PAPER

The σ and β (absolute) convergence in real per capita income across Italian regions (1971-1996).

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***Abstract*:** The paper aims to investigate the Italian economic process to the current debate on neoclassical convergence. It tests empirically the validity of the neoclassical predictions on σ-convergence and on absolute β convergence in terms of per capita income during the time period 1971-1996. In contrast with previous empirical studies, using regional annual data in constant 1990 prices, the cross-regional distribution of real income per head shows that the time period analysed was a period of ongoing σ-divergence. Furthermore, the empirical analysis shows an absolute β-divergence across the twenty Italian regions over all time period but also over the two sub-periods (1971-1981; 1981-1996).

Introduction:

Since the 1980s, a prominent issue in the macroeconomic literature has been the debate on economic convergence-divergence in per capita income and in output across countries and regions of the world.

The so called *convergence* issue is derived from traditional neoclassical growth models –such as Solow [1956] and Swan [1956] models- based on

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the assumption of diminishing returns to reproducible capital. Given identical preferences and technologies across the world economy, convergence implies a long-run tendency towards the equalisation of per capita income and productivity across countries, as pointed out firstly by Abramovitz [1986]. Specifically, the neoclassical growth theory predicts that poor economies will tend to grow faster than richer ones. Such theoretical framework should lead empirically to both *σ-convergence* as well as *absolute* (or *unconditional*) *β-convergence* evidences across countries or regions in the world in terms of per capita income and productivity levels.

On the one hand, across economies *σ- convergence* is provided when the dispersion of GDP per capita levels has declined across time, while, on the other hand, *absolute-β-convergence* is supported when there is a systematic tendency for economies with initially lower levels of GDP per capita to grow faster than those with initially higher levels of GDP per capita. In particular, across economies *absolute-β-convergence* (in terms of per capita income and productivity levels) is described as having occurred if a negative relation between initial per capita incomes and their rates of growth is estimated empirically (Barro, 1991, Barro and Sala-i-Martin, 1992). If such negative relationship holds only controlling for the possibility of different rates of saving (and hence investment, *Say's Law*) and of different endowment of human capital across economies, then, the evidence should show the existence of *conditional β-convergence* [Barro, 1991, Mankiw, Weill, Romer, 1992].

An important contribution on convergence issue was given by Baumol [1986] who shows empirically no absolute-β-convergence in per capita incomes across the world economy. Since then, there has been an outpouring of econometric studies attempting mostly to test the existence of both *absolute (or unconditional)* and *conditional β-convergence* hypothesises both in terms of per capita incomes and productivity to confirm the empirical validity of the neoclassical theoretical paradigm. Only in recent years, given the availability of regional data, the topic of regional convergence-divergence has regained popularity in the European and in the American academic communities.

At an empirical level, Italian regions could be viewed as a *case study*. In fact, in the case of Italy, differences in growth rates – in terms of per capita income and output (or productivity of labour per worker) - is a long standing problem that can be traced back to the Unification, in the 1860s. Since today, differences in levels of per capita income among Italian regions are still important, given that eight of the twenty regions being 'Objective 1' (in the terminology of the European Union[1]).

Then, the aim of this paper is to show the relevance of the Italian experience to the current debate on convergence in terms of per capita income only at the Italian regions to understand if (or whether) poor regions tend to growth faster than rich ones and if such long-term absolute-β-convergence process could be at work. Specifically, in a first moment (Par. 1), I examine the neoclassical growth hypothesis of sigma and beta convergence. After (Par. 2), I survey the empirical works that have been done on convergence in European regions and their findings. In a second moment, I verify the empirical validity of the neoclassical prediction. To do it, preliminary, I show the reason for the chosen a long-time-horizon and I describe the regional annual data (Par. 3), comprised between 1970 to 1996. Then, (Par. 4), I analyse statistically the behaviour of the regional level of real GDP per head across time to verify the hypothesis of σ-convergence. After (Par. 5), I examine the absolute (or unconditional) β-convergence hypothesis in terms of real per capita income. Finally, I conclude.

1. The neoclassical hypothesises of convergence.

The neoclassical theory uses a simple growth model with one sector aggregate function and the aggregate marginal productivity theory of distribution for explaining regional growth path.

Considering a perfect competition in the world economy, the neoclassical model of growth [*Solow, Swan, 1956*] is based on three main assumptions.

[1] 'Objective 1' regions are regions whose Gross domestic Product per capita is below 75% of the Union's average, and they are hence eligible to receive Structural Funds to finance their development and structural adjustment.

First, labour force and labour saving technical progress grow at constant exogenous rate[2]. Second, all saving is invested (*Say's Law* implied the inexistence of independent investment function). Third, output is a function of capital and labour where the production function exhibits constant returns to scale and diminishing returns to individual factors of production.

In particular, given the hypothesis of diminishing returns to capital, in the steady-state, the long-run growth of output is determined by the rate of growth of labour force in efficiency units, that is, the rate of growth of physical labour force plus the rate of labour augmenting technical progress.

Then, the long-run growth of output is independent of the saving-investment ratio because a higher level of saving, and hence investment, is offset by a higher capital-output ratio, or a lower productivity of capital. In such scenario, the steady-state of regional output is ultimately determined by the growth of labour force and technical progress.

In the long-run, there is convergence in per capita incomes (or output) with all economies converging on a common long-run steady-state growth of labour augmenting technical progress.

This concept of *absolute* (or unconditional) β-*convergence* requires an *unique* steady-state which, in turn, requires that technology, saving rate, population growth and depreciation rates are equal across a set of economies.

The main element behind the force for convergence is diminishing returns to reproducible capital, so that, poor economies (countries or regions) with low capital-labour ratios have a higher marginal productivity of capital and hence will grow faster than richer ones, given the same level of saving and investment. Diminishing returns to capital implies that the rate of return is negatively relate to the stock of capital per head so that, other things being equal, economies with a low amount of capital per head are expected to growth faster.

Furthermore, each economy is characterised by a unique globally *stable* (non-trivial) *steady-state-long-run-equilibrium*, economies (regions or countries) that are similar in all respects except for their initial level of output per capita are expected to converge towards the same steady-state level of

[2] Technical progress is a public good, so that all economies will benefit from the

output per capita and, hence, to one another. Indeed, the condition of free factor mobility and free trade are essential and contribute to the acceleration of the convergence through the equalization of prices of goods and factors of production.

In a regional context, the *mobility* of production factors, as capital and labour, across regions within a country accelerates the working of the market mechanism and, therefore, it will accelerate the *absolute β-convergence* on income and on productivity levels. Since diminishing returns to individual factors of production (K and L), as pointed out by Borts [1960], factor movements are at work for reinforcing the equilibrating tendency towards the convergence across regions within a country. If wage, for instance, are too high in the developed regions, labour will migrate from the less developed ones. Then, labour will become *scarce* in the latter and abundant in the former and it leads to an up-ward or down-ward movement of wages. Indeed, the wages and the marginal product of capital are inversely correlated and therefore capital will move to labour-intensive sector in low wage regions (poor or less developed regional economies); this will diminish the trend for labour to migrate outwards. Thus, in the poor regions, the inflow of capital will generate faster growth of output, hence, economic growth should be faster in poorer regions than in the richer ones.

In the long-run, any tendency for disparities decline over time, given that factor costs are lower and profit opportunities are higher in poor regions compared to rich regions. In this context, transitory-shocks have short-run effect but not have a lasting effect[3].

The role of government policy is limited to promotion of market forces and the provision of macroeconomic stability. According to Borts and Stein [1964], given perfect competition, '*growth is essentially a reallocative*

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exogenously given technical progress.

[3] On the one hand, in the short-run, any differences in regional productivity growth is considered as the result of the gains accruing from a progressive reduction in an initial interregional or intra-regional misallocation of resources or in both (McCombie, 1988). On the other hand, for example, any existence of regional unemployment is viewed as a temporary phenomenon which is due to real wage being too high (rigidity in the labour-market due to trade unions). However, these disparities in regional productivity growth -as well as the existence of unemployment – are seen as merely transitory caused by a misallocation of resources. In the long-run, in fact, these disparities will vanish, given that

process', where, an unaffected working of the market mechanism will be equilibrating and any disparities in regional determinants of growth tend to disappear over time.

This is the neoclassical argument for explaining regional growth path. At the empirical level, the neoclassical prediction of convergence has been tested by two different hypothesises. The first is the so called hypothesis of "sigma" (σ) convergence which leads to show a narrowing dispersion of real per capita income across regions with the passage of time. The second, or the alternative hypothesis of "beta" (β) convergence which predicts a negative relationship between the growth of per capita incomes over a given period and the initial level of income per head across different regions (or countries). The concept of beta could refer to absolute (unconditional) or conditional β-convergence. The absolute (β) convergence is interpreted as a convergence to the same steady-state growth of per capita income (or productivity) for all economies (regions or countries in a given set), see Barro and Sala-i-Martin, [1991]. In the case of conditional (β) convergence, the convergence is controlled for differences in the capital accumulation, physical and human, and in the ability of the economies to become more competitive (what Abramovits, 1986 calls differences in "social capability"). In this work, I test empirically only the absolute (β) convergence hypothesis.

In general, for as regard the empirical works, the sigma convergence hypothesis is examined by using a time series approach which analyse how the dispersion of per capita income (or labour productivity) of different economies (regions or countries similar in their structural characteristics) decrease over time. This concept of sigma (σ) convergence is measured by the coefficient of variation. The hypothesis of beta (β) convergence is tested by a cross-section analysis and it estimates a linear or a non-linear relationship between the average growth of per capita income (or productivity) over a certain time-period and the initial level of income (or productivity) of different economies.

The sigma (σ) and the beta (β) convergence not only are measured by two different ways but, more important, they yield different information on

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regional growth rates will approach to their steady-state levels (that is the same for all

growth path. As pointed out by Sala-i-Martin [1996] the beta convergence is used to show whether there exists any convergence pattern among different economies, how fast this convergence process is, and if it is partial (that is limited to same time-period) or total (for the whole time period considered).
The same author argues that beta convergence is a necessary but a not sufficient condition for sigma convergence.
For such reason, many empirical studies use both concept of convergence for providing a more complete information on development process of a set of economies. However, there is who strongly criticizes the emphasis on the neoclassical hypothesis of beta convergence. For instance, Quah [1996] argues that the concept of beta convergence informs about the important contribution of the physical capital for growth non more and no less. By showing a negative correlation for growth rates and levels of per capita income (or productivity), and it says nothing about how the poor economies are catching up with the richer ones (Quah, 1996).

2 A review on the convergence findings at European regional level.

Interest on economic growth and, in particular, on the question of convergence were renewed in the Baumol's [1986] findings of both sigma and beta (unconditional) convergence on productivity (GDP per work-hour) among 16 industrial countries, over the long time period 1890-1979.
Baumol shows a weak convergence for a sample of less developed countries. In general, he finds that there is a lack of unconditional (or absolute) β convergence across all sample of industrialized countries, with a "convergence club" process has been taking place within the whole sample.
Since the Baumol's article, a prominent issue in the macroeconomic literature has been the debate on economic convergence-divergence in per capita income across countries and regions of the world.
In Europe, to test the absolute β-convergence hypothesis among regions, Barro and Sala-i-Martin [1991] choose 73 regions within homogeneous

regional economies within a country and, also across the world).

countries –as Germany, France, United Kingdom and Italy – which are likely similar for their development paths and, hence, for their structural characteristics. Using the Molle's [1980] regional dataset for the time-period 1950-85, their findings show absolute β-convergence on regional per capita incomes at a stable rate of 2% per annum. Furthermore, for as regards σ-convergence, the authors observe that Italy has the highest dispersion for the log of per capita GDP within the four largest countries in their European sample, but having verified absolute β-convergence they affirm:

"there is nothing surprising in the relative performances of the regions of northern and southern Italy. The south of Italy has not jet caught-up because it started far behind the north, and the rate of β-convergence is only about 2% per year…' [Barro and Sala-i-Martin, 1991 p.151]

Later on, Barro and Sala-i-Martin [1995] examines the σ-convergence among European regions. They show that since the post-Second World War Era there has been a period of σ-convergence in income per head until the 1980s when a period of on-going σ-divergence starts until the early 1990s.

Button and Pentecost [1994] investigate absolute β-convergence using official statistics from the former 9 EC member states (NUTS I level regions). Specifically, they use annual data for regions among nine EC member states (included Italian regions) but for a longer period started in 1975 they confirm the validity of neoclassical prediction.

Neven and Couyette [1994] test the unconditional convergence hypothesis across European regions (all NUTS II level regions- included Italian regions) for the time-period 1980-89 and, then, they find evidence for convergence in per capita income growth across the large sample with a speed of similar order as Barro and Sala-i-Martin (1991) found.

Later, using annual data from Cambridge Econometric data set, Armstrong [1995] confirms the absolute- β-convergence for his large sample of 85 regions for the time-period 1950 to 1992, using GDP per capita at market prices. However, contrary to previous study, his findings show substantial narrowing of per capita incomes between 1950 and 1970, slower convergence between 1970 and 1990, then he argues:

"… candidates here are Italy and Spain, both of which exhibit a strong north-south regional divide. There is no evidence, for the twenty Italian regional data set used here and by Barro and Sala-i-Martin, to indicate that

southern Italy has separated off as a distinct convergence club from the northern Italy[4]*….*" [Armstrong, 1995 p.62- 63]

Fagerberg and Verspargen [1996] investigate 70 regions in six European regions for the time-period 1957-90. They find interesting results with considering principally three sub-periods. In particular, they estimate a statistically significant speed of unconditional-convergence for the first two sub-periods until 1980, since then (for the 1980-90) the estimated speed was not significant.

In a recent study, using a data base assembled at CRENOS and examining a very large sample of 109 regions for the time period 1980-90, Paci [1997] analyses both absolute β-convergence in per capita income and in productivity rates. On the one side, he finds no evidence of unconditional convergence in terms of per-capita income while, on the other side, he finds a strong evidence across all regions into the sample of unconditional convergence in productivity. Given such different findings, he argues that substantial difference in his results is due to the account on rates of unemployment and participation across regions which affect the level of per capita income but not productivity[5]. Furthermore, for as regard the dispersion of per capita income and labour productivity per worker across time, the author shows that:

"*There is no evidence of a decrease in the cross-region dispersion of the per capita income. The standard deviation remains almost constant over the 1980. Further, considering labour productivity we can again observe that the dispersion across the European regions decreases. In particular, it is worth noting that most of the reduction in labour productivity dispersion* occurred *after 1980 when Spain and Portugal fully joined the European Community. It appears that a stronger integration and trade liberalisation have helped the process of convergence across the regional production systems. However, the productivity convergence process seems to have been achieved at the cost of increasing unemployment, hence, widening the income disparities across the European regions …*" [Paci, 1997 p.622-623]

[4] He argues "It is quite possible that the structural dislocation associated with major changes such as those now occurring in the EC may trigger increased cross-sectional disparities (that is, σ-convergence) but that the β-convergence process will come slowly back into play in the longer term. Fears that the pace of current EU integration policy may widen regional disparities are not necessarily incompatible with the evidence presented in this paper "

[5] Fagerberg and Caniels [1996] support Paci's results, given that they show how regional differences in per capita income are systematically related to differences in unemployment rates. In their conditional convergence regression, they show that labour migration have a strong positive impact on per capita income growth.

Tondl [1999] tests the unconditional β-convergence hypothesis among the European Union regions and between regions inside and outside it (refers to the EFTA regions) for a long time period since 1950s until 1990s, using a panel data-technique and three different data set (data provided by Molle, by Cambridge Econometrics and Vandermotten). Looking at the evolution of disparities in regional per capita incomes, he shows that regional incomes disparities sharply declined since the 1960 until the 1973. For the post 1975 period, for which he has annual data, the author shows that income disparities had mounted again until 1981. But, after 1985 disparities declines distinctly and this tendency continued for all 1980s and for the early 1990s. For as regard the unconditional –convergence, he shows that, in general, regional convergence was only pronunced inside the European Union in its intial stage. Specifically, European regions seemed to have joined on a common convergence path until 1973, after 1975, convergence slowed down distinctly and several poorer regions on the Southern periphery started to show a deviation in steady state income between rich and poor regions, which a number of the latter could not recover when the convergence process set in again in the late 1980s.

A different empirical result is shown by the empirical study of Marques and Soukiazis [1999]. By examining 175 EU regions over the period 1987-1995, and by testing both sigma and beta hypothesises, they show a slow absolute β-convergence in per capita income (in PPP terms) of around 1,3% per annum for the whole period, but they find also a higher convergence rate among poor regions (3,8%) than the intermediate one and no convergence at all between the rich regions. Therefore, the authors argues that regions in the EU converge towards a different steady-state (convergence-clubs) which depends on their level of economic prosperity and, in such context, maybe structural funds will help more the poor regions to reduce their differences in standard of living.

Across 13 UK regions over the time-period 1970-1995, McGuines and Sheehan [1998] found weak evidence of convergence in per capita income with a speed of 0,9 % per year, while the sigma convergence hypothesis is supported only during years of slower economic performance, more in general. For the case of 88 Finish sub-regions during the time- period 1934-

1993, and using as measure or per capita income level the taxable per capita income. Kangasharju [1998] finds an absolute convergence process that runs at about 2% per years in the long run, but in the short run the speed appears unstable.

An opposite picture is provided by Siriopoulos and Asteriou [1998] for the Greek regions over the time 1971-1996. They show the rejection of unconditional β-convergence for the whole period and also for three sub-periods, and indeed, they find evidence of the existence of economic dualism across the southern and northern regions of the country.

For as regard the case of Italy, Mauro and Pedrecca [1994] reject the neoclassical hypothesis of β (absolute) convergence and they show an economic dualism between the richer North and poorer South regions. The Di Liberto's [1994] findings show instead that there is evidence of a σ and β (absolute) convergence process across the Italian regions during the time period 1960 to 1991, with a estimated beta coefficient that decreases over time. With annual regional data on real per capita income and labour productivity for the long period 1950-1993, Paci and Saba [1998] find a β (absolute) convergence only for the time period from 1960 to 1975, after there is evidence of a bimodal distribution of real per capita income across the southern regions.

By using a panel data technique, Paci and Pigliaru [1995] show a working β (absolute) convergence process across Italian regions for the time period 1951-1975, after there is a sharply increase in income inequality across regions.

Looking at the bimodal distribution of per capita incomes across the Italian regions during the time period 1951-1975, Paniccià [1999] shows the existence of an economic dualism between the North and the South regions. The latter findings confirm previous empirical studies (as for instance, Mauro and Pedrecca, 1994, Paci and Saba, 1998). By examining the labour productivity, D'Amato and Pistoresi [1997] and Cellini e Scorcu [1997] show that it is difficult to find the existence of an economic dualism in Italy but, at the same time, it could be possible to find some convergence clubs that are not linked with the traditional division between the northern and southern regions.

3. The Italian case: the time-period, the data and the methodology.

To test empirically the validity of the neoclassical prediction of absolute β and σ-convergence in terms of per capita income and productivity rates across the Italian regions, I select the time period 1970 to 1996. It is a long-time horizon that comprises different phases of Italian performance. It includes the last years of the Italian economic miracle – when there was a strong favourable export performance of the Italian manufacturing products in the world market, the first trade-union struggles and the first and second oil shocks and the collapse of the Bretton Woods International Monetary System and also the full participation of Italy in the European Union. Usually, in the Italian economic literature, it is distinguished two phases. The first phase is the post-war reconstruction and, then, the economic miracle and it ends around 1975. I analyse only the latter years of the post-war reconstruction.

This was a time in which the national government implemented an active industrialisation policy in favour of Southern regions. In such period, high priority was given to install structural infrastructure into the Southern regions and to help their industrial sector via 'Cassa per il Mezzogiorno'. As a consequence of this national governmental policy, in the 1973, for the first time, the South's share in national industrial investment reached 44%. However, on the one side, for Graziani [1975, 1978], such policy-induced-investment in the southern-manufacturing sector would have triggered off a process of opening-up in southern-market which, in turn, would have been detrimental to the southern-indigenous sector. Specifically, Graziani argues that such policy has contributed to worsening the performance of the pre-existing southern manufacturing productive capacity and, as a consequence, there was a crisis in employment levels due to crisis in local productive capacity. But, on the other side, the Graziani's idea is not always accepted by Italian economic literature.

After the mid-70s a different national policy was implemented. The national government has chosen to substitute the direct support for the southern-industrial sector, and it has been implemented a policy of transfers of incomes towards the populations of the Southern regions.

Such policy continues until the end of the 1980s. In response to this change of national policy, the share of Southern regions in national industrial investment started to decline and at the end of the 1980s, it was down to the level of the early 1960s (Del Monte and Giannola, 1997). Then, a new policy was implemented. This new policy tries to improve the economic structure of the less developed regions, via supporting private investment with public capital for new enterprises.

To investigate empirically the Italian regional development performance, I use regional data assembled at CRENOS in constant 1990 prices.

For the whole time period (1971-1996) I examine the behaviour of the level of real GDP per head (or real per capita income) across regions and across time. Level captures the differences in long-run economic performance that are most directly relevant to distribution and welfare as measured by consumption of goods and services (level of GDP per head). Specifically, GDP per head is total output divided by population.

4. Some evidences on the distribution of real income per head across Italian regions to test σ-convergence over the time-period 1970 -1996

The peculiarity of the Italian case has to be examined, first of all, looking at the regional equality (or inequality) in terms of the income available to citizens inhabiting different territories. Regional equality refers to the neoclassical concept of σ-convergence across regions.

This concept of convergence pertains to the decline of the cross-regional dispersion of per capita incomes over time, and not at a given moment in time. In the neoclassical world, at a given moment in time, any dispersion of per capita income across regions could reflect temporary intraregional or interregional misallocation of resources, but there is σ-convergence if the dispersion diminishes over time. Therefore, the σ-convergence concerns with

the spread-dispersion of the regional income distribution within the overall national distribution across time[6].

Plotting the real per capita income at some point in time, for instance in the 1970 and 1981 and 1991, it could be noted huge cross-regional differences in real per capita income across Italian regions (*Figure 1*)

FIGURE 1

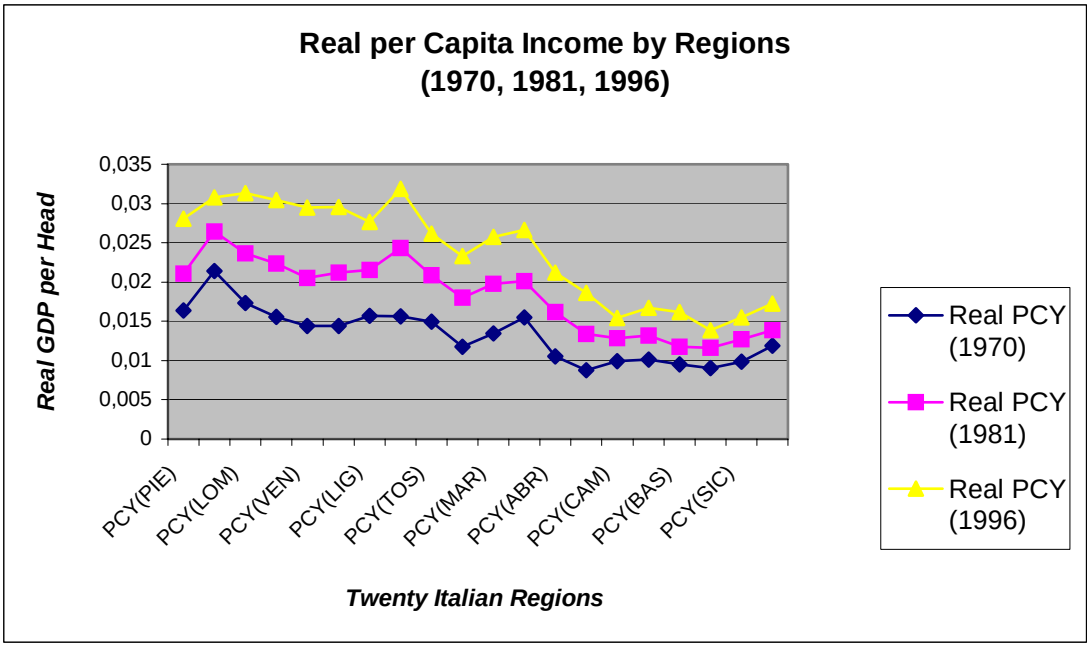


Figure 1 shows that there were significant differences in per capita GDP across regions in the 1970. Although there were significant disparities across regions in the 1970s these disparities has been accentuated at some given selected points in time. However, maybe there could be some social economic elements that determine these differences in real per capita income across regions, which are captured by the GDP per head variable.

Then, from the above cross-regional evidence for some points in time, I cannot *a priori* exclude that, in general over all time-period, across Italian regions, dispersion in the levels of per capita income tends to diminish[7].

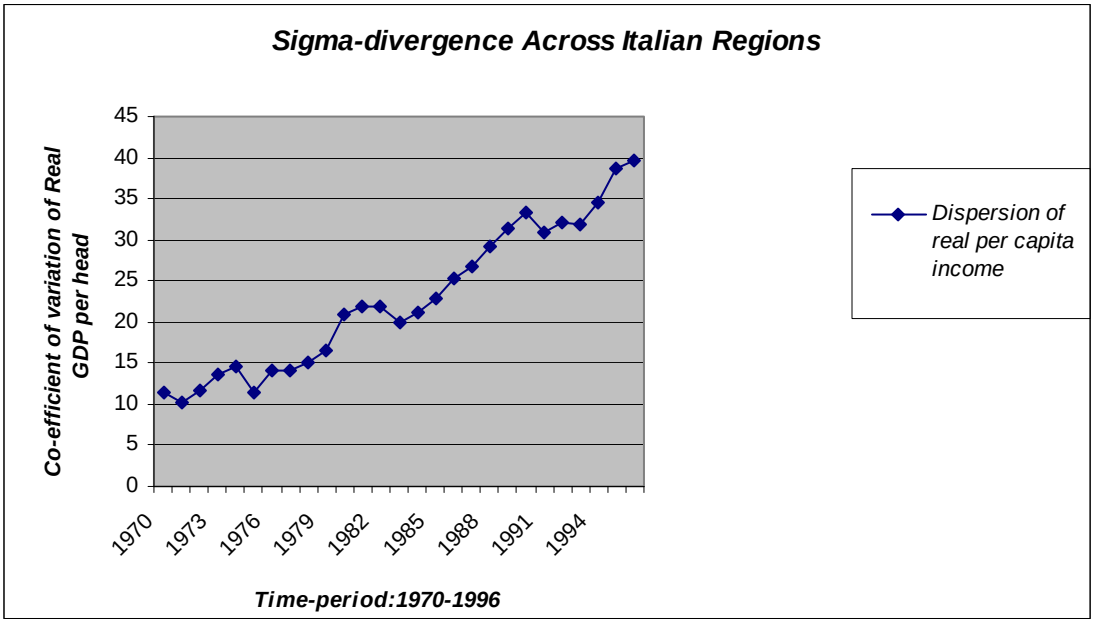
[6] To measure the spread-dispersion of income distribution, across regions in Great Britain, Chatterji and Dewhurst (1996) and Dunford (1997) and Roberts (2001) use the coefficient of variation of real per capita income. I replicate the same methodology for looking at the sigma-convergence in real per capita and output levels.

[7] In other words, we cannot a priory exclude that the described distribution churning is a more general feature of the distribution dynamics for the analised Italian regions.

To test if across time and across Italian regions there is σ-convergence, I measure the spread-dispersion of the regional income distribution within the overall national distribution across time, using the coefficient of variations of real per capita income.

The following Figure 2 plots the coefficient of variation in real per capita income across Italian region over all time-period.

FIGURE 2



Notes: Coefficient of variation is in scale (1: 10,000000)

Looking at the coefficient of variation, it could be possible to note that after a slight fall in the 1971 and 1975, and in the 1983 and, again, in the 1991 and 1993, the dispersion in real GDP per head increases more continuously until the end of the time period. Specifically, after the 1983, it increases sharply until 1990. Then, the cross-regional distribution of real income per head shows that the time period between the 1970 and 1996 was a period of ongoing σ-divergence.

5 Test the absolute β-convergence on per capita income across Italian regions.

Now, I investigate the empirical validity of the neoclassical long-run absolute β-convergence prediction on the level of real per capita income across Italian regions for the whole period 1971-96. Specifically, I estimate the convergence-growth- specification as:

$$AVGR\ (y_{i,t}) = \alpha_i + \beta\ Ln(y_{i,0}) + \varepsilon_{i,t} \qquad \text{(Eq.1)}$$

where the dependent variable is AVGR is the average of real growth rates in per capita income for each economy into the sample and across all time period investigated; on the right hand side, the explanatory variable is the logarithm of the level of real per capita income in the starting year while (α)[8] is a constant and (ε) is an error term.

Running the regression on the unconditional convergence growth- equation for the all time-period, 1971-96 I find econometric significant evidence of absolute β-divergence across twenty Italian regions, see Table 1.

TABLE 1
Absolute- β-Divergence Across Twenty Italian Regions.
(Time-period: 1971-96)

	Cross-sectional-regression		
Dependent Variable	**α**	***β***	**R**
Eq. 1.			
AVGR (yi,t)	0.013	0.0005	0.0009
	[0.07]	[0.004]	

Notes: Regressions carried out using Microfit (4.1)
Number of observations are 20, i.e the number of Italian regions.
Standard errors in brackets
(*) indicate coefficient is significant at 10% level or above

TABLE 2

Statistical test:	
-	**1^ Regr.**
LM test for serial correlation	2.15*t
Functional Form	3.03*
Heteroscedasticity	0.06*

(*) indicate coefficient is significant at 10% level or above

The cross-regional regression passes the statistical tests and the estimated coefficient of the initial level of real GDP per head [$\beta_{Ln(1970)}$] is not

significant and it has a positive sign. Also the intercept is not significant. Then, across all time period 1971 to 1996, across the twenty Italian regions there is not evidence of absolute β-convergence. Therefore, the evidence suggests that since the 1970s until the 1990s, differences in regio-specific steady-states had become more pronounced. However the R-squared indicate that they do not fit very well, maybe because the long-time period comprises different dynamic of the Italian economic system [9]. Thus, I subdivide the long-time horizon. Running the unconditional-convergence-growth equation for two sub-periods, specifically, 1971 to 1981 and 1981 and 1996 other interesting results emerge. Table 3 show the results.

TABLE 3

Cross-sectional-regression			
Dependent Variable	**α**	**β**	**R**
AVGR (yi,t)	0.013	0.0005	0.0009
1971-96	[0.07]	[0.004]	
1^ Sub-period			
1971-81	0.016	0.0007	0.0006
	[0.12]	[0.007]	
2^ Sub-period			
1981-96	-0.025	0.002	0.032
	[0.055]	[0.003]	

Notes: Regressions carried out using Microfit (4.1)
F-tests statistically significant at 5% level. Number of observations are 20, i.e the number of Italian regions. Standard errors in brackets; (*) indicate coefficient is significant at 10% level or above

TABLE 4

Statistical test:		
	1^sub-period.	**2^ sub-period.**
LM test for serial correlation	2.89*	0.006*
Functional Form	1.82*	2.83*.
Heteroscedasticity	0.61*	0.01*.

(*) indicate coefficient is significant at 10% level or above

For the both sub periods there is not evidence of unconditional-β-convergence. In particular, for the two different sub-periods the estimated

[8] The constant in the regression express the assumption that all economies into the sample share the same production function; i.e. they are homogenous economies, that is to say they have the same structural characteristics

[9] The time under consideration comprises the end of an active industrialisation policy in favour of southern regions, the end of the economic miracle and the implementing of a income transfers-policy towards the populations of the South, and the enter of Italy in the CE and then in the EU

coefficient β is still positive and not significant and also the intercept is not significant. In particular, for the second sub-period, 1981-1996, the estimated value of α has a negative sign. Furthermore, this implies that not only in the latter sub-period there is evidence of absolute β-divergence but such divergence lead regional economies to become more different in their structural characteristics across time. Then, the results reject the hypothesis of unconditional β-convergence across Italian regions over all time-period 1971 to 1996, but also over the two sub-periods, 1971 to 1981 and 1981 to 1996 with the latter showing that divergence lead Italian regional economies to became more different in their structural characteristics across time.

Concluding remarks

This work tests empirically the validity of the neoclassical regional growth model for the growth process across the Italian regions in the time-period between 1971 to 1996. Empirically, it investigates the validity of the neoclassical predictions on σ-convergence and absolute β-convergence in terms of per capita income.

In contrast with previous empirical studies, using regional annual data in constant 1990 prices, the cross-regional distribution of real income per head shows that the time period between the 1970 and 1996 was a period of ongoing σ-divergence. Specifically, looking at the coefficient of variation of real GDP per head, I note that after a slight fall in the 1971 and 1975, and in the 1983 and, again, in the 1991 and 1993, the dispersion in real GDP per head increases more continuously until the end of the time period. Specifically, after the 1983, it increases sharply until 1990.

Furthermore, I test the hypothesis that huge dispersion in real per capita income since the 1980s accelerates because of increases in regional unemployment. This hypothesis is supported by the data. However, to verify if such trend in regional inequality in terms of dispersion in real GDP per head has to be view as a temporary intra-regional or of interregional misallocations of resources given, I examine the hypothesis of unconditional

β-convergence across Italian regions over all time-period 1971 to 1996, but also over the two sub-periods, 1971 to 1981 and 1981 to 1996. I find absolute β-divergence across the twenty Italian regions over all time period. However, I note that since the 1980s divergence come from the fact that Italian regional economies became more different in their structural characteristics across time.

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