conditions are similar. Thereby each region moves toward it's club specific steady state equilibrium, which depends on the initial position of the region. More precisely Quah (1997) stressed the role of human capital and growth rate in an endogenous growth framework. So according to his study economies with different human capital level will experience diverging growth rates and henceforth would not converge. Unfortunately Quah is not able to explain why economies are endowed with different levels of human capital. Other reasons leading up to the formation of clubs are initial conditions, path dependency, hysteresis and similar complex phenomena, yielding different scenarios (Durlauf and Quah, 1999; Quah, 1996).

As we have seen the standard empirical results confirm the hypothesis of conditional convergence and club convergence (*à la* Quah), while the absolute convergence is rejected. In effect as pointed out in the survey by Durlauf and Quah (1999) and Durlauf (1996), differences in growth rate and per capita income across nations persist. Obviously we might ask ourselves if the evidence supports absolute convergence within a country instead of among countries, given that the structural characteristics among regions are very similar. This might be the case of developed countries, whose growth process in some periods decreases the internal economic inequalities (this is the case for Italy across the period (1950-1973).

As we have highlighted, the rebirth of growth theory, which took place in the 80s, focused on the acceptance or rejection of the so called neoclassical

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[3] Quah (1996) is the pioneer of the twin peaks hypothesis, according to which while the gap between poor and rich countries widened in the considered lax of time, the intermediate class became poorer.

model. According to the main view, differences in per capita output or productivity were explained by different parameter values of the underlying model. Missing such differences, countries would be expected to converge to a conditionally unique long run path. The same idea, centred on the convergence between rich and poor economies, was adopted in conceptualizing the differences observed in within countries regional development (for US and Japan see Barro and Sala-i-Martin 1992; for Europe and Japan see Sala-i-Martin 1996). In fact, just like countries, regions were expected to converge to the same long run growth path even easier than countries, given higher factors mobility, a competitive market system and enhanced knowledge spillovers in technology. If economies are meant to converge, the policy would not have to worry about supporting one or the other region or groups of regions. On the contrary the policies would have to be uniform considering each economic units within the country as equal. This because the poor regions would merely be in a catching up process. But as we will see the regional convergence hypothesis has not found support on the empirical side, at least for the Italian case, thereby comes the necessity to investigate further the issue.

The empirical approach that we apply (for related works, see Brida 2008 and Brida et al. 2011) to study the convergence of the Italian regions differs on two features as compared to the approaches faced in the literature. On the one hand we use a non-parametric method which make it different to all the parametrical convergence tests developed out of neo-classical and endogenous growth theories. On the other hand, our method differs from the non-parametrical Quah (1996, 1997) method because we analyze the dynamic of two measures of relationships among the regions. The average distance between each pair of regions that gives information about how close the regions have been during the period, and the correlation distance that produces information about the growth path followed by the clustering regions having similar responses to external shocks.

So the study conducted here aims at analyzing the dynamic of convergence clubs from the perspective of economic performance, with a view to identifying performance clubs. To this end it analyzes the behavior of per capita income levels for the Italian regions using a non-traditional (non-parametric) statistical model: the minimum spanning tree and the hierarchical tree.

This paper is organized as follows. Section II gives an overview of the Italian Regional Subdivision. Section III presents a brief review of the concept of convergence and its empirical tests, with particular reference to the Italian regions. Section IV displays the traditional theories of Italian economic dualism. Section V describes data and the proposed method, while section VI presents the empirical results. Lastly, section VII sets forth the main conclusions and future directions for research.

2. Italian Regions

The Italian Republic is divided into twenty regions, constituting its first NUTS administrative level: Aosta Valley, Liguria, Piedmont, Lombardy (North-West), Veneto, Friuli-Venezia Giulia, Trentino-Alto Adige/Südtirol, Emilia Romagna (North-East), Tuscany, Umbria, Marche, Lazio (Center), Molise, Abruzzo, Campania, Calabria, Basilicata, Apulia (South), Sicily and Sardinia (islands).

The regions are one of the five constitutional elements of the Italian Republic, together with municipalities, provinces, metropolitan cities and the central state. They constitute a regional entity with own statutes, powers and functions along the principles fixed by the Constitution of Italian Republic (article 114). The regional authorities, whose statutes are approved by their regional councils, have been disciplined by the constitutional assembly in 1947 (article 22) and were created in 1970. Each region has an elected parliament, which is called Regional Council (except for Sicily, where it is called Regional Assembly), and a government called Regional Junta, headed by the President of the region, which is elected directly. The only exceptions are Aosta Valley and Trentino-Alto Adige/Südtirol, where the president is chosen by the Regional Council.

Five of the twenty regions, due to their cultural and linguistic differences with the rest of the country, are endowed with a special autonomy status: Trentino-Alto Adige/Südtirol, Sardinia, Sicily, Aosta Valley and Friuli-Venezia Giulia. The autonomous regions possess legislative and administrative powers in sectors such as education, health, infrastructures, which are funded with own resources. In fact the autonomous regions retain from 60% (Friuli-Venezia Giulia) up to 100% (Sicily) of all the levied taxes.

Apart from the regional administrative entity, in Italy there is also the status of autonomous province. The two examples are the provinces of Trento and

Bolzano, constituting the region Trentino-Alto Adige. Those provinces are entitled with legislative and executive powers comparable to a regional status, so that the Trentino-Alto Adige regional institution has a merely coordinating role. The historical roots of this special status are due to the presence of a German-speaking (Südtirolerisch) minority (32.73% in the whole region).

There are differences among Italian regions in terms of development and economic performance. According to EUROSTAT statistics. Italy is the unique European country having at same time a per capita income in line with the continental average, together with a huge percentage of population (29%) living in a province where per capita income is less than 75% of EU average, as well as 26% of population residing in a province with a level of per capita income equal to 125% of the average. In the next section we will present the main historical explanations to this Italian dualism.

In Spain, where per capita income is comparable to the Italian one, only 6% of population resides in areas where per capita income is lower than 75% of EU average. In France, which has a higher per capita income than Italy, only 8.5% of population lives in high income departments (GDP per capita higher than 125% of EU average). The share of citizens living in rich areas is by contrast similar to Italy in United Kingdom and in Germany (respectively 25% and 27%), where yet per capita income is higher. For what concerns the main economic indicators, the GDP per capita in Southern Italy is only 60.3% of the national average, the rate of fixed gross investment per capita is 61.7%, while the rate of employment and the rate of unemployment are respectively 71.6% and 293.9% with respect to national average.

3. Economic convergence of Italian regions

The phenomenon of regional convergence has been studied in an extensive fashion by Barro and Sala-i-Martin (1995) who examined the GDP convergence hypothesis for 90 European regions: 11 in Germany, 11 in United Kingdom, 20 in Italy, 21 in France, 4 in the Netherlands, 3 in Belgium, 3 in Denmark and 17 in Spain. The authors conclude in favor of an absolute convergence at 2% of speed every year within and among countries for the period 1950-1990. According to this result it is only a matter of time before southern Italian regions would converge to the rest of the country. This conclusion is confirmed by the work of Armstrong (1995),

who finds a process of absolute convergence in gross per capita value added for 82 European regions in the period 1950-1970.

However these findings seem a way too optimistic as clearly in the 70s and in the 80s there has been a process of convergence between countries, but the differentials among regions seem unaltered or even increased. In fact the decrease in the dispersion in Italian regional GDP per capita, which was strong in the 60s, disappeared after 1975.

As argued by Aiello and Scoppa (1999), there is a considerable agreement on the literature that the convergence between the Italian regions has been reversed in the last 25 years (Mauro and Podrecca 1994; Cosci and Mattesini 1995, 1997; Paci and Pigliaru 1995; Cellini and Scorcu 1997a, 1997b; Di Liberto 1994; Paci and Saba 1998; Bianchi and Menegatti 1997; Fabiani and Pellegrini 1997). In particular Mauro and Podrecca (1994) argue that the findings of Barro and Sala-i-Martin (1995) are affected by the use of data which were not timely homogeneous, as they were extracted from different sources (Unioncamere 1963-70; ISTAT old time series 1970-1980; ISTAT new time series 1980-1989). To solve this problem, they divide the period 1963-89 into the three sub-periods consisting of homogeneous data. Thus, they show a process of convergence in the 60s and 70s, but not in the last ten years of available data. Also Paci and Saba (1998), making use of the new dataset, evaluated the convergence hypothesis in Italy in the period 1951-1993. They find a process of absolute convergence in output per worker, which however was determined by a catching up process taking place from 1960 to the middle of the 70s. In particular Paci and Saba (1998) find that the per capita income and labor productivity change pattern in 1975. This makes a case for the works by Barro and Sala-i-Martin (1991) and Sala-i-Martin (1996), covering the years in which Italy underwent a process of absolute convergence. Moreover, many other papers show a growth recovery for southern Italy in the 60s and 70s, but no convergence in the 80s (Di Liberto 1994; Piras 1992; Cellini and Scorcu 1997a; Paci and Pigliaru 1995; Cosci and Mattesini 1995; Fabiani and Pellegrini 1997). Additionally Di Liberto *et al.* (2003) report the standard deviation of the logarithm of GDP for Italian regions in the period 1963-1994, observing that the dispersion has indeed increased in the middle of the 70s, and afterward remained stable. By observing the deviation from the average Italian income, Aosta Valley was the richest region in the 60s (42% wealthier than Italian average), followed

by Lombardy (32%), while the poorest regions, Calabria and Basilicata, had an income 38% lower than the average. This disparity has decreased along the 70s and 80s, but neither persistently nor uniformly. In fact, as reported by Di Liberto *et al.* (2003), the Northwestern area (Piedmont, Aosta Valley, Lombardy and Liguria) decreased its relative advantage, while the Northeast (Veneto, Friuli-Venezia Giulia, Trentino-Alto Adige, Emilia Romagna) improved it's relative position. These findings are confirmed by Aiello and Scoppa (2000) who computed the time pattern of the standard deviation of regional per capita incomes over the period 1960-93 using the CRENoS database.

As reported in Aiello and Scoppa (2000), the hypothesis of conditional convergence, according to which the Italian regions converged towards different steady states of output per worker, is tested and verified by several works (Di Liberto 1994; Cellini and Scorcu 1997b; Cosci and Mattesini 1995, 1997; Fabiani and Pellegrini 1997; Ferri and Mattesini 1997; Bianchi and Menegatti 1997; Di Liberto and Symons 1998). By contrast few works find no evidence of it (Mauro and Podrecca 1994; Paci and Pigliaru 1995), while some others admit its existence only up to the end of the 80s (Cellini and Scorcu 1997a).

Concluding there is no evidence backing a continuous and consistent process of absolute convergence, but only of conditional convergence taking place for the Italian economy[4]. Several government policies tried to foster convergence. As argued by Di Liberto *et al.* (2003), there was a decrease in migration from Southern to Northern Italy during the 70s, due to national policies directed at diminishing the wage differential among Italian regions as well as increasing the development of the South. In particular in the 60s and 70s the national government boosted investment in the South in sectors such as chemical and steel. Indeed as reported in Graziani (1978) the share of industrial investments in the south shifted from 15% during the period

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[4] Also for some other economies the process of convergence has been found to be non homogeneous. De la Fuente (1997) finds that the process of regional convergence followed a similar pattern in Spain, while Sala-i-Martin (1996) argues that in the middle of the 70s many OECD countries experienced a stop in regional convergence. Of course this process might have been determined by the increase in oil price in 1973-1974, which decreased investments and technology transfers.

1951-1959 to 44% in 1973. Together with this process there has been an acceleration in administrative decentralization which enhanced the amount of resources devoted to the public sector.

4. Economic Dualism in Italy

Italy has started the process of catching up started at the end of the 19th century, and had its most favorable momentum between 1950 and 1970. At the end of the 70s growth slowed down, and in the 90s the catching up process was even reversed (see for instance Penn World Tables). This dynamic is reflected in the regional imbalances, which diminished when Italy was catching up with US, and increased afterward.

After the Italian unification (1861) and until the beginning of the 20th century, the differences in terms of GDP and industrialization rate between Northern and Southern Italy were not that impressive. It is only with the beginning of the industrialization process that the cleavage started to deepen. At this point the political establishment started to realize that Italy was not unified from the economic and social points of view, due to historical and natural causes, as well as to wrong policies. Indeed Italy was (and remains) in a situation of economic dualism: on one hand there is an economically and socially advanced centre North, and on the other hand the South remains virtually pre-industrial. In fact Southern Italy is in a state of backwardness characterized by lacking social and economic infrastructures, lacking entrepreneurial spirit, low productivity in every sector, low wages and huge propensity to emigration (roughly 12% of Southern population emigrated toward Northern Italy and foreign countries after WWII).

More technically we can define the dualism as the coexistence, within the same economic system, of two entities following different development paths, in terms of per capital income growth as well as in terms of social and economic transformations. Following Vita and Realfonzo (2006) the economic dualism can be characterized in three different ways: territorial dualism, when there are differences in development from the spatial point of view; industrial or sectoral dualism, leading to a dichotomy among firms, sectors or productive systems; job market dualism, due to the presence of regular and irregular employed. In the Italian case, those three dimensions are interconnected.

From 1861 to 1950 many so called "special laws" tried to alleviate the backwardness of the South, without much success. During Fascism (1922-1940) the Regime tied to deny the very existence of the economic dualism, hoping to divert the superabundant Southern agricultural labor force to the Libyan and Abyssinian colonies. It is only after the Second World War, that the conditions for a real development in the South started to arise. Between 1950 and 1970 the country level Italian development led the disparity between North and South to decrease, substantially through public intervention aimed at attracting investments toward Southern industry. In fact in this period 50% of investments in the South were carried out by state owned companies. Obviously this process was not sustainable in the long run, thereby after the crisis in the 70s and especially in the 90s the convergence process between North and South stopped.

During the 50s and the 60s there have been many economic models trying to explain the origins of the dualism and the possible ways of solving it. Lutz (1962), Lewis (1958) and Kindlerberger (1964) claimed that the Italian economic dualism was determined by unbalances and distortions in the job market; Eckaus (1961) and Liebenstein (1962) stressed the relevance of the technological development process; finally, and in contrast with the formers, there are the unbalanced development model by Marzano and the export led development model by Graziani (1965), who argued that the market mechanism would not bring the system to its equilibrium, so that the distortions in the Italian economy would increase thus fostering the dualistic process.

In particular Lutz (1962) claims that the Italian economic dualism is due to the neglect of market laws: in a regime of perfect competition, the system works in full employment and each factor's remuneration equalizes among sectors. Thus there is the maximum level of development allowed by technology and endowments. By contrast in the Italian economy there were some distortions.

The greatest distortions in the job market are due to the presence of Unions, wages controls, and the moral suasion adopted by the authorities who bind the great industries to keep a workforce not in line with the production possibilities. Hence the productivity and wage dualism in the job market does not bear a structural nature, but can be rather solved by re-instituting the market competition rules.

Another distortion is the presence of monopolistic positions in the final goods market, leading to an excessive factors' remuneration. Moreover the insufficient propensity to consume industrial goods together with the different elasticity of supply and demand for agricultural goods determines a situation in which the increase in income fosters a demand shift towards agricultural goods, whose relative price augments. Thereby there is an excess of supply in industrial goods, together with a lack of demand for agricultural products, which causes insufficient revenues for industry hence halting the accumulation and development processes.

The policy recommendations from Lutz 's (1962) model are: from the demand side, try to decrease the pressure on the agricultural sector fostering migration in order to augment productivity and income; from the supply side, increase the agricultural production in order to substitute imports.

The thesis of Lutz (1962) was criticized, among others, by Ackley (1963) and Spaventa (1962), especially regarding the necessity for a strong emigration from South to North in order to have industrialization. The two authors show that, in presence of a double unbalance between the demand for industrial products and the supply of agricultural goods, a quick industrialization in the North together with a massive Southern emigration might be harmful for the entire country, because the extent of the market for Southern firms would shrink. Moreover Sylos-Labini (1972) upholds the necessity of a public intervention fostering a process of industrialization.

So Lutz (1962) argued that economic development would be reached only by removing all the unbalances present in the system, thereby getting as close as possible to perfect competition. Lewis' idea is pretty much the opposite: the development process requires imbalances. Lewis (1958) assumes 2 sectors: a capitalist sector and a subsistence sector. He also assumes flexible coefficients, closed economy, unlimited work supply and no work specialization. The capitalistic sector is technically efficient and consists of profit maximizing firms: capital and labor are combined in a way allowing equalization between price and marginal product. On the other hand the subsistence sector is not efficient and its firms are not profit maximizing, so that marginal and average productivities are low and there is superabundance of workforce.

The labor force surplus in the subsistence sector moves to the capitalist sector seeking for higher wages, increasing productivity and general welfare,

while the wages in the subsistence sector remain low and constant. The increase in general welfare would also boost profits, investments and development. Thereby there are two forces at work: the marginal productivity of workers in the capitalistic sector will be driven up by capital formation and driven down by additional workers entrance.

For the system to keep developing the following conditions are necessary: workforce surplus in the subsistence sector; the ability of the subsistence sector to satisfy the demand increase due to the shift of labor to the capitalistic sector (which boosts income) in order to prevent inflationary pressures as well as changes in the term of trade between the two sectors; the absence of Unions struggling for wage increase in the capitalist sector; a wage differential between the two sectors, in favor to the capitalistic one.

This process stops when the excess of work force supply in the subsistence sector vanishes, thereby leading the wage rate to increase. At this point lack of workforce, increasing wages and decreasing profits halt investments as well as the adoption of capital intensive production techniques.

The Lewis (1958) model was applied to the Italian case by Kindlerberger (1964), who thought it suitable to describe the development of Italian economy up to 1963. According to him in Southern Italy, where production is based on agricultural and traditional tertiary activities, the work supply is infinitely elastic because of subsistence wages and consequent work surplus. In this way a shift of labor from the Southern agricultural economy to Northern Italy (characterized by industrial activity, a modern tertiary sector, capitalist agriculture and higher wages and productivity) leaves at the beginning wages unchanged, boosting profits and investments, thus feed backing the process. Given that the wage rate is constant, the overall income increases with the share of employed workers, because the technical progress boosts production more than employment, enhancing profits (and investments) with respect to wages. This virtuous process of development would continue until the workforce surplus from the South stops, leading to an increase in wages and a decrease in profits and investments.

Kindleberger's thesis has been criticized by many scholars. According to Vaciago (1969) in 1963 the system did not reach full employment. By contrast a process of differentiated technical progress nested on economic dualism determined a productivity heterogeneity which favored a continuous reallocation of resources. Moreover according to Marzano (1981) the crisis

of 1963-64 was due to the explosion of the unbalancing factors accumulated during the recent development phase.

Let's switch now to the analysis by Eckaus (1961) and Liebenstein (1962), who stress the role of technological progress in development. According to Eckaus (1961) the technical improvements in the technological process create the a cleavage among sectors: some sectors will adopt traditional and job intensive production techniques; others will adopt modern and capital intensive production techniques. On this ground Eckaus (1961) explains the presence of unemployment in backward economies with the presence of market imperfections, limited factors' mobility, and poor factors' substitutability. Eckaus (1961) assumes two production factors employed by two sectors (one advanced and the other traditional) combined to produce a unique good. Considering a different ratio of factors' substitution in the two sectors, as well as a labor surplus in the backward area, Eckaus (1961) hypothesizes a trade- off between collective welfare (given technical and endowments constraints) and full employment. According to him only industrialized countries carry out innovation and technological progress, while poor countries can only imitate and import techniques which are soon outdated. Moreover this outdated imported techniques are also capital intensive, thereby leading to unemployment.

Liebenstein (1962) highlights the fact that there is no incentive to invest in the underdeveloped sector. He makes use of a discontinuous production function in which some factors' combinations are not feasible, especially in case of low capital/labor ratio. Theoretically investing in the backward sector should be more profitable because there is a higher potential of improvement in production techniques. Thereby the rate of development would equalize among sectors and regions through the diffusion of technical progress. By contrast, the discontinuity of the production function in the backward sector limits the incentive to invest because in order to permanently shift the production techniques, it would be necessary to substantially increase the capital/labor ratio. Finally Liebenstein (1962) reaches a neoclassic conclusion arguing that market expansion, increasing returns to scale, location advantages (lower wages) would determine an incentive for firms to move to the backward sector thereby eliminating the unbalances.

All the aforementioned models rely on the neoclassic paradigm according to which development arises in a gradual fashion when unbalances are solved through market mechanisms.

However, there is a class of models abstracting from the standard paradigm. Marzano (1961) claims that it is natural for dualistic economies (such as the Italian case) to be characterized by sectoral and territorial development concentration due to natural and historical differences. In his models there are three sectors: a leading industrial sector, a led non agricultural sector and a led agricultural sector, which are differentiated according to their contribution to development in terms of capital accumulation rate. Another distinction is of territorial nature: Italy has an unbalanced development due to the concentration of investments and innovative production activities in the North. Finally there are two categories of agents: the capitalists, who divert most of their income to saving, and the workers, who consume all of their wage. The process of development is thus driven by the investment decisions in the leading sector, which have afterward and effect on the led sectors, so that some regions would enjoy an advantage and some others would bear a disadvantage. The process is cumulative, so that differences increase by time.

Another non-standard class of works is represented by the export-led development models, according to which the divergence process among advanced and backward regions (sectors) is enhanced by economic openness. In particular Graziani (1965) studied the inequalities determined by export-led development models in the context of the Italian economic dualism, highlighting a central role in the development process for a combination of internal factors (favorable job market conditions for firms) and external factors (profitable international markets). In particular export-led development determines and reinforces economic dualism because favors exporting firms while productions for the local market are penalized. Exporting firms would adopt capital and innovation intensive production techniques, thereby enjoying higher returns to scale and competitiveness in the local market too. On the other hand firms producing for the internal market are no threatened by foreign competition so are less forced to increase productivity. Thus there is an enhancement of the industrial dualism between a dynamic and advanced exports sector, with high wages and productivity and capital intensive production techniques; and a backward

and stagnant sector with low wages and productivity, high workforce absorption, labor intensive production techniques and low development rates.

Moreover exports determine a shift in demand from traditional to new commodities, so that only innovative productions could specialize and enjoy returns to scale. In fact if traditional sectors would specialize, development would clash with low productivity and an international saturated demand. So the economy is divided in two sectors: one specialized, innovative and export oriented; the other one producing for the internal market, stagnant and low growing. Given that the advanced export sector has a limited capability to absorb workforce, the latter would converge to the back ward sector decreasing wages and fostering the incentive to adopt labor intensive production techniques.

Thereby the thrust toward foreign markets prevented the development in the South perpetuating the economic dualism and boosting the development and the clustering of innovative productions in the North because of Southern workforce surplus and demand composition.

5. Data and Methodology

The analysis has been carried out by using the regional GDP per capita series excerpted from the database "Regio-It 1970-2004: Data-base on the Italian regions" developed by Paci, Caruso and Carboni in 2007. Albeit being longer than the series released by the Italian institute of statistics (ISTAT), which spans from 1995 to 2009, in the database we use the years along the financial crisis are missing (2007-2009). Unfortunately it is not consistent to integrate the two series due to the fact that they have been obtained by using two different methodologies.

In fact, according to the standards defined by the Community guidelines, starting from 2005 ISTAT has introduced in the national accounts estimation the chain index method in order to measure the real dynamics of economic aggregates. The chain indexes make use of volume measures which, for each yeas of the estimation, are obtained on the basis of previous year prices (for instance the estimations of 2007 are based on 2006 prices, the estimations of 2006 are based on 2005 prices, and so forth). The previous year price estimations are chained in order to obtain the indexes relative to the year of reference (for instance 2000); by multiplying those

indexes for the current 2000 values the series expressed in monetary terms are obtained. Thereby, the weighing system is updated every year, so that the dynamics of national account aggregates are measured consistently with the real dynamics of the economic phenomena. Before 2005, there was a fixed weighing method based on a year of reference.

By contrast in the database "Regio-It 1970-2004: Data-base on the Italian regions", the authors starting from the GDP series at country level released by ISTAT (beginning in 1970), make use of an algorithm developed by Marroccu and Carboni in 2007 in order to compare the ISTAT accountancy systems SEC79 and SEC95.

6. Dynamic of Distribution

The dynamic of the distribution of the regional GDP per capita in a country captures how the GDP per capita of an average regions move through the distribution along the time.

The year-to-year changes in the distribution of GDP per capita can be represented by an homogeneous Markov process, assuming that $\forall t$:

1. $f_{Y_{t+1}|Y_t}(y_{t+1}|y_t) = f_{Y_{t+1}|Y_t}(y_{t+1}|y_t, y_{t-1}, y_{t-2}, y_{t-3}, \dots)$

2. $f_{Y_{t+1}|Y_t}(y_{t+1}|y_t) = f_{Y_t|Y_{t-1}}(y_t|y_{t-1})$

Where $y_{i,t} = Y_{i,t}/\bar{Y}_t$ is the GDP per capita of region i relative to the average of the regions at time t, Y_t is the GDP per capita of the region i, $\bar{Y}_t = 1/n \sum_{i=0}^{n} Y_{i,t}$ is the average regional GDP per capita during the period t; $f_{Y_t}(y_t)$ is the cross-regional GDP per capita distribution at time t, where Y_t indicates the corresponding random variable and $f_{Y_{t+1}|Y_t}(y_{t+1}|y_t)$ is the conditional density function.

The first assumption guarantees that only previous period GDP per capita distribution impacts on next period one (i.e. history does not matter). The stationary assumption in 2 ensures that the transition probabilities do not vary with the time. Although quite restrictive, both assumptions are necessary for estimating long run transition probabilities given the available data.

Given this assumptions, the conditional density function encodes information about economies' passage over time. Moreover, long run tendencies towards convergence are encoded by the ergodic distribution. This is the stationary distribution of GDP per capita, which will be approached in the long run should certain technical conditions hold. Formally, the ergodic is the distribution f which solves the following functional equation:

$$f(y_{t+1}) = \int_{-\infty}^{\infty} f_{Y_{t+1}|Y_t}(y_{t+1}|y_t) f(y_t) dy_t$$

In Figure 1 it is presented the results of estimating the joint distribution (Y_{t+1}, Y_t) thorugh a bivariate stochastic kernel. The contour kernel captures the transitional probabilities from the average value in 1970 to 2004.

Figure 1: Contour of Kernel
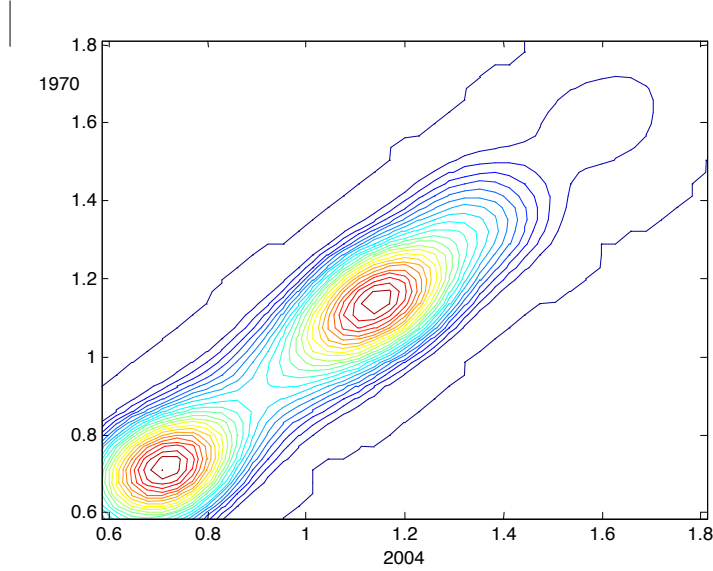
In Figure 2 it is depicted the ergodic distribution from the 35 years of GDP per capita evolution.

Figure 2: Long Run Distribution
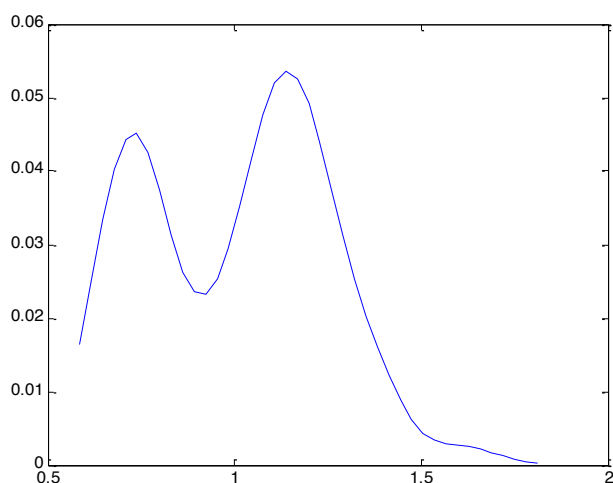
The results suggest the presence of two convergence clubs of regions in Italy. Let's recall that the concept of club convergence implies that per capita incomes of economies (in this case regions) that are similar in their structural characteristics converge in the long run provided their initial conditions are similar. Thereby each region moves toward the club specific steady state equilibrium, which depends on the initial position. This result is corroborated by other studies. As mentioned in Daniele (2007), several analysis (Mauro and Podrecca 1994; Paci and Pigliaru 1995; Cellini and Scorcu 1997; Bianchi and Menegatti 1997; Paci and Saba 1997; Paci and Pigliaru 1998; Ciriaci 2001; Tullio and Quarella 2001) show that labour productivity and per capita income converged among Italian regions in the period 1960-1975. Afterward, and in particular in the 80s and 90s, the process of convergence even reversed. Our analysis is developed across the period 1970-2004, where the convergence process was no longer taking place. More in particular some works, like Mauro and Podrecca (1994), Di Liberto (1994) and Paci and Saba (1998) study the dualism and the convergence hypothesis using a dummy variable for the homogeneity of groups according to their geographical position. Their results are significant

and supporting the idea of a perpetuating dualism across Italian regions. Moreover Cellini and Scorcu (1997) assess the occurrence of convergence clubs among Italian regions, and find that there are clubs consisting of few regions not reflecting geographical proximity, but rather structural composition. So as we have seen our result concerning the club convergence of Italian regions is confirmed by other empirical works. In the following sections we will assess the composition of such clusters by the mean of minimal spanning trees and the hierarchical trees.

7. Dynamic analysis: distances and clustering techniques

To compare the evolution over time of the different dynamics followed by the countries of the Americas, it is necessary to have some notion of the neighborhoods of these evolutions. Different
notions of distance can be defined in the space of the one-dimensional time series. In this exercise we shall introduce two metrics: the *average* distance and the *correlation* distance.

8. Average Distance

Given two time series $X = (x_t)_{1 \leq t \leq T}$ and $Y = (y_t)_{1 \leq t \leq T}$, the average distance between them is computed according to:

$$d^m(X,Y) = \frac{1}{T} \sum_{1 \leq t \leq T} |x_t - y_t| \tag{2}$$

where $|\,|$ represent the absolute value of a real number.

This notion of distance between time series in our context captures how far two regions were during their evolution. A distance of size 0, means that both time series coincide. Two economies with average small distance have presented a close evolution during the time period and then they have similar dynamic behavior. By the contrary, two economies with a large average distance must present trajectories that are far during the time period. The average distance gives almost the same information than other equivalent metrics as is the case of the very well known Euclidean distance or the supremum distance $(d^s(X,Y) = max|x_t - y_t|, 1 \leq t \leq T)$. The average distance among all the Italian regions is captured in the distance matrix D^m. This matrix is the basic ingredient to determine the minimal spanning tree

connecting the economies of the Italian regions. The minimal spanning tree is attractive because provides an arrangement of the regions which selects the most relevant connections of each point of the set.

9. Correlation distance

The correlation coefficient is defined as

$$\rho_{ij}(\Delta t) = \frac{\langle Y_i, Y_j \rangle - \langle Y_i \rangle \langle Y_j \rangle}{\sqrt{\left(\langle Y_i^2 \rangle - \langle Y_i \rangle^2\right)\left(\langle Y_j^2 \rangle - \langle Y_j \rangle^2\right)}} \tag{1}$$

where Y_i and Y_j are two time series and Δt is the time horizon. The empirical statistical average, indicated in this paper with the symbol $\langle .,. \rangle$, is here a temporal average always performed over the investigated time period. By definition, $\rho_{ij}(\Delta t)$ can vary from $\quad$ 1 (completely anti-correlated pair of series) to 1 (completely correlated pair of series). When $\rho_{ij}(\Delta t) = 0$ the two stocks are uncorrelated. Then, following (Gower, 1966) a metric distance between a pair of time series can be rigorously determined by defining

$$d^\rho\left(Y_i, Y_j\right) = \sqrt{2\left(1 - \rho_{ij}(\Delta t)\right)} \tag{2}$$

Let call this metric the *correlation distance*. The correlation distance d^ρ between two economies i and j quantify the degree of similarity between the synchronous time evolution of i and j. The distance varies in the range [0,2] with 0 meaning that the two economies are totally correlated (meaning that they move in lockstep with the other, either up or down) and 2 means that the two economies completely anti-correlated. Note that d_{ij}^ρ fulfils the three axioms of a metric: (i) $d_{ij}^\rho = 0$ if and only if $i = j$; (ii) $d_{i,j}^\rho = d_{j,i}^\rho$ and (iii) $d_{i,j}^\rho \le d_{i,k}^\rho + d_{k,j}^\rho$. We call d_{ij}^ρ the correlation distance between two time series. The correlation distance among all the regions is captured in the distance matrix D^ρ.

### 10. Minimal spanning and hierarchical trees

The metric distances introduced in the previous section allow us to obtain the minimum spanning tree (MST) and a hierarchical tree (HT) by using the nearest neighbor single linkage cluster analysis (Ramal et al. 1986). When using the correlation distance, from these trees, both geometrical (through the MST) and taxonomic (through the HT) information about the correlation between the elements of the set can be obtained. Note that the MST and then the HT are constructed using the Pearson correlation coefficient as a measure of the distance between the time series. Moreover, we performed bootstrap technique to associate a value of reliability to the links of MSTs and HTs. We also used the average linkage cluster analysis for obtaining the HT. These methods give a useful guide to determining the underlying economic causal connections for individual regions. When using the average distance, the information given by the MST and the HT refers to the dynamical evolution of the economic performance of the regions.

The MST is a graph which selects the most relevant connections of each element (region in our case) of the set. The MST allows us to obtain the ultrametric distance matrix and the hierarchical organization of the elements of the investigated data set. The MST is progressively constructed by linking all the countries together in a graph characterized by a minimal distance between time series, starting with the shortest distance. The method relies upon Kruskal's algorithm of single linkage (Kruskal, 1956) and in our case the tree is a graph with 20 vertices corresponding to each region and 19 links which selects the most relevant connections of each element of the set. In the first step we choose a pair of time series with the shortest distance and we connect them. In the second step we connect a pair with the 2nd shortest distance with a line proportional to the previous link. In the third step we connect the nearest pair that is not connected by the same tree. We repeat this until all the given regions are connected in a unique tree. A pedagogical exposition of the determination of the MST in the contest of financial time series is provided in Mantegna (1999). The MST allows us to obtain, in a direct and essentially unique way, the ultrametric distance and the hierarchical organization of the elements (countries in our case) of the investigated data set. (see Brida and Risso, 2008).

11. Empirical Results

In Figure we show the Minimum Spanning Tree obtained by using the average distance D^m

Figure 3: Minimum Spanning Tree using the Average Distance Matrix D^m
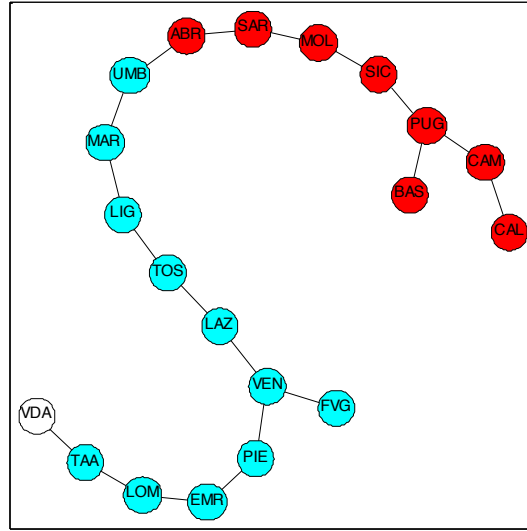
The hierarchical tree obtained starting from the MST described in Figure is shown in Figure 4. In the figure, each vertical line indicates a region. Each of the investigated economies is indicated with its tick symbol in the figure caption. The stopping rule Tibshirani et al. (2001) indicate that the optimal number of clusters is two and there is a region outside the clusters (Aosta Valley)[5].

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[5] As we will see and comment afterward, Aosta Valley represents an outlier both in the current and in the next analysis.

Figure 4: Hierarchical Tree using the Average Distance Matrix D^m
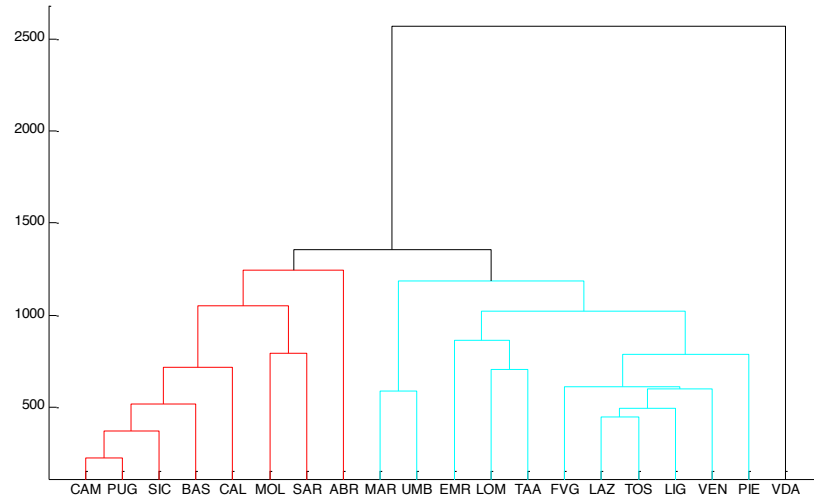
Note: The two clusters are painted in different colors. The cut-off is to distance of 1390 according to the gap test.

Cluster 1 is composed by Liguria, Piedmont, Lombardy, Veneto, Friuli-Venezia Giulia, Trentino-Alto Adige/Südtirol, Emilia Romagna, Tuscany, Umbria, Marche, Lazio. Cluster 2 is composed by Molise, Abruzzo, Campania, Calabria, Basilicata, Apulia, Sicily and Sardinia. There is a clear division between regions from the center and north of the country and regions from the south and islands of Italy.

These clusters represent the presence of two main geographical blocks, one encompassing rich regions from centre North and the other one including regions from the South and islands. Within the two groups we are able to identify further sub-clusters characterized by regions which are closer in their dynamic behavior. In our work the high performance cluster can be divided into three sub-clusters: Marche and Umbria; Emilia Romagna, Trentino Alto-Adige and Lombardy; and the rest of the high performance regions. On the other hand, in the low performance cluster there is the sub-cluster consisting of Molise and Sardinia. Nonetheless, also Abruzzo seems

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to have a dynamics which is slightly different from the rest of the low performing regions. It is also interesting to notice the connection between Friuli-Venezia Giulia and Veneto within the cluster of high performance regions, and between Apulia and Basilicata among the low performance ones. Finally we can say that Abruzzo on the low performance regions side and Marche and Umbria on the high performance regions side represent the boundaries between the two clusters.

Let's discuss more in detail the nature of this economic landscape, stressing in particular the structural differences between North and South.

Clearly in Northern Italy there is an aggregation of economic activities, especially manufacture and services. In all North east the share of employees in manufacture reaches 50%, with a concentration in small and medium enterprises. Moreover in North west, and in particular in Piedmont, the share of big industry is higher than the Italian average. As far as the tertiary sector is concerned, also the services to small and big enterprises are clustered in the North. Lazio constitutes an exception regarding the services to great enterprises, due to the presence of the capital city and the government institutions. Instead in the South and in the islands there is a concentration of micro enterprises and services to micro enterprises.

Switching to the structure of production, we have that in Northern Italy there are from 70 to above 80 firms per 1000 inhabitants (especially in North east), while the Italian average is 66. On the contrary in all the Southern regions the figure is significantly lower than the average. The density of economic activities in the centre north is also reflected on the distribution of population and income: 2/3rd of Italian population resides in the centre north, where more than 70% of Italian GDP is produced and where income per capita is almost twice (23,389 against 13,688) than in the south.

Can economic theory help in explaining this polarization? As we have already mentioned Northern regions performed historically better than Southern ones since the Italian unification. There was nonetheless a process of convergence in the 50s and in the 60, but this process has halted in the middle of the 70s and was even reversed in the 80s and 90s.

The new theories on the spatial distribution of economic activity can help in interpreting these stylized facts. As it is widely known according to New

Economic Geography[6] growth is a spatially cumulative process which tends to increase inequalities. In fact Krugman (1991) claims that location plays an important role in economic activity of the region. In addition to other factors economic situation of a region depends on its location and also on its neighbors. Regions belonging to the same cluster have a high chance to develop similar dynamics. Indeed a core-periphery pattern occurring at regional level is representative of spatial heterogeneity and may imply the presence of convergence clubs. This because the distribution of per capita GDP is spatially auto-correlated.

The New Economic Geography strand has highlighted, in particular, location and agglomeration externalities. These can arise because of knowledge spillovers, market size effects (firms tend to locate where the expenditure is higher) and input-output linkages between the firms operating at various spatial levels (e.g. regions, cities, district of cities, etc.). The interaction between those agglomeration externalities and the dispersion forces shape the economic landscape of a territory. As shown by many theoretical works, an increase in the integration between regions determines an imbalance in favor of agglomeration forces leading to a circular cumulative causality fostering clusterization of economic activities, causing regions with slight underline differences to diverge dramatically. We believe this is what happened in Italy. At the beginning (after the unification) the difference between the North and the South were quite limited. After the increase of economic integration in 21st century due to the decrease in trade costs led by the construction of road arteries, agglomeration forces triggered the rise of a core-periphery structure, where the core is a club whose elements (regions) enjoy positive growth spillover. Taking an European perspective, we could even say that the core, consisting of Northern regions, is merely a part of the bigger economic cluster starting from Northern Italy and reaching Scandinavia and Southern England, passing through France, Belgium, Germany and the Netherlands. By contrast Southern regions belong to the periphery.

In Figure 5 we show the Minimum Spanning Tree obtained by using the correlation distance D^ρ. In this case we also obtain two main clusters but with several regions that do not form clusters. Again Aosta Valley is an

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[6]   For a review of New Economic Geography, please refer to Baldwin et al. 2004.

outlier, but in this case also Calabria and Basilicata, and in a small measure Apulia, Marche, Lazio and Sardinia are outliers. In this case, the meaning of being outlier is a consequence of having very low correlation values with all the other regions in the sample. That is, each one of the outliers present a time series having very different co-movements of per capita GDP with any other region. By the contrary, regions in a same cluster with respect to the correlation distance moves in lockstep with each other of the cluster, either up or down. In other words, regions belonging to the same cluster have a similar reaction to external shocks and regions not belonging to a same cluster react in a different way to the same external shock.

Figure 5: Minimum Spanning Tree using the Correlation Matrix D^ρ
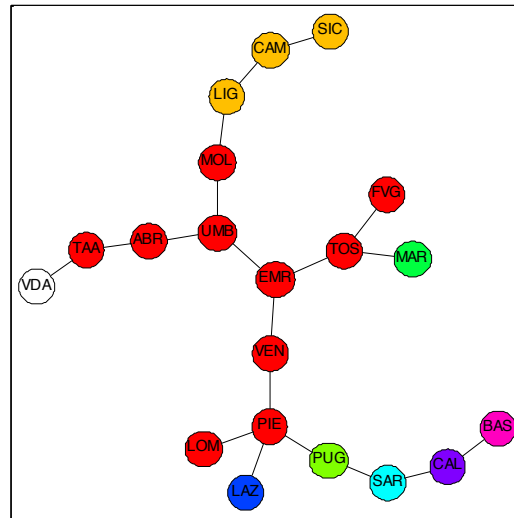
The hierarchical tree obtained starting from the MST described in Figure 5 is shown in Figure 6. The stopping rule from the test introduced in Tibshirani et al. (2001), indicate that the optimal number of clusters is nine. This optimal number is also confirmed by the Pseudo-F test (Calinski 1974) and Pseudo-t test (Duda and Hart 1973). The two biggest clusters with respect to

the correlation distance are the following: Cluster A is composed by Molise, Umbria, Abruzzo, Trentino-Alto Adige/Südtirol, Emilia Romagna, Tuscany, Friuli-Venezia Giulia, Veneto, Piedmont and Lombardy. Cluster B is composed by, Liguria, Campania and Sicily. In this case the clusterization does not follow a clear geographical division of the region but we can note that cluster A is mainly composed by North-center regions (with the exception of Molise). Regions from the South have very different behaviors in terms of movements down and up of per capita GDP while regions of the North-center have homogeneous reactions with respect to external shocks, with the exception of Aosta Valley, Liguria (belonging to cluster B) both from the North and Lazio from the center of the country.

Figure 6: Hierarchical Tree using the Correlation Distance D^ρ
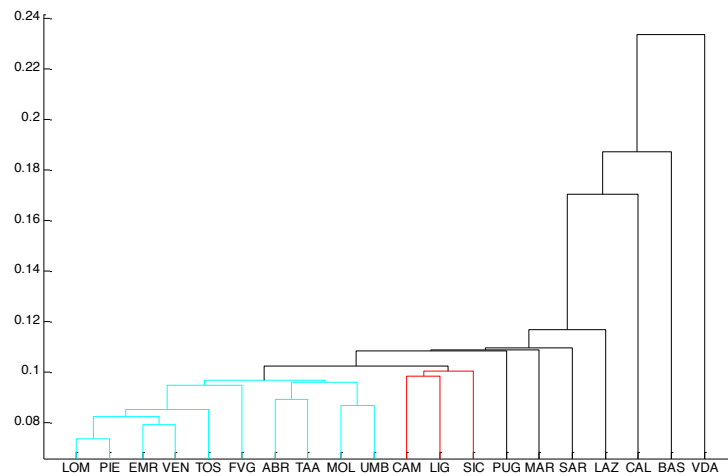
As we can see the main cluster[7] is basically composed by regions from the North as in the former average distance analysis. This because, as we have already explained, neighbor regions belonging to the same cluster have a high chance to develop similar dynamics as well as a higher degree of

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[7] The data cited in this paragraph belong to ISTAT and EUROSTAT.

correlation, and thereby to react in the same way to external shocks. This is mainly due to input-output linkages, technological, location and agglomeration externalities. But not all the most developed regions belong to the cluster (see Liguria and Lazio), while on the contrary one of the poor ones (Molise) belongs to it. On the other hand, most of the regions not belonging to one of the two clusters are peripheral in the distribution of economic activities as well as in geographical terms: Calabria, Basilicata, Apulia, Marche, Sardinia. Apart from Calabria, they have a prevalence of micro industrial firms, and overall their level of employment and productivity remains low.

There are different possible explanations for the fact that Liguria does not have an homogeneous response to external shocks with respect to the other regions of Northern Italy. A possible explanation lies on the different economic structure with respect to the rest of the North. While for instance big and medium industrial firms characterize the economic landscape of Piedmont, Emilia Romagna, Friuli-Venezia Giulia and Veneto, and services to small and big enterprises are common in Lombardy and Trentino-Alto Adige, in Liguria we see the prevalence of services to micro firms. This is probably due to the process of de-industrialization occurred in the region after the 70s. Before that, the economy was centered on big iron and steel, chemical and mechanical industries, which were partly owned by the state. After a de-industrialization process, the share of industry in value added fell from 18% in 1981 to 10.8% in 2005. By contrast the share of services in value added increased up to 82.4%, much higher than the average of the rest of the North west (64%). In this process of tertiarization the most important service sectors are tourism and transports: Liguria owns 69.2 km of highway per 1000 square km of surface, against an Italian average of 22.

What about Lazio? Despite belonging to the club of developed regions, it does not share the same dynamic. Also in this case, the most probable explanations lie in the structural characteristics of the region. Lazio's economy is based on services to great enterprises and a preponderant public sector. In fact the public expenditure is 12,264 Euro per capita, inferior only to Aosta Valley, Trento and Bolzano, and highest among the most populated region. This of course has to do with the presence of the government and other institutions, whose turnover represents almost 20% of value added. The economy is gravitational, with at the centre Rome where more that 70%

of labor units are located, and where is produced almost 80% of valued added. Moreover the economy is based on services and tertiary sector (beyond 80% of value added) while industry, in contrast with the North, is under represented (13% of valued added).

As far as Molise is regarded, the only explanation for belonging to cluster A lies on its specialization in "made in Italy" products export, such as Tuscany and Veneto. Thereby Molise could follow the dynamics of some center North regions, whose economies are export led.

Taking into account the cluster B, composed by Liguria, Campania and Sicily, we see that the composition of production is similar in the three regions. In fact all the three economies are centered on services to micro enterprises. Those services firms are smaller than the Italian average. In fact the number of workers per firm goes from 3.09 in Campania to 3.59 in Liguria, against an Italian average of around 4. As already mentioned for the region Liguria, also in Sicily there is a huge importance of service and tertiary sector. In particular services produce 81.02 % of value added against a Southern average of 77. On the hand, industry represents only 15.44 % of value added, while in the rest of the South it accounts for 19%.

Also in Campania we have such kind of structural composition, with 12 % of value added produced by industry, and 78 % entitled to services production. Thereby, we may argue that having a similar sectoral composition, the three regions might have responded in an analogous way to external shocks.

A case can be done for Aosta Valley. As we have seen it is an outlier both for what concerns the average distance and the correlation distance. This is due to some dimensional and structural characteristics making this region unique. Aosta Valley is the smallest region, with a surface of 3,263 square kilometers, while the average Nuts2 dimension in Italy is 14,300. It is also the least populous, with about 130,000 inhabitants, which is roughly the half of the second smaller region Italian region (Molise). Moreover the percentage of Aosta Valley municipalities which are classified as mountainous reaches 100%, while the Italian average is 51,9%.

From the economic point of view, Aosta Valley's income is well above the average, with a GDP per capita[8] of 26,756 Euro, while the GDP per capita in Italy is 24,400 Euro. Its economy is based on tourism, energy production

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[8]   Data are from ISTAT, 2009.

(hydroelectric power) and public transfers from the central government. In fact in Aosta Valley the availability of beds is 419,9 per 1000 population, while in Italy the figure is 76,4 beds per 1000 inhabitants. And the transfers from the central government amount to 17,749 Euro per capita, while the Italian average is about 13,000 Euro.

Thereby the dimensions and morphology (very small and mountainous) and the structure (specialized in tourism and depending from central government transfers) of the economy determine a severance between the dynamics of Aosta Valley and the rest of Italian regions. In particular tourism is based on winter sports and exclusive and luxury locations such as Courmayeur and Cervinia, thereby it is relatively not influenced by the economic cycle. Moreover and most important the local economy is highly subsidized by the central government, which are arguably constant across time and do follow political concerns.

12. Conclusions

In this paper we analyzed the dynamic of convergence from the perspective of economic performance, with a view to identifying performance clubs. To this end we studied the behavior of per capita income for the Italian regions along the period 1970-2004 using a non-traditional (non-parametric) statistical model: the Minimum Spanning Tree and the Hierarchical Tree.

First of all, the results of the bivariate stochastic kernel and the long run ergodic distribution analysis confirm the state of dualism in the Italian economy, rooted on the cleavage between an economically and socially advanced Centre North, and a virtually pre-industrial South, lacking social and economic infrastructures, entrepreneurial spirit and bearing low productivity in every sector. Moreover our analysis provides hints about the fundamentals defining the process of divergence at regional level, as the performance clubs pattern we uncovered reflects the distribution of economic activities as well as the structural attributes of the regional economies. The Minimum Spanning Tree and the Hierarchical Tree obtained by the mean of the average distance matrix display the presence of two main geographical blocks, one encompassing rich regions from Centre North and the other one including regions from the South and islands. This let us believe agglomeration forces to have triggered the rise of a core-periphery structure, where the core is a club composed by center north regions,

enjoying positive growth proximity spillover and showing a close evolution and dynamic behavior during the time period considered. Of course this result reinforces and corroborates the former studies on economic dualism in Italy.

The Minimum Spanning Tree and the Hierarchical Tree obtained by the mean of the correlation distance present a main cluster (which we dubbed as A) mostly composed by regions from the North as in the former average distance analysis. This because neighbor regions belonging to the same cluster have a higher chance to develop a higher correlation leading to a similar reaction to external shocks.

But not all the developed regions show an homogeneous response to external shocks. For instance Liguria, albeit being a Centre North region, displays a low correlation distance with respect to the other developed regions. This might be due to the prevalence of services to micro firms determined by the process of de-industrialization occurred in the region after the 70s.

Moreover Lazio does not share the same dynamics with the club of developed regions, most likely because of its structural characteristics. Indeed its economy is based on services to great enterprises and an overwhelming public sector.

Regarding the other cluster stemming from the correlation distance analysis (which we called B), we see that it is composed by Liguria, Campania and Sicily, having a similar composition of production. Thereby their economy might have responded in an analogous way to external shocks. In fact all the three economies are centered on services to micro enterprises, with services firms much smaller than the Italian average. Finally we have Aosta Valley, which is an outlier both for what concerns the average distance and the correlation distance. This is due to its small dimension and its mountainous morphology, as well as to the structure of its economy, specialized in tourism and depending from central government transfers. All those aspects of the economy determine a cleavage between the dynamics of Aosta Valley and the rest of Italian regions.

The limitations of our research include the short length of time series as well as the use of only one variable to represent a very complex system. Future research can include the study of the evolution of the clusters by using time windows to investigate if there are always two main clusters, if there is

mobility between clusters, if the clusters tend to be more compact or more expanded, if the average region of both each clusters tends to converge or diverge. That is, to investigate the dynamical properties of the clusters' structure. Moreover it would be interesting to use of other concepts of distances and/or other variables representing the economic performance of the regions can enrich the discussion. For instance a possible other measure of economic performance might be a development index taking into account not only per capita income levels and growth, but other variables such as quality of institution and services, human capital or distance from the technological frontier.

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