Uneven Regional Development in Italy: Explaining Differences in Productivity Levels

Francesco Aiello and Vincenzo Scoppa

Abstract Many empirical studies have analysed the convergence of the Italian regions, but no evidence is provided on the causes of differences in productivity levels. Moving from a recent approach focusing on differences in levels across countries, rather than in growth rates (Hall-Jones, 1999), the determinants of regional differences in levels of labour productivity and Total Factor Productivity are investigated. Through an evaluation of regional stock of physical and human capital, we carry out the decomposition of the output per worker in the contribution deriving from factor accumulation and from TFP. The paper achieves two relevant results. First, the growth accounting exercise shows that regional disparities in output per worker are mainly due to the differences in TFP, rather than in inputs accumulation. Second, the estimation of an econometric model of the determinants of TFP, in contrast with previous studies, shows the importance of some variables (infrastructures, state intervention, financial system, property rights enforcement) in explaining Italian regional differences.

JEL Classification: O47; R11; O11.

1. Introduction

In the recent empirical literature, stimulated by New Growth theories, and in the long-running debate on the lags in development of the Mezzogiorno (Southern Italy) and problems of dualism of the Italian economy, scant attention has been paid to find the causes of the differences in regional levels of output per worker.

The main purpose of this paper is to evaluate – using the Growth Accounting approach – to what extent differences in levels of output per worker (rather than in growth rates) can be ascribed to the quantity of inputs employed (physical and human capital) and to what extent they are attributable instead to differences in the efficiency in their use, that is to say, to differences in Total Factor Productivity (TFP). To this end, new measures for human and physical capital across regions are provided.

Growth accounting does not explain, however, why factor accumulation or factor productivity differs so widely across regions or countries. The second part of the paper attempts to single out the determining variables in order to answer this question. It is underlined the fact that the main cause of the development gaps lies in differences in TFP rather than in differences in factor accumulation and an attempt is made to grasp the most important variables in explaining TFP through cross-section regression analysis. The variables considered are those suggested by growth theories and by the traditional policy debate about the dualism of Mezzogiorno: endowment of infrastructures, structure and development of the financial system, enforcement of property rights and crime rates, level of public intervention, etc..

The investigation into the disparities in regional development in Italy has much in common with the recent studies examining the hypothesis of a process of convergence across Italian regions. These studies – based on regressions of growth rates on the initial income levels and other economic variables – have produced mixed results. Yet, they have reached a substantial consensus as regards the following two points: 1) there has been no absolute convergence (apart from a short period up to the middle of the 1970s), that is, there does not appear to be any tendency for less developed regions to grow faster than the more developed ones; 2) there is, nevertheless, a certain degree of conditional convergence; that is to say, each region tends to reach its own steady state. However, there is no analysis on levels of productivity among Italian regions, as recently carried out on a cross-country level (Hall-Jones, 1999; Klenow-Rodriguez Clare, 1997b). Besides, there are theoretical and empirical factors which cast some doubt on growth rate approach and suggest the examining of differences in levels.

In the light of these factors, in this paper attention has been focused on levels rather than growth rates: the aim is not to find out whether there is, in fact, any convergence but to evaluate the principal determinants

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in the persistent differences detected in productivity levels among Italian regions. The results obtained show
that many of the variables considered important in the past – infrastructure, financial system, social
environment – which have not resulted significant in the studies on convergence turn out, in fact, to be
important for productivity.

The paper has been organized in the following way. Section 2 is a brief survey of literature on
convergence between Italian regions, Section 3 offers some reasons to focus on levels instead of growth
rates. Section 4 explains the methodology of growth accounting and Section 5 presents data on the stock of
human and physical capital at regional level, the decomposition of labour productivity and the determination
of TFP. Finally, Section 6 is dedicated to an econometric analysis to find out the effects of some economic
variables on regional differences in productivity.

2. Convergence in Italy: a brief summary of the literature

Neo-classical theory suggests that the income of poorer regions will converge, in the long run, to that of the
richer regions and that, as a consequence, the growth rate of a region is inversely correlated to its initial level
of per capita income (Solow, 1956). This process of absolute convergence takes place when the regions share
the same steady state level, in other words, when exogenous variables - preferences, technology, demographic growth - are equal for poor and rich regions.

As regards applications of the neo-classical growth model to the Italian situation, the publication of
Barro-Sala-i-Martin’s work in 1991 restarted a wide and lively debate on convergence. This study analyses
convergence in Europe and, as far as Italy is concerned, the most important result to emerge is completely in
contrast with interpretations stressing the dualistic nature of the Italian economy. With reference to the
period 1950-1985, the two authors, in fact, show that there was a process of absolute convergence taking
place at an annual rate of 2%. Similar conclusions are obtained in a more recent work by Sala-i-Martin
(1996).

However, other studies which have examined the question of convergence in the Italian economy have
arrived at quite different conclusions from those of Barro-Sala-i-Martin (1991). Indeed, many papers tend to
exclude any process of absolute convergence, while others claim that such a process took place up to the
middle of the 1970s but that the growth tendency of the Italian economy has been inverted in the last twenty
or twenty five years (Mauro-Podrecca (1994), Cosci-Mattesini (1995, 1997), Paci-Pigliaru (1995), Cellini-
(1997)).

Mauro-Podrecca (1994), in particular, show how the conclusions drawn from the evidence gathered by
Barro and Sala-i-Martin were influenced by the use of data not timely homogeneous. In order to overcome
this problem, the authors subdivided the period 1963-89 into three sub-periods based on the availability of
homogeneous data within each time period1. Their results appear to exclude the possibility that there was a
process of absolute convergence of per capita income covering the entire country, even if, when labour
productivity is used as a measure of regional differences, it appears that growing convergence can be seen
only in the 1960s and 1970s, but not in the last ten years considered (Mauro and Podrecca, 1994).

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productivity is used as a measure of regional differences, it appears that growing convergence can be seen
only in the 1960s and 1970s, but not in the last ten years considered (Mauro and Podrecca, 1994).

The use of a new data base allows Paci-Saba (1998) to overcome the problems found in the work of
Barro and Sala-i-Martin and to evaluate convergence in Italy over the period 1951-1993. Their analysis
shows absolute convergence in output per worker and per capita income over the entire period under study.
However, they also show that this finding is in large part due to a catching up process which really involves
only the period from 1960 to the mid 70s (Paci-Saba, 1998)2

1 The decision to subdivide the analysis into three periods was justified by the fact that the data comes from
(Mauro and Podrecca, 1994, pp. 452-3).

2 The diversity of the periods analysed in different works does not allow us to identify the exact year in which the
Italian regional economies stopped converging and began to diverge. Nevertheless, Paci-Saba (1998) make a
strong case for 1975, because the pattern of both the growth indicators used - per capita income and labour
productivity - changes direction in that year. These findings help to explain the conclusion of Barro-Sala-i-Martin
(1991) and Sala-i-Martin (1996), because the periods studied in both these works cover the years in which Italy
was undergoing a marked process of global convergence.
These empirical studies supply clear evidence of the absence of an overall process of absolute convergence between different parts of the country. A likely explanation for this outcome is that Italian regions converge towards different steady state levels of output per worker, that is, there is conditional convergence. The empirical tests of this hypothesis have led to heterogeneous results, which strongly depend on the way conditional convergence is measured. In fact, when differences in regional steady state equilibria are proxied by regional dummies, the econometric evidence suggests the presence of conditional convergence (Mauro-Podrecca, 1994; Paci-Pigliarì, 1995; Paci-Saba, 1998; Di Liberto, 1994, Cosci-Mattesini, 1995), while, when regional differences are measured using some specific socio-economic variables, the outcomes are contrasting. However, the presence of conditional convergence is demonstrated in a much greater number of works (Di Liberto, 1994; Cellini-Scorcu, 1997b; Cosci-Mattesini, 1995; 1997; Fabiani-Pellegrini, 1997; Ferri-Mattesini, 1997, Bianchi-Menegatti, 1997; Di Liberto-Symons, 1998) than the ones which exclude such a possibility (Mauro-Podrecca, 1994; Paci-Pigliarì, 1995) or others which find evidence of its existence only up to the end of 1980s (Cellini-Scorcu, 1997a). Based on the empirical investigations supplied by the work on this argument, it would seem, therefore, reasonable to maintain that there has indeed been a process of conditional convergence taking place in the Italian economy.

Besides the results on the existence of conditional convergence, these studies provide important insights to understanding whether and how the considered structural variables influence growth in the Italian economy. In all the papers, the variables used as proxies of structural differences among regions or provinces include both those indicators which in cross-country analyses provide sound explanations for differentials in growth and specific variables representing the model of development in Italy. These are proxies of infrastructure levels, efficiency of the financial system, agglomeration economies, institutions, government intervention, migration and specialisations in production.

The wide variety of results makes it impossible to reach any unequivocal conclusion. This is also due to the fact that the estimates obtained have weak statistical significance and, therefore, make interpretation both of the sign and of the value of the estimated parameters difficult.

Nevertheless, for certain important aspects there is enough empirical evidence to enable the authors to find some common ground. Investment, in particular, is a variable with a highly significant explanatory power when dealing with differences in growth rates between countries, whereas it is not significant when considering models of growth in the Italian economy (Del Monte-Giannola, 1997; Paci-Pigliarì, 1995; Mauro-Podrecca, 1994). On the contrary, the impact of public spending on growth rates is both negative and significant (Paci-Pigliarì, 1995; Di Liberto-Symons, 1998). A further element on which there is wide consensus among authors, concerns a strong statistical relationship between levels of infrastructure and growth rates (Ferri-Mattesini, 1997; Paci-Pigliarì, 1995), whereas the evidence for the effects of human capital (Paci-Pigliarì, 1995, Bianchi-Menegatti 1997, Mauro-Podrecca, 1994; Cosci-Mattesini, 1995 and 1997) and for many financial, institutional and environmental indicators (Fabiani-Pellegrini, 1997; Cellini-Scorcu 1997b; Cosci-Mattesini, 1997; Usai-Vannini,1999) is ambiguous and difficult to interpret.

3. Why focus on levels rather than on growth rates

As noted above, several recent studies have dealt with the question of the developmental gaps across Italian regions. In the wake of cross-country studies, the approach has concentrated on the analysis of the determinants of growth rates and the problem of convergence or lack of it.

This paper, on the other hand, focuses attention on the analysis of the determinants of the levels of output per worker, instead of growth rates. This approach has been followed for a number of reasons.

First of all, such an analysis has never been applied to the Italian regions and it is worthwhile paying attention to levels, because, as Hall-Jones (1999, p. 85) argue, “levels capture the differences in long-run economic performance that are mostly directly relevant to welfare as measured by the consumption of goods and services”.

3 Many other studies bring to light further empirical evidence to support the hypothesis according to which there was a recovery in terms of growth which affected the regions of the Mezzogiorno compared to the richer regions of Central and Northern Italy only in the 1960s and 1970s, while no convergent pattern in Italian development re-emerged in the 1980s (Di Liberto, 1994; Piras, 1992; Cellini-Scorcu, 1997a; Paci-Pigliarì, 1995; Cosci-Mattesini, 1995, Fabiani-Pellegrini, 1997).
Secondly, a number of theoretical and empirical factors, suggested by many recent contributions, casts some doubts on the validity of the approach on growth rates and solicits a focus on levels (Easterly-Kremer-Pritchett-Summers, 1993; Klenow-Rodriguez Clare, 1997b)

Easterly et al. (1993) highlight some econometric pitfalls which undermine studies on growth rates. They observe that the growth rates of most countries vary widely over time and show weak correlation between one period and another. On the other hand, the typical explanatory variables – accumulation rate, weight of public sector, levels of education, etc. – used in the regressions of growth rates demonstrate a great persistence over time.

These features are also confirmed by data on Italian regions. For example, the correlation coefficient between regional growth rates for the period from 1960 to 1979, and growth rates for the period from 1980 to 1993 is a tiny 0,16 (see Figure 1). On the other hand, the correlation between investment levels (total investment for all sectors) for the corresponding periods is above 0,95, as are the results for both collective consumption and levels of education4.

Figure 1. Italian regions. Correlation between growth rates of income per capita (1960-79 vs. 1980-93).

This evidence seriously challenges the results of regressions in conditional convergence because it is difficult to explain how a constant pattern of the explanatory variables could give rise to such great fluctuations in growth rates.

Another point closely related to the conclusions of Easterly et al. (1993) comes from Jones’(1995) analysis of the time series used in the growth regressions. He found that the growth rates of most developed countries are stationary series, trendless and without any unitary roots. Nevertheless, the explanatory variables used in the new growth theories (AK models and models based on R&D) are often characterized by a large trend component. Commenting on Jones’ work, Solow observes that “there is no trend, neither deterministic nor a unit-root trend, in the growth rates. Therefore, any other time series that is to have a permanent effect on the growth rate ought to be trendless as well” (Solow, 1994, p.112).

Easterly et al. (1993) show that the low persistence of growth rates can be explained by a model with gradual diffusion of technological progress on a global level, while countries are relatively close to their own steady state levels determined, in turn, by their characteristics and policies. Thus, characteristics and policies determine levels of output but do not explain growth rates, which are rather determined by a series of shocks that hit the various economies. Similar models in which all countries grow at the same rate, but are different in levels of productivity and income, have recently been proposed by Parente-Prescott (1994), Barro-Sala-i-Martin (1997) and Eaton-Kortum (1996).

A further reason for investigating differences in levels across regions is provided by the empirical evidence on convergence which, instead of absolute convergence, shows some conditional convergence at work across Italian regions, confirming the existence of differences in steady state levels. In fact, as shown in Section 2, the studies regarding Italy demonstrate that absolute convergence ceased to occur at the middle of

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4 Data are from CRENOS databank (http://www.crenos.unica.it/databanks/italian.html).
the 1970s. This is clearly confirmed by the time pattern of the standard deviation of regional per capita incomes (\( \sigma \)-convergence) over the period 1960-93 (Figure 2).

**Figure 2. Dispersion of income across Italian regions.**

![Dispersion of income across Italian regions](image)

\( \sigma \) = Standard deviation of regional per capita incomes.
Source: own computations. Data are from Crenos’ databank.

Different results emerge when conditional convergence is examined, since a number of studies shows that there is quite a strong process of conditional convergence. This implies that Italian regions tend towards different steady state levels.

On the basis of cross-country evidence, which, as explained, reflects the evidence found in Italy, Klenow-Rodriguez Clare (1997b, p. 610) conclude: “Recent studies finding that the rate of conditional convergence is large suggest that countries are near their steady state relative income levels. This is also suggested by the fact that there is no absolute convergence. Thus, to explain differences in income levels, it is necessary to explain differences in steady state income levels”.

### 4. The decomposition of output per worker through levels accounting

An analysis of regional gaps in output levels requires, first of all, a comparative evaluation of the quantity of inputs employed and their contribution to the determination of output. Growth accounting - see for example Solow (1957) and Denison (1967) – allows us to identify to what extent the output of a given region or its growth rate is due to the accumulation of inputs – physical capital, human capital and raw labour – and to what extent it is due to Total Factor Productivity (TFP).

In our analysis, the output is separated by distinguishing the contribution of inputs from that of productivity. This procedure follows some recent studies which – abandoning the approach based on growth rates and convergence – adopt a methodology which estimates the levels of per capita output or productivity (Hall-Jones, 1997 and 1999; Klenow-Rodriguez-Clare, 1997; McGrattan-Schmitz, 1998).

The starting point of the analysis is a neoclassical aggregate production function augmented to include human capital as in Mankiw-Romer-Weil (1992). It is assumed that the aggregate production function is a Cobb-Douglas with constant returns to scale (with the same form across regions):

\[
Y_i = (K_i)^{\alpha} \left(A_i L_i h_i \right)^{1-\alpha}
\]  

[1]

The level of output in region \( i \) (\( Y_i \)) is determined by the stock of physical capital available in the region (\( K_i \)), by a measure of the technology level \( A_i \) (labour augmenting measure of productivity),\(^5\) and by the number of workers employed (\( L_i \)) multiplied by the individual amount of human capital (\( h_i \)). The coefficient

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\(^5\) It is assumed that technical progress is labour augmenting (or Harrod-neutral) as opposed to Hicks-neutral.
\( \alpha \) is the output elasticity of capital, which represents, in a neoclassical framework, the capital’s share of national income and, consequently, \((1-\alpha)\) is the fraction of total income accruing to labour.

As regards the determination of human capital, the procedure – following Bils-Klenow (2000) – is based on the *earnings functions* proposed by Mincer (1974). Mincer estimated the returns to investment in education through a regression in which the log of a worker’s wage \( \ln(w_i) \) depends on her/his years of schooling \( S_i \) and experience \( T_i \) (the latter variable enters into the equation as quadratic). The following is a typical Mincerian equation:

\[
\ln(w_i) = \gamma S_i + \psi_1 T_i + \psi_2 T_i^2
\]

where \( \gamma \) represents the rate of return to each year of schooling and \( \psi_j \) denotes the returns to training. Thus, the stock of human capital per worker for region i, \( h_i \), is assumed to be equal to:

\[
h_i = e^{\psi_1 S_i + \psi_2 T_i S_i^2}
\]

where \( S_i \) and \( T_i \) refer in this case to the regional average values. 

The production function [1] can be expressed in terms of output per worker, dividing both members by \( L_i \):

\[
\frac{Y_i}{L_i} = \left( \frac{K_i}{L_i} \right)^{\alpha} \left( A_i h_i \right)^{1-\alpha}
\]

By multiplying the right-hand member by \( \left( \frac{Y_i}{Y_i} \right)^{\alpha} \) and rearranging one gets:

\[
\frac{Y_i}{L_i} = \left( \frac{K_i}{Y_i} \right)^{\alpha} A_i h_i
\]

Thus, on the basis of equation [5] we can obtain a measure of Total Factor Productivity \( A_i \):

\[
A_i = \frac{\left( \frac{Y_i}{L_i} \right)^{\alpha}}{\left( \frac{K_i}{Y_i} \right)^{\alpha} h_i}
\]

Equation [6] is of crucial importance for our analysis because it allows us to determine directly the level of TFP across regions by using data on output per worker and the capital-output ratio, the coefficient \( \alpha \)

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6 In the literature a series of heterogeneous measures have been employed to estimate human capital (see Barro and Lee, 1993). Bils-Klenow (2000) argue that *earnings functions* provide the best results.

7 Because of the well-known difficulty in finding reliable data on training, some authors adopt a simplified version of equation [3] in which years of experience \( T_i \) are not considered, that is, \( h_i = e^{\gamma S_i} \).


\[
H = \frac{s_t}{n + g + \delta}, \text{ where } s_t \text{ represents investment in human capital.}
\]
(the share of capital in total output), the years of schooling and experience and estimates for the returns to investment in human capital.

5. Measuring physical and human capital and TFP by region

The main data sources used for the 20 Italian regions are ISTAT (Italy’s National Statistical Institute) Regional Economic Accounts, 1999 (Conti Economici Regionali, Anni 1980-1996) for the period 1980-1996 (plus recent updating for 1997) and SVIMEZ ("I conti economici delle regioni italiane dal 1970 al 1998") for the period 1970-1979. Variables are computed at current price for the year 1997, the most recent year for which all the necessary data are available. All the economic sectors are considered.

The level of output per worker \( (Y/L) \) by region is obtained as the ratio between the regional value added and the total units of labour (“unità di lavoro totali”).

5.1. Physical capital

To determine regional capital stocks the research was carried out in two stages. First, the perpetual inventory method was used to calculate a provisional stock of capital \( \hat{K}_j \) in order to compute each regional share of capital:

\[
\eta_i = \frac{\hat{K}_i}{\sum_{j=1}^{20} \hat{K}_j}.
\]

Then, the regional absolute value for capital stock (in 1997) was obtained by dividing up among the regions – according to the shares \( \eta_i \) – the stock of capital at national level (as recently estimated by ISTAT\(^9\)), which we consider a more reliable measure of the stock of capital.

The perpetual inventory method allows us to build a measure of capital stock based on net investment over time.\(^11\) The estimate for capital in the first year \( \hat{K}_0 \) is the starting point for the analysis. In the neoclassical growth model, the steady state level of capital per worker \( k^* = K/L \) can be expressed as:

\[
k^* = \frac{s f(k^*)}{n + g + \delta} = \frac{I/L}{n + g + \delta}
\]

where \( s \) represents the saving rate, \( f(.) \) is the per worker production function, \( n \) is the growth rate of the labour force; \( \delta \) is the depreciation rate, \( g \) is the rate of technical progress, which can be approximated by the growth rate of labour productivity, and \( I \) represents total investments. Multiplying by \( L \), the result (taken at time \( t_0 \)) is:

\[
\hat{K}_0 = \frac{I_0}{n + g + \delta}.
\]

Given \( \hat{K}_0 \), the subsequent values of capital \( \hat{K}_t \), are obtained through the following dynamic equation:

\[
\hat{K}_{t+1} = (1 - \delta)\hat{K}_t + I_t.
\]

The first year \( t_0 \) for which data are available is 1970. The calculations were carried out using total investment at constant prices, by setting the depreciation rate at \( \delta = 6\% \), \( n \) equal to the growth rate of labour force for every region, \( g \) is calculated as the growth rate of labour productivity. In Table 1 we report the regional shares of net capital stock, as determined by the perpetual inventory method.

\(^9\) These data have been made available very recently by Istat, “Conti economici territoriali secondo il Sec95” (October 2000).


Finally, the net capital stock for each region used to determine TFP was obtained by dividing up the net stock of capital in 1997 for Italy as a whole ($K_{ITA} = 6.124,897$ billions of lira), according to regional shares ($\eta_i$): $K_i = \eta_i K_{ITA}$.

Only recently has there been some paper evaluating the stock of capital at a regional level: see Bonaglia-Picci (2000), Paci-Pusceddu (1999) and Picci (1995). All these studies, following more rigorous and sophisticated methods, obtain results very similar to ours.\textsuperscript{12}

The capital share $\alpha$ was calculated as the ratio of gross profits to the value added ("Quota dei profitti lordi sul valore aggiunto al costo dei fattori"). The average value over the period 1980-1998 is $\alpha = 28.24\%$ (ISTAT, Rapporto annuale 1999: la situazione del paese).

### 5.2. Human capital

In order to obtain an indicator of regional human capital, we use the earnings functions of education proposed by Mincer (1974), based on the average years of education and experience of the labour force for every region ($S_i$ and $T_i$) and on parameters $\gamma$, $\psi_1$, and $\psi_2$ in equation [2].

The calculation of years of education is obtained by the number of years required to reach a certain level of qualification, weighted by the relative regional educational qualifications (see Di Liberto-Symons, 1998). In symbols:

$$S_i = \sum_j n_j \frac{Q_{ij}}{L_i}$$  \[9\]

where $j$ represents educational level, $n_j$ the number of years required to attain the $j$-th level of education,\textsuperscript{13} $Q_{ij}$ expresses the number of workers in region $i$ for whom $j$ represents their educational qualification. Data are from ISTAT ("Indagine ISTAT sulle forze di lavoro 1997")\textsuperscript{14}.

With regard to the years of experience (on-the-job training), the usual specification $T_i = (Age_i - S_j - 6)$ (see Bils-Klenow, 2000) is amended considering the factor $(1 - u_i)$ (where $u_i$ is the average unemployment rate for region $i$ over the period 1980 to 1996) in order to take into account the different regional labour markets situations. The idea is that in regions with higher levels of unemployment

\begin{table}
\centering
\begin{tabular}{lcc}
\hline
Regions & Regions \\
\hline
Piemonte & Abruzzo & 2.1\% \\
Valle d’Aosta & 8.4\% & Molise & 0.6\% \\
Lombardia & 18.6\% & Campania & 7.3\% \\
Trentino Alto Adige & 2.2\% & Puglia & 4.9\% \\
Veneto & 8.3\% & Basilicata & 1.1\% \\
Friuli Venezia Giulia & 2.5\% & Calabria & 2.9\% \\
Liguria & 3.6\% & Sicilia & 6.7\% \\
Emilia Romagna & 7.4\% & Sardegna & 3\% \\
Toscana & 6\% & Northern Central regions & 71.4\% \\
Umbria & 1.5\% & Italy & 100\% \\
Marche & 2.5\% & Mezzogiorno & 28.6\% \\
Lazio & 9.8\% & \\
\hline
\end{tabular}
\caption{Regional shares of net capital stock ($\eta_i$). Year=1997}
\end{table}

\textbf{Source:} own computations. Data are from ISTAT (various publications) and Svimez (Regional Economic Series).

\textsuperscript{12} In fact, the correlation coefficients among our capital stock series and Paci-Pusceddu’s is 0.998, whereas with respect to Bonaglia-Picci’s is 0.974.

\textsuperscript{13} The calculations are as follows: 0 for no academic qualification, 5 for completing primary education, 8 for completing lower secondary, 13 for completing secondary education and 18 for a degree.

\textsuperscript{14} A similar calculation has been carried out on the basis of data from ISTAT (Censimento della Popolazione 1991). The results do not substantially differ from those used in this analysis.
the representative worker has received less years of on-the-job training compared to workers of low unemployment regions. Therefore, we determine $T_i$ as follows:

$$T_i = (Age_i - S_i - 6)(1 - u_i)$$  \[10\]

As for educational and experience rate of returns, we used, as reference, the micro-econometric analysis carried out by Colussi (1997), based on the survey conducted by the Bank of Italy on Italian households (“Survey of Household Income and Wealth”). The estimated coefficients are the following: $\gamma = 7.65\%$; $\psi_1 = 2.09\%$; $\psi_2 = -0.0001827$ (see Colussi, 1997, p. 261).

5.3. Total Factor Productivity

Table 2 displays, on the basis of equation [6], the decomposition of output in the contribution deriving from factor accumulation and TFP. To better evaluate capital accumulation, data on the capital labour ratios, $K/L$ was also included. Regional values are compared to the Italian ones.

In order to consider how our results are sensitive to the chosen parameters (see the remarks in Mankiw, 1997), the variables were assessed using alternative coefficients for $\alpha$, $\gamma$, $\psi_1$, $\psi_2$. With respect to $\alpha$, we used, as alternative values, $\alpha = 1/3$ (the figure used in the standard neoclassical approach) and $\alpha = 0.39$ (used for Italy by Barro-Sala-i-Martin, 1991). With respect to the parameters in the earnings function, the coefficients estimated for Italy by Psacharopoulos (1994) were used: $\gamma = 0.028$; $\psi_1 = 0.010$; $\psi_2 = -0.00027$.

For each parameter, new estimates for the variables are built. In all the cases, the correlation coefficients between series in Table 2 and the new series are always higher than 0.98. These results indicate that the chosen values do not affect significantly our variables of interest.

In Table 2 we find a few well known facts in the debate regarding the development of the Italian economy together with some more surprising evidence.

The labour productivity differences in favor of the Northern and Central regions are considerable. Valle d’Aosta (13% more than the national average), Lombardia (+12%), Lazio (+8%) and Piemonte (+6%) are the regions with the highest levels of output per worker, while Calabria (-19%), Puglia (-17%) and Campania (-14%) record the lowest levels. Given the general low level of employment in Southern regions, the differences in per capita income are much more marked.

The estimates of the capital-output ratio (second column) puzzlingly show that most of the Southern regions have a higher capital-output ratio than the Central and Northern regions. Apart from Valle d’Aosta (+18%), we observe the most elevated capital-output ratios in Basilicata (+16%), Sardegna (+13%) and Calabria (+11%); on the other hand, Emilia Romagna (-6%), Toscana (-4%) and Lombardia (-4%) have the lowest ratios.

This finding confirms what has been brought to light in many studies (see, for example, Galli-Onado, 1990): in contrast with the evidence at an international level, in the case of Italian regions there is some negative correlation between capital accumulation and the level of development. When capital per worker ($K/L$) is considered (excluding the outlier Valle d’Aosta), practically no correlation emerges between $Y/L$ and $K/L$ ($\rho = 0.02$) and the richest and poorest regions do not differ significantly with respect to $K/L$.

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15 The average rate of return at international level is 6.8% (for OECD countries) (see Psacharopoulos, 1994; McGrattan-Schmitz, 1997).

16 Given the method followed to compute the regional stock of capital, the depreciation rate chosen has almost no effect.

17 These results are available upon request.

18 Standard deviation for income per capita is 0.25 and R is equal to 1.87 (see also Paci-Saba, 1998).
Table 2. Labour productivity, capital-output ratio, human capital per worker and TFP by region (Italy=1). Year: 1997.

<table>
<thead>
<tr>
<th>Regions</th>
<th>Y/L</th>
<th>K/Y</th>
<th>H</th>
<th>K/L</th>
<th>TFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piemonte</td>
<td>1.064</td>
<td>0.988</td>
<td>1.001</td>
<td>1.031</td>
<td>1.075</td>
</tr>
<tr>
<td>Valle d’Aosta</td>
<td>1.127</td>
<td>1.183</td>
<td>0.990</td>
<td>1.727</td>
<td>0.963</td>
</tr>
<tr>
<td>Lombardia</td>
<td>1.118</td>
<td>0.962</td>
<td>1.026</td>
<td>1.014</td>
<td>1.132</td>
</tr>
<tr>
<td>Trentino Alto Adige</td>
<td>1.038</td>
<td>1.015</td>
<td>1.006</td>
<td>1.077</td>
<td>1.017</td>
</tr>
<tr>
<td>Veneto</td>
<td>0.994</td>
<td>0.963</td>
<td>0.999</td>
<td>0.902</td>
<td>1.033</td>
</tr>
<tr>
<td>Friuli Venezia Giulia</td>
<td>1.028</td>
<td>1.026</td>
<td>1.023</td>
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<td>0.980</td>
</tr>
<tr>
<td>Liguria</td>
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<td>1.074</td>
<td>1.026</td>
<td>1.272</td>
<td>0.963</td>
</tr>
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<td>Emilia Romagna</td>
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<td>0.937</td>
<td>1.014</td>
<td>0.873</td>
<td>1.081</td>
</tr>
<tr>
<td>Toscana</td>
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<td>0.996</td>
<td>0.880</td>
<td>1.018</td>
</tr>
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<td>Umbria</td>
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<td>1.026</td>
<td>0.907</td>
</tr>
<tr>
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<td>1.001</td>
<td>0.893</td>
<td>0.941</td>
</tr>
<tr>
<td>Lazio</td>
<td>1.076</td>
<td>0.991</td>
<td>1.054</td>
<td>1.053</td>
<td>1.030</td>
</tr>
<tr>
<td>Abruzzo</td>
<td>0.900</td>
<td>1.049</td>
<td>1.005</td>
<td>1.018</td>
<td>0.854</td>
</tr>
<tr>
<td>Molise</td>
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<td>1.101</td>
<td>0.983</td>
<td>1.217</td>
<td>0.879</td>
</tr>
<tr>
<td>Campania</td>
<td>0.865</td>
<td>1.053</td>
<td>0.965</td>
<td>0.886</td>
<td>0.851</td>
</tr>
<tr>
<td>Puglia</td>
<td>0.837</td>
<td>1.021</td>
<td>0.961</td>
<td>0.882</td>
<td>0.853</td>
</tr>
<tr>
<td>Basilicata</td>
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<td>1.161</td>
<td>0.941</td>
<td>1.332</td>
<td>0.834</td>
</tr>
<tr>
<td>Calabria</td>
<td>0.810</td>
<td>1.114</td>
<td>0.960</td>
<td>1.065</td>
<td>0.758</td>
</tr>
<tr>
<td>Sicilia</td>
<td>0.919</td>
<td>1.058</td>
<td>0.964</td>
<td>1.060</td>
<td>0.902</td>
</tr>
<tr>
<td>Sardegna</td>
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<td>1.135</td>
<td>0.935</td>
<td>1.220</td>
<td>0.833</td>
</tr>
<tr>
<td>Italy</td>
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<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

| Standard Deviation | 0.090| 0.068| 0.031| 0.196| 0.098|
| Correlation with (Y/L) | 1.000| -0.268| 0.713| 0.308| 0.849|
| R                 | 1.292| 0.952| 1.065| 1.139| 1.274|

R: Ratio 4 richest to 4 poorest regions

Source: own computations. Data are from ISTAT (various publications) and Svimez (Regional Economic Series). Y/L is the ratio between the value-added per worker and the total units of labour; K/Y is the ratio between the stock of physical capital and the level of value-added; H is a measure of human capital; K/L is the ratio between the stock of physical capital and the total units of labour; TFP is the Total Factor Productivity. Data refer to 1997.

As regards human capital, there exists a notable correlation between h and Y/L, even if the differences across Italian regions are not particularly marked. Lazio (+5%), Lombardia (+3%) and Liguria (+3%) have higher human capital results, whereas Sardegna (-6%), Basilicata (-6%) and Calabria (-4%) figure at the bottom.

The most significant finding is, without any doubt, the high correlation between output per worker and the TFP indicator: the correlation is 0.85 (Figure 3). Lombardia (+13%), Emilia Romagna (+8%) and Piemonte (+7%) have the highest index of TFP. Calabria (-24%), Sardegna (-17%) and Basilicata (-17%) record the worst performances.
Further evidence for the determinants of disparities between Italian regions can be found by comparing the (geometric) average for the four richest regions (Valle d’Aosta, Lombardia, Lazio, Piemonte) with that of the four poorest regions (Calabria, Puglia, Campania, Sardegna), indicated by the ratio R in the bottom line of Table 2. In fact, it is observed that:
- labour productivity differences between rich and poor regions is about 29%;
- capital-output ratio is 5% lower in the most advanced regions;
- human capital is 6% higher in rich regions;
- TFP differences in favor of rich regions are very similar to the differential in labour productivity, being equal to 27%.

Differences between Italian regions in the light of the data reported in Table 2 and Figure 3 show clearly that most of the variation in labour productivity is explained by differences in TFP. Factor accumulation does not account for regional differences in productivity: the rich regions are so because of their greater efficiency in production and not because they employ higher levels of physical capital and human capital.

Therefore, the outcomes with regards Italian regions are in line with the findings of many other economists who, in analysis aimed at explaining productivity differences across countries (see Easterly-Levine, 2000; Hall-Jones, 1999; Klenow-Rodriguez-Clare, 1997; McGrattan-Schmitz, 1998) find that most of the disparities in output per worker are due to different levels of TFP, rather than to different levels of factor accumulation, as argued by neoclassical growth models (e.g. Mankiw-Romer-Weil, 1992). In the next section, an econometric analysis is carried out in order to single out the causes of differences in productivity.

6. An attempt to identify the determinants of Italian regional productivity

The preceding analysis provided clear empirical indications on two fronts, the first, confirming the absence of a pattern of convergence of the Italian regions towards a single steady state and the second, of the role of TFP as a variable able to explain differences in output per worker across regions.

Based on this and on the findings of the recent literature on growth it is useful, at this point, to focus attention on the causes of regional differences in TFP. In this Section, the aim of the econometric analysis is to find out to what extent, the differences in TFP across Italian regions depend on a series of variables relating to specific regional aspects.
The identification of variables which influence regional productivity is not an easy task to accomplish and it is even more difficult if one bears in mind that the phenomenon under examination is the result of a complex web of relations in which each variable can be considered both something that helps to provide an explanation and something that needs to be explained. Economists cannot say with precision what exactly determines TFP, but they know roughly that it is composed of a series of elements: «There are other possible interpretations of TFP: the education and skills of the labour force, the strength of property rights, the quality of infrastructure, cultural attitudes toward entrepreneurship and work, and so on» (Romer, 1996, p. 25). Furthermore, Hall-Jones (1999) argue that the principal explanation for gaps in development lies in the economic environment in which actors “produce, exchange, accumulate and invent”, that is to say, in the social infrastructure which the authors define as formal and informal institutions, both private and public, which oversee economic activity and supply incentives for production and accumulation. Following these arguments, it is considered reasonable to assume that among the variables which determine levels of TFP across regions there are indicators of infrastructures (INFRA), financial system development (FIN), socio-environmental conditions and enforcement of property rights (proxied by crime levels, CRIM), government intervention (GOV), and agglomeration economies (AGGL).

Furthermore, it is recognized that many of the explanatory variables used are likely to be endogenous. For example, the level of development of financial system or the infrastructure are plausibly related to the regional economic development: there is a simultaneity problem. This is quite a general problem plaguing all the empirical analysis of growth (see, i.e., Mankiw, 1995). The standard procedure adopted in literature to solve, at least partially, this problem is to use as regressors the lagged values of explanatory variables (or their average value over a certain number of years) or to find instruments for these variables employing the Instrumental Variables method (Temple, 1999). There is though a shortage of good instruments - that is, variables that have to be exogenous to economic growth, but highly correlated with the explanatory variables and, consequently, the initial value of the variable is often used as an instrument. Our approach in facing the problem follows the literature. Firstly, Ordinary Least Squares method (OLS) is applied, where the explanatory variables (in logs) are averaged over the three years period 1980-1982, apart from the index of infrastructures which refers to 1977. The use of lagged variables in OLS estimates does not unambiguously resolve the issue of causality, but it allows the understanding of whether the initial value of each regressor is a good predictor of the regional growth over the next 15 years. Besides OLS, the check for endogeneity is re-made by using the Instrumental Variables method (IV), where each lagged variable enters into regressions as its own instrument. The tests carried out (see below) allow confidence in the adopted solution.

Before presenting econometric results, here is a brief description of data. As regards infrastructure we use the indicator proposed by Bracalente-Di Palma (1982), who in the formulation of their index take into account various categories of infrastructure - transport, communications, public utilities (water, electricity, gas etc.), education, health services, tourism, entertainment facilities (e.g. sport) and socio-cultural services. Table 3 shows that in 1977 there were large differences in infrastructures between Italian regions: the highest and the lowest values occur, respectively in Lombardia and in Basilicata and, generally speaking, the Southern regions were less endowed than the Central and Northern areas. The index utilised to gauge government intervention is the ratio between the average wage per worker in the public sector and the average wage per worker in the private sector in every region. In this recent papers are followed (Alesina-Danninger-Rostagno, 1999; Aquino 2001) which document how public employment in Italy has been largely subsidised and unequally distributed across regions and demonstrate that public jobs negatively influences individuals’ attitudes towards job search, education and risk taking activities. Data in Table 3 underline that the gap between public and private wages is not relevant in Central and Northern Italian regions, whereas it is very marked in the regions of Mezzogiorno. On an regional basis, the lowest value of the ratio “public wages/private wages” occurs in Lombardia and Piemonte, where the gap of salary is about less 18% than the national value. At the opposite extreme, in Calabria and Sicilia the

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19 Bracalente-Di Palma (1982) calculate the index of infrastructure by dividing figures of basic infrastructures (roads, length of electric networks, museums, book-shops, number of seats in cinemas and theatres, beds in hospitals, etc.) to regional surface area or to regional population. This allows the authors to obtain homogenous data region-by-region. Then, standard figures are normalised and aggregated in order to determine the considered index. This procedure is repeated in Di Palma-Mazziotto-Rosa (1999).

20 Data are from the Conti Economici Regionali 1980-1996 published by Italy’s national statistical institute (ISTAT, 1999). Public job salaries are proxied by the figures of the sector of non-market services ("Servizi non destinabili alla vendita"), while wages in private jobs are those observed in regional industrial sectors.
difference in wages is in favor of public employees, respectively, 30% and 22% higher than the national benchmark (Table 3).

The development of financial systems is gauged by “Private Credit”, defined as the amount of credit to the private sector divided by GDP. This choice is based on the hypothesis that financial systems, which channel a major share of credit to the private sector, provide properly the standard financial functions (researching firms, exerting corporate control, providing risk management services, mobilising savings and facilitating transactions) and, as a consequence, positively influence economic growth (see, i.e., Levine 1997; Levine-Loayza-Beck 2000; Rajan-Zingales 1998). Private Credit is calculated by using data from Statistical Bulletin published by the Bank of Italy and refers to the credit allocated to local private industrial firms and to producing families by banks operating in each region. In 1980-1982, the ratio Private Credit/GDP in all the southern regions is less than the national average and is far below that achieved in the regions (i.e. Lombardia, Emilia Romagna, Piemonte), where banks mainly work with the private sector (Table 3).

Population density was used as an indicator of economies of agglomeration (DENS), while the proxy for socio-environmental conditions is represented by the ratio between the total number of crimes committed against the economy and the resident population (DEL). For these variables too there is a strong contrast between Southern and Central-Northern regions: except in Campania, the population density of Southern area is below the national average, while the ratio Crimes/Population indicates that property rights are better enforced in the Centre-North.

Table 4 reports econometric outcomes. An initial finding is that, from a statistical point of view, the model provides good results, the share of variability of TFP explained by the regressions being high: in OLS estimates, the adjusted $R^2$ is equal to 0.95, that is, a very satisfactory value for sectional analyses. The values of diagnostic tests (i.e., t-statistics and F-statistics) are similarly high. Moreover, in OLS estimates, the Bartlett test suggests that residuals are homoschedastic and, therefore, the results can be considered consistent and efficient. Finally, LM tests indicate that the ortogonality conditions cannot be rejected at the 5% level and this permits the considering of the instruments used as appropriate. In terms of economic interpretation, IV estimations provide some evidence that the observed relationships between TFP and the chosen explanatory variables do not appear to be driven by endogenous biases.

Table 4 also presents results derived by considering as a dependent variable the output per worker (Y/L) or the capital-output ratio (K/Y), as shown in Table 2. This extension is considered very useful because it discloses a more general picture of the phenomenon under examination, i.e. differences in Italian regional growth. In fact, after verifying the impact of each regressor on TFP, attention is paid to compare these results with the analogous ones which emerged in the other two regressions. This allows, on the one hand, the discerning of the channels (TFP or K/Y) via which the considered explanatory variables affect economic growth and, on the other, the adding of evidence on the relationship between Y/L, or K/Y, and the variables which are considered strongly relevant in explaining TFP.

As regards the interpretation of the role of the single variables in explaining regional growth, the first thing to observe in regressions on TFP and Y/L is that the parameter associated with the variable INFRA is positive. This means that the regions with the best infrastructures record a higher level of output per worker. As for the impact of INFRA on the components of aggregate production function, it emerges that regions with a higher level of infrastructure have higher productivity and lower capital intensities (even if it

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21 Evaluating the impact of the financial system on regional growth makes sense only if markets are segmented. This assumption seems to be empirically founded, since Italy still represents an interesting case of poor integration of financial markets on a regional level, that is, capital mobility across the Italian regions is far from perfect. This peculiarity of the Italian banking system has been largely debated and for a recent analysis it is worthy referring, among others, to Usai-Vannini (1999).

22 The following crimes are taken into consideration: embezzlement, counterfeiting, robbery, burglary, swindling, handling stolen property. Data are from ISTAT (Statistiche giudiziarie, 1983, Rome).

23 Results obtained in the regressions on human capital, the other component of the production function (see Equation 5 and Table 2), are not reported because of their low statistical significance: our model explains less than 5% of the variability of human capital and the single coefficients are never significant at 5%-10% level.

24 As the dependent variables are expressed as logs of components of equation 5, the lack of results on human capital (see note 23) implies that the sum of coefficients across rows in TFP and K/Y regressions is not equal to the one obtained in Y/L estimation.
is not highly significant from a statistical perspective).\textsuperscript{25} Consistent with expectations, the analysis points out the positive and significant relationship between infrastructure and TFP indicating the role of infrastructure in attracting production, reducing costs and fostering efficiency (Hirschman 1958; Munnel 1990; Hulten-Schwab 1991). This important role of infrastructures is confirmed by the fact that public capital alone explains roughly 80% (65%) of the variations in regional TFP \((Y/L)^{26}\).

With reference to the impact of State intervention, our indicator, the ratio between public and private wages, is negatively and significantly linked with the output per worker and with TFP, while no interpretable effect emerges on the ratio \(K/Y\). The results on TFP and \(Y/L\) are in line with the interpretations offered by Alesina-Danninger-Rostagno (1999) and Aquino (2000), who emphasise, as public employment in Italy has been used to pursue different goals from providing efficient services and public goods and this has presumably stimulated rent seeking activities and generated disincentives to allocating resources in private entrepreneurship.\textsuperscript{27} This vicious circle ends up by lowering regional TFP and, as a consequence, depressing the ratio \(Y/L\).\textsuperscript{28}

As for the financial variables, other things being equal, one would expect growth to be positively linked to the structure and extent of the financial system.\textsuperscript{29} On the basis of the empirical evidence on the positive and significant coefficient associated with the ratio “Private credit/GDP” in the regressions on TFP and on \(Y/L\), it emerges that the more credit private activities receive the higher is the regional level of total factor productivity and output per worker. This means that finance does not simply follow growth, but that it is a good predictor and a determinant of the level of growth. The impact on the ratio \(K/Y\) is negative (but not highly significant). This is an interesting result, because it leaves open the question about how local economies finance capital accumulation. There is much evidence to believe that the working of the financial system has not affected \(K/Y\) because firms’ decisions to invest in physical capital have been encouraged massively by policies aimed at the development of the Mezzogiorno. In fact, the subsidised financial resources seems to have exerted a strong impact on capital accumulation,\textsuperscript{30} but no effects on our indicators of productivity, probably because the selection of investment projects is not efficient when loans are guaranteed by public institutions (Levine 1997). This is an interesting view, even if not original (see, i.e., Siracusano-Tresoldi, 1990), with strong policy implications if one thinks that the major beneficiary regions account nowadays for the highest levels of capital intensity, but the lowest levels of economic growth (see Table 2).

Turning to the regressions, the relation between growth and agglomeration economies is of interest. The idea is that there exists scale effect and incentives to locate businesses in large regions with agglomeration economies, which, in this study, are approximated by population density in a given area. In this case, the reduction in transport costs and the advantages deriving from concentration of production in one area should determine a positive effect on development (Krugman, 1991; Fabiani-Pellegrini, 1997). Estimations indicate, in some ways, that the output-per-worker and the TFP are positively determined by agglomeration economies (the parameter concerned results as positive both in OLS and IV estimates). Instead, the coefficient in the regression of \(K/Y\) is not valuable because of its low significance.

The final aspect to consider is the effect of the conditions of security of property rights on regional growth: one would expect that the greater the safety and reliability of regional economic relationships, the more profitable would be investments and production and hence, \textit{ceteris paribus}, the higher the TFP and the output per worker (Putnam, 1993; Marselli-Vannini, 1996). From the regression on \(Y/L\) and TFP, it emerges

\textsuperscript{25} This finding seems to indicate, in some ways, a sort of substitution between capitalisation and the local existence of infrastructure, i.e., in the sense that Southern regional economies might have increased their level of capital intensity in order to compensate for the lack of public services.

\textsuperscript{26} These result are available upon request.

\textsuperscript{27} Similar views are in Del Monte-Giannola (1997) and Di Liberto-Symons (1998) and in the whole literature that analyses the efficacy of Italian government intervention from the end of ‘70s, that is when it has not been motivated to support investment but to increase the size of local authorities.

\textsuperscript{28} These results are not in contrast with the general view (Barro, 1990) according to which state intervention takes resources away from the working of free-market forces, creates distortions and upsets long term equilibrium.


\textsuperscript{30} In fact, if in OLS and IV regressions on \(K/Y\) the relative amount of subsidised credit is inserted, as expected, positive and significant values of the relative coefficient are obtained. The findings are not presented here because the main interest is in paying more attention on the determinants of TFP and, in addition, it was decided to consider regressions with an uniform set of explanatory variables. Anyway, these results are available upon request.
that the coefficient associated with offences and crimes concerning the economy and property is always negative with a level of significance below 5% in the case of regression of TFP. Again, the coefficient of crimes in the capital accumulation regression is not significant.

To sum up, econometric analysis shows that the explanatory variables concerned have a significant effect on $Y/L$ and on TFP and their sign is the expected one, while they do not contribute to explain regional capital accumulation. Therefore, the main conclusion to be drawn is that the regional differences in output per worker depend on differences in Total Factor Productivity and the impact of socio-economic variables on $Y/L$ are determined by their impact on TFP, which results as being the component of the aggregate production function which is better explained by our model.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Explanatory variables (Italy=1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piemonte</td>
<td>1,312</td>
</tr>
<tr>
<td>Valle d’Aosta</td>
<td>1,384</td>
</tr>
<tr>
<td>Lombardia</td>
<td>1,370</td>
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<tr>
<td>Trentino Alto A.</td>
<td>1,168</td>
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<tr>
<td>Veneto</td>
<td>1,298</td>
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<tr>
<td>Friuli Venezia G.</td>
<td>1,024</td>
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<td>Liguria</td>
<td>1,125</td>
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<tr>
<td>Emilia Romagna</td>
<td>1,327</td>
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<tr>
<td>Toscana</td>
<td>1,182</td>
</tr>
<tr>
<td>Umbria</td>
<td>1,038</td>
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<tr>
<td>Marche</td>
<td>1,038</td>
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<td>Lazio</td>
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<td>Abruzzo</td>
<td>0,865</td>
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<td>Molise</td>
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<td>Campania</td>
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<tr>
<td>Puglia</td>
<td>0,678</td>
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<td>Basilicata</td>
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<td>Calabria</td>
<td>0,519</td>
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<tr>
<td>Sicilia</td>
<td>1,009</td>
</tr>
<tr>
<td>Sardegna</td>
<td>0,562</td>
</tr>
</tbody>
</table>

**Legend:** the index of Infrastructures is from Bracalente and Di Palma (1982); Public to private wages is calculated using data from ISTAT (1999) and is the ratio between the average wage per worker in public sector and the average wage per worker in the private sector. Population density is from ISTAT. Crimes/Pop is from ISTAT and refers to crimes against the “economy” (embezzlement, robbery, burglary, swindling) over resident population. Credit to private is from Bank of Italy and is the amount of credit, expressed in percentage of GDP, allocated by banks to regional private firms and producing families.
Table 4  Determinants of TFP, Y/L and K/Y, OLS and IV estimates.

<table>
<thead>
<tr>
<th>Variables</th>
<th>log (Y/L) OLS</th>
<th>log (Y/L) IV</th>
<th>log (TFP) OLS</th>
<th>log (TFP) IV</th>
<th>[(1-(\alpha)) / (\alpha)] log(K/Y) OLS</th>
<th>[(1-(\alpha)) / (\alpha)] log(K/Y) IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
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<td>-1.18</td>
<td>1.01</td>
<td>0.93</td>
<td>8.448</td>
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<tr>
<td>Infrastructures</td>
<td>0.12</td>
<td>0.09</td>
<td>0.15</td>
<td>0.13</td>
<td>-0.09</td>
<td>-0.06</td>
</tr>
<tr>
<td>Government intervention</td>
<td>-0.35</td>
<td>-0.30</td>
<td>-0.25</td>
<td>-0.21</td>
<td>-0.03</td>
<td>-0.07</td>
</tr>
<tr>
<td>Credit to private as % of GDP</td>
<td>0.097</td>
<td>0.14</td>
<td>0.14</td>
<td>0.15</td>
<td>-0.03</td>
<td>-0.07</td>
</tr>
<tr>
<td>Agglomeration economies</td>
<td>0.004</td>
<td>0.038</td>
<td>0.03</td>
<td>0.03</td>
<td>0.009</td>
<td>0.01</td>
</tr>
<tr>
<td>Crimes</td>
<td>-0.09</td>
<td>-0.12</td>
<td>-0.04</td>
<td>-0.06</td>
<td>-0.03</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

| \(R^2\)                          | 0.78          | 0.69         | 0.96          | 0.9          | 0.75                                        | 0.7                                        |
| \(\bar{R}^2\)                    | 0.71          | 0.95         | 2.03          | 0.66         |
| SSE                              | 0.05          | 0.02         | 0.05          | 0.03         |
| SSR                              | 0.03          | 0.007        | 0.03          | 0.02         |
| F-Fisher                         | 10.5          | 80.43        | 3.64          | 5.05         |
| Bartlett (2)                     | 3.64          | 5.05         | 4.01          |

Source: own computations.

Legend: Besides the value of the estimated coefficients and t-student (in brackets), the statistics reported are: \(R^2\) = determination coefficient; \(\bar{R}^2\) = adjusted determination coefficient; SEE=Standard Error of the regressions; SSR= Sum of Square of Residuals; B(gdl)= Bartlett Test (degrees of freedom in brackets). *: the null hypothesis of LM test is that the instruments are not correlated with the residuals. Critical values for LM test: (2 d.f.): 10%=4.61, 5%=5.99.
7. Conclusions

When adopted to explain the development of the Italian economy, the methodology used to analyse convergence of growth rates shows that there is no single steady state towards which the various regions converge. On the contrary, conditional convergence which has been observed in Italy shows how regions are different from each other because of the existence of different long run equilibria.

This frame of reference has been challenged by several recent contributions on growth theory, which have put in discussion the reliability and usefulness of the models analysing growth rates. The questions discussed here move basically in two directions. The first consideration hinges on the fact that the low correlation in growth rates would indicate that these could not be explained by the variables usually considered in models of conditional convergence, because of their persistence. This seems to suggest that differences in growth rates between countries are transitory. In the second place, the fact that there is no absolute convergence and regions rather experience a sustained conditional convergence, suggests the investigation of differences in steady state income levels rather than in growth rates.

Bearing in mind the conclusions of this debate, this paper tries to provide new elements of evaluation in order to interpret the North-South dualism in Italy. In the first place, an original decomposition of output per worker has been carried out in order to try to determine to what extent this depends on the accumulation of inputs - distinguishing physical from human capital - or on different levels of TFP. The results achieved in the first part of the paper indicate that the relevant differences which can be observed among Italian regions in output per worker are not caused by differences in factor accumulation but rather their cause can be traced to the different levels of efficiency observed in regional economic systems. In particular, the outcomes confirm, on the one hand, the empirical regularity according to which regions with better capital endowment – the Southern regions – are not the most productive, while, on the other hand, low differences in human capital do not help to explain differences in productivity.

The final part of the work explores in detail the problem relating to the determinants of regional levels of productivity. The specifications of the regressions have been constructed by considering as a dependent variable the output per worker and two relevant components of regional aggregate production function (the ratio K/Y and the level of TFP) and by using as explanatory variables some of the indicators employed in the literature on convergence. By trying to check for endogeneity, both OLS method, with lagged regressors, and instrumental variables method, where each variable enters in regressions as its own instrument, are considered.

The first relevant result concerns the marked explanatory power of the model. This is especially true in TFP regressions and it is to a great extent due to the high significance of certain developmental indicators (infrastructure and state intervention) which on their own are able to explain a large share of the variations of regional labour productivity and of TFP. The analysis shows, unequivocally, that the regions with the best infrastructures and the lowest distortions in the public-private wage ratio attain, all things being equal, higher output per worker. This overall outcome mainly derives from the fact that these regressors are the most significant determinants of TFP. Furthermore, from the regional data it emerges that there is a positive effect on regional productivity deriving from the well functioning of financial markets and from agglomeration economies, while a negative empirical relation is observed in the levels of criminality. When the regressions on physical capital are considered the picture is more ambiguous and it claims for further investigations.

It is not easy to sum up the implications of all these results for economic policies aimed at overcoming the Italian North-South dualism and it certainly can not be carried out by a simplistic formula such as «Less State, more market» or its opposite «More State, less market». On the one hand, there is a definite need for the State to play a more active role, intensifying its activities as regards improving infrastructure and maintaining law and order, protecting property rights and enforcing contracts. On the other hand, the indications from the empirical analysis on the effects of public employment policies suggest the need to rethink the role of the public sector as a last-resort employer and distributor of welfare benefits.

References


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