Regional Development and Public Spending

The Case of Italy

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Abstract

In Italy redistribution and regional policies have been implemented since World War II; poorer regions have been receiving large amount of public funds, namely public consumption and infrastructure investment, to stimulate economic activity or, more generally, to increase welfare. Starting with this premise, the paper analyses the effects of public spending on regional growth in Italy. Taking advantage of both the spatial and the time dimension of the available data, we offer results of two distinct panel analyses which stress the cross-section or the time dimension, respectively. The main results are the following: there is a positive relationship between regional growth and infrastructure capital which mainly holds for the Manufacturing sector; within the Manufacturing sector, the impact of public investment on productivity is noticeably stronger for the low-income group of regions than for the high-income group of regions. No positive impact of public consumption on productivity is detected.

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1. Introduction
Empirical research on economic growth exploited a large number of data sets related to countries and regions. There is a general feeling that differences among regions in terms of technology, preferences, and institutions are likely to be smaller than those across countries (Barro - Sala-i-Martin 1995). The rate of diffusion of technology among regions within a country should be faster than that across countries; firms and households of a country should have roughly similar tastes; regions within a single country share a common central government. This means that predictions of growth theories are more likely to apply across regions within countries than across countries. When regions do not share the same level of wealth, however, it is very likely that public spending is not homogeneously distributed among regions. If the objective of central government is to reduce regional disparities, low income regions are likely to receive a relative higher share of the common public revenue than high income regions. Thus, the original premise upon which regional studies are based disappears and we cannot study regional inequalities ignoring the long-run effect, if any, of government policy.

The allocation of public funds among regions, through the national budget, is the main policy instrument to fight against regional disparities. Within developed countries, the main effect of redistributive policy and transfers is that low income regions enjoy a positive inflow of resources, that is, they pay for taxes less than they receive as services and benefits, while high income regions provide financial support. Transfers among regions arise at least for two reasons. First, each region is part of a community with national standards for public services and welfare, and a common base of taxation. This ensures that, for a region with an income level lower than the national average, the amount paid for taxes is lower than the amount of public expenditure received. Second, poorer regions benefit of regional policies aimed at reducing disparities and stimulating growth. The main forms of these policies are investment in infrastructure and subsidies to induce inward investment.

In Italy redistribution and regional policies have been implemented since World War II; poorer regions have been receiving large amount of public funds to stimulate economic activity, or, more generally, to increase welfare. The failure of the South to converge towards the level of wealth of the Center-North contrasts, however, the attempts made by the Italian government to use public expenditure to reduce disparities. Following the work of Barro - Sala-i-Martin (1991), many studies have documented the existence of disparities in level of per-capita and per-worker income among Italian regions, showing that a convergence process operated until the mid 1970s and stopped afterwards.1 During the last decade regions shared roughly the same growth rate. Among previous studies, however, there have been no systematic analysis of the relationship between regional growth and public spending. Moreover, there has been no work that has exploited both the time and the cross-section dimension of the available data.

Public services can determine the development of regions both affecting the productivity of private inputs and/or affecting decisions about the level of private inputs. Starting with this premise, the paper aims at verifying if differentials among Italian regions, in terms of labor productivity, can be, at least in part, related to public services supply and government activities. We will assume that public consumption and infrastructure investment variables are proxies for the main channels of government

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1 See Di Liberto (1994); Mauro - Podrecca (1994); Cellini - Scorcu (1995); Terrasi (1995); Paci - Pigliaru (1997). Note that regional convergence has been investigated with respect to other countries too. See de la Fuente (1996) for Spanish regions; Persson (1997) for Swedish counties.
interventions. Taking advantage of both the spatial and the time dimension of the data, the paper offers results of two distinct panel analyses which stress the cross-section or the time dimension, respectively. Exploiting the properties of a panel data set we can control for regional characteristics and we allow regions to have different steady-states and rates of convergence, thus achieving more reliable estimates of the effects of government policies. We show that the effects of government spending differ between public investment and public consumption, and between Southern and Northern regions; in particular, infrastructure capital has a significant positive impact on the productivity of regions, while public consumption has no, or even negative, effect.

In section 2, we provide evidence of regional differences in terms of productivity level and government intervention. Section 3 surveys recent evidence on the relationship between growth and public spending, while section 4 discusses some issues of regional data. Section 5 and 6 present our results and offer some explanations. In the final section, we conclude.

2. Regional Disparities and Government Intervention in Italy

At the beginning of the 50’s, Italy was a country with striking differences in terms of per capita GDP and labor productivity among regions, mainly between Northern and Southern regions. During the following decades, the Italian economy has experienced a sustained growth process, which has enabled Italy to become a member of the G7 group. In particular, during the period 1963-93, the average growth rate of GDP has been 3.2%, while the average growth rate of employment has been roughly 0.6%. Notwithstanding, the twenty regions of Italy exhibited in 1993 large differences among themselves in GDP per capita and in labor productivity. In particular, it seems to persist the historical dichotomy between Center-Northern (richer) and Southern (poorer) regions. At the beginning of the 60’s, the ranking of the 20 regions of Italy in terms of GDP per capita numbered at the eight lower positions the eight regions of the South; moreover, looking at the labor productivity five of the eight Southern regions were at the lower positions. In 1993, the eight Southern regions were again the poorest in terms of GDP per capita; moreover, seven out of the eight poorest regions of Italy in terms of labor productivity were part of the South. A convergence process, however, has been effective from the late 50’s up to the mid 70’s, and it determined a reduction of initial differences. Figures 1 and 2 offer supporting evidence for these conclusions. [Insert Figures 1-6]

Looking at Fig. 1, on the horizontal axis it is measured the average labor productivity (output per employed) of a region over the period 1963-65, while on the vertical axis it is measured the same variable over the period 1991-93. Regional productivity is expressed relative to the national counterpart. As it is clear, the dispersion of the 20 points along the vertical axis is lower than that along the horizontal axis, and it is more centered around the value of one. Therefore, poorer regions, in terms of labor productivity during 1963-65, have grown at rates higher than that of Italy as a whole, while richer regions have grown at lower rates. The former, however, did not catch up the latter. Fig. 1 also reveals that regions which started with productivity levels similar to the national one, like Puglia and Friuli-Venezia-Giulia, or Piemonte and Sardegna, present large differences in the period 1991-93. Thus, both (global) convergence and divergence processes interested Italian regions during the years 1963-93. Fig. 2 reveals, however, persistence of labor productivity differences in the period

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2 Average growth rate corresponds to the coefficient of a deterministic trend in a regression of the log of the variable on a constant and a trend.
1978-93, and it implies that the convergence process documented above concerns the period 1963-75. During 1978-93, inequality between regions remained roughly unchanged with very low variations within the distribution. Even the very good performances of the Adriatic Southern regions during the period 1963-80 disappear if one considers only the second part of the sample.

Poorer regions have not been able to reach the productivity levels of more prosperous ones, notwithstanding they benefited of a larger amount of public resources. The intensity of the government policy intervention in Italy is represented in Fig. 3 and Fig. 4. The two figures present a comparison of the average rate of public investment in infrastructure (Fig. 3) and the average share of government consumption on GDP (Fig. 4), between decades and regions. It is clear that during the last three decades Southern regions benefited of a relative greater amount of public spending than regions in Center-North. At the same time, Fig. 3 also reveals that during the 80’s Southern (Center-North) regions benefited of less (more) investment than during the 60’s and 70’s. The relative dynamic of public consumption and infrastructure is more evident looking at the ratio between the share of public spending in the South and that in the Center-North (Fig. 5 and Fig. 6). Clearly, the two ratios changed in opposite direction, that is government consumption increased while infrastructure investment decreased. The different evolution of the two types of public spending could explain at least partially why during the 80’s the convergence process among regions in Italy has been interrupted.

3. Public Expenditure and Growth: a brief review
The relationship between public expenditure and productivity growth has been recently tested by many authors, following a production function approach, or a growth theory approach. The basic idea consists in expanding the standard aggregate production function to include the flow of productive services from the government sector: \( Y_t = f(K_t, L_t, G_t) \). Exploiting annual data for the United States over the period 1949 to 1985, Aschauer (1989) found non military public capital to be productive with output elasticity in the range 0.38 to 0.56, which implies “an important role for the net public capital stock in the productivity slowdown” after the 1970. Following essentially the same methodology, similar results have been also obtained by Munnell (1990a).

Two important criticisms, concerning spurious regression and causality, have been raised in critical assessment of these papers. Holtz-Eakin (1994) notes that the concomitant slowdown in productivity growth and public sector capital accumulation in the early 1970s is not peculiar to the United States. Thus, any conclusion about causality is difficult to ascertain. Moreover, the time series approach with regressions estimated in levels can produce misleading (spurious) results if data contain stochastic trends and cointegration does not hold. Tatom (1993) shows that, when the issue of stationarity is properly taken into account, the productivity impact of infrastructure capital disappears.³

Many authors have tried to overcome previous criticisms by using time series, cross section data across states or regions. Studies employing panel (state-level) data seem to suggest a minor role for public capital in determining directly economy-wide differences in productivity. Costa - Ellson - Martin (1987), Munnell (1990b), Garcia-Milà - McGuire (1992), de la Fuente - Vives (1995), and La Ferrara - Marcellino (1999)

³ A third general criticism is that employing yearly-spaced observations it is difficult to identify short-run and long run (supply) effects of an increase in infrastructure investment. This can induce large estimated elasticity.
conclude that public inputs have a positive and significant effect on output. However, Holtz-Eakin (1994), Evans - Karras (1994a), Garcia-Milà - McGuire - Porte (1996), and Holtz-Eakin - Lovely (1996) using a panel data set for 48 contiguous U.S. states, find no evidence that the public capital variables are productive. These striking differences with respect to previous studies seem to rest largely on a better specification of the estimated model. In particular, estimates obtained controlling for unobserved state-specific characteristics would not support the hypothesis of economy-wide variations in private productivity due to government capital spillovers. Of course, it would be wrong to interpret these results as providing evidence against the benefits accruing from public capital. Instead, the main message of these latter studies should be that estimates within the production function framework reveal no role for public sector at the margin.

The studies reviewed above follow essentially the same methodology, which consists of estimating the output elasticity with respect to public capital. An alternative approach exploits the predictions of growth models, searching for empirical linkages between growth and the share of GDP devoted to public expenditure. In this framework, the public investment’s share of output, for example, is a proxy for that part of government revenue which provides the private sector with productive services. Empirical studies, using for the most cross-country data, again show mixed results. Easterly - Rebelo (1993) show that investments in transport and communication are positively correlated with growth. Holtz-Eakin - Schwarts (1995) estimates a positive, but modest, productivity effect of infrastructure investment rate. Easterly (1994) finds that the share of total public investment raises the growth rate of growing countries while Khan - Kumar (1997) show the positive impact of public investment rate on productivity for developing countries. These results, however, contrast those reported, among others, by Barro (1991) and Boldrin - Canova (1998). In particular, looking at regions within the European Union during the 80’s, Boldrin - Canova provide an indirect evidence on the ineffectiveness of European structural funds. Great attention has also been devoted to the relationship between growth and the ratio (or the growth rate of the ratio) of government consumption to GDP. This variable proxies for the size of government and tax-induced distortion, or for that part of government spending which is not productive. Results suggest a negative relationship (Landau, 1983; Barro, 1991; Guseh, 1997) or no effects at all of public consumption on growth in the long-run.

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4 In particular, Garcia-Milà - McGuire (1992) find that education expenditures have a strong impact on output. La Ferrara - Marcellino (1999) also exploit the cost function and the growth accounting approaches and they find that among regions in Italy public capital is positive and significant under all three approaches.

5 See, also, Evans - Karras (1994b).

6 This criticism cannot be raised to La Ferrara - Marcellino (1999). Moreover, note that Evans - Karras (1994a) find fairly strong evidence that government educational services (expenditures for education) are productive. At the same time, Holtz-Eakin - Lovely (1996) find evidence of a positive impact of public capital on manufacturing variety, suggesting the presence of important indirect channels by which public capital affects productivity.


8 As Boldrin - Canova themselves clearly state, they do not estimate any elasticity of public capital (due to the lack of data). They show that “regions that are structural funds recipients evolve, over time, and maintain over time their relative inequalities, pretty much as the rest of the European regions”.

9 Barro (1990) suggests that the relationship between growth and the size of government is inversely U-shaped, because when the tax rate exceeds a threshold level negative effects induced by tax distortion overwhelms positive effect induced by public services supply. The latter prevails for moderate size of government.
Summarizing previous evidence, in general there is not a consensus view about the effects of both public consumption and infrastructure investment on growth. Results within the growth theory approach seem to assign a positive impact to public capital. The indirect evidence in Boldrin - Canova (1998) is the main exception.

4. Regional Data, Distributive Policy, and the Causality Issue

One of the main criticisms raised to cross-countries regressions is based on the comparability of data. This problem is likely to be less serious at regional level as there is a higher homogeneity between regions than between countries. Moreover, due to the large amount of public resources devoted to growth promotion, Italy seems a case study for determining the impact of public spending on growth. Regional data introduces, however, some peculiarities to deal with which otherwise would induce wrong inferences about the impact of public spending on growth, both in a cross-section or in a time-series framework. In particular, the causality issue between growth and public spending is very difficult to disentangle.

The existence of significant transfers of funds from richer to poorer regions, which is peculiar of any redistributive policy, does not allow to maintain the hypothesis that poorer regions cover own expenses just with local taxes. Poorer regions, instead, usually get a level of resources to spend for public services higher than the level of resources locally withdrawn by taxes, and they have a higher ratio of government expenditure to GDP than more developed regions. Thus, looking at a cross-section of regions, the activity of redistribution would imply a positive relationship, coeteris paribus, between the relative size of public expenditure, usually measured by the share of public spending on GDP, and growth. The positive correlation originates because richer regions suffer the negative impact of distorting taxation without benefiting of an equivalent positive effect of public services on productivity. In this case, growth can be negatively affected. Poorer regions, at the same time, get positive transfers to provide free public services to private producers. If government intervention is equally efficient in all regions, we should expect an overall positive relationship between the relative size of public expenditure and growth.\footnote{It is important to note, however, that if a positive relationship should be estimated at regional level it does not necessarily imply any positive assessment on the overall effect of government activity. On this point, Mera (1975) argues that, when regions do not share the same production function, government policy aimed at equalizing productivity could lead to a loss of the aggregate national output. At the same time, it has been also argued, however, that regional policy should be supported because disparities among regions could have harmful consequences on the efficiency of the national economy.}

Regional data introduce a linkage between the distributive policy of the central government and the causality issue. When we consider a cross-section of regions, it can be estimated a positive as well as a negative relationship between government spending and growth consistently with a causal relationship leading from growth to public expenditure. If poorer regions are supplied with more public consumption than richer ones, due to the distributive policy of the government, there will be a negative correlation between a region-specific index of the level of wealth and public consumption. At the same time, if more prosperous regions could induce government to spend more on public capital, there will be a positive correlation between the same

\footnote{Using a different framework, Ram (1986) estimates a positive relationship between growth rates of GDP and government consumption.}
index and public sector capital. The correlation between the region-specific index and public spending can induce wrong inferences on the relationship between the latter and growth. In particular, if we do not take account of such correlation, the estimated relationship between public expenditure and growth could reflect reversal causal links due to the distributive policy of the central government.

A further problem of interpretation arises if we exploit the time dimension of the data for each region through a static regression between productivity and public spending on GDP. The relationship between the two variables is likely to have a negative sign, as in the cross-section framework, even if the explanation of the result is different. An increase of public consumption at time $t$ usually causes an increase of output and labor productivity at the same time.\textsuperscript{12} If the level of output at time $t$ increases proportionally more than the level of public consumption (the elasticity of output respect to public consumption is greater than one), the coefficient of a static regression (along the time dimension) of labor productivity on the share of public consumption is estimated negative. However, as in the case of the cross-section framework, even with a simple time series regression no negative judgment can be inferred on the effect of public expenditure on productivity. In fact, it is neither a true negative effect nor a long-run effect.\textsuperscript{13}

Previous discussion confirms that when we try to analyze the relationship between growth and public spending, it is difficult to ascertain the direction of causality and to disentangle supply-side effects by estimating simple regression both in a cross-section or time series framework. Some care should be taken in order to avoid previous problems. Thus, in the following section a systematic analysis will be performed in order to derive reliable information on the impact of public spending.

5. Public Spending and the Productivity of Regions in Italy: 1963-93

5.1. Estimation Issue and Results: Part One

The general purpose of the empirical analysis is to relate productivity differentials among Italian regions to initial conditions, regional characteristics, and differences in the amount of public expenditure allocated by the central government. Differentials are measured as differences between the regional value of a variable and its national counterpart; therefore, in the following we will always refer to variables taken as deviations from national values. In particular, in this section we try to relate the cross-sectional distribution of labor productivity to public spending and public capital. By using the time-series dimension of the panel data set, region by region, we firstly estimate the distribution of steady state levels of output per employed (Canova - Marcet, 1995). To this end, an AR(2) model is estimated during 1963-93 for each region.\textsuperscript{14} Then, the cross-sectional distribution of steady-states is regressed on an index of infrastructure capital, measured roughly at 1995, which contains roads, railways, energy, telephones and sewers, per capita or per unit of land area. The $R^2$ of the regression is

\textsuperscript{12} It is reasonable to expect that labor productivity increases too, at least because output is more volatile than labor in the short run.

\textsuperscript{13} In a dynamic setting, if we estimate the relationship between labor productivity and the share of public consumption adding a lag of public consumption as a further regressor, the estimated coefficient of the lagged variable is likely to be positive. In principle, it should be roughly of the same magnitude of the contemporaneous effect, if the effect of public consumption on productivity holds just one year. However, as it is well known the impact multiplier estimate is biased and this can induce a negative sum of the two coefficients even if public consumption just induces a short-run effect.

\textsuperscript{14} Further lags do not substantially improves estimates while just one lag determines the same results.
very high, above 0.8, and the estimated coefficient 0.32 appears as a reasonable value. Assuming private capital mobility among regions and a production function with constant returns to scale, the coefficient is consistent with an output elasticity of public capital ranging from 0.1 (if the output elasticity of private capital is 0.7) to 0.22 (if the output elasticity of private capital is 1/3). These values are in line with those reported in other works. For example, the output elasticity of public capital estimated by de la Fuente - Vives (1995) for regions in Spain is 0.141 if the output elasticity of private capital is assumed to be 1/3, while the same parameter is estimated 0.1 by Holtz-Eakin - Schwartz (1995) for US. Thus our first check on the relationship between productivity and public capital is promising; regional inequalities in terms of productivity are very well matched by inequalities in terms of infrastructure. The estimates of infrastructure capital suggest that at 1995 the level in the South was roughly 55% with respect to the Center North (65% with respect to the country value). This implies that an equalization of infrastructure capital among regions (that is an increase in the South of 80%) would foster an increase of output per employed of roughly 24%.

The second step of our analysis rests more deeply on investigating the relationships between productivity and public spending, allowing for inequalities in regional characteristics and initial conditions. The general form of the estimated equation is

\[
Y_{i,t} - Y_{i,t-\tau} = \eta Y_{i,t-\tau} + \sum \varphi_j X_{i,t,j} + \epsilon_{i,t} \tag{1}
\]

where the indexes \(i\) and \(t\) denote region and time respectively, and the index \(j\) denotes explanatory variables. The variable \(Y\) stands for the logarithm of real gross domestic product (or value added) per employed worker. The set of variables denoted with \(X\) includes the (logarithm of) real government spending for consumption as a share of real gross domestic product, denoted as \(CG\); the (logarithm of) real public spending for infrastructure investment as a share of real gross domestic product, denoted as \(IG\); and the (logarithm of the) sum of depreciation rate of public capital, and growth rates of employed and technology, denoted as \(\Delta L\). Depending upon the choice of parameters \(\tau\) and \(s\), and the modeling of \(\epsilon_{i,t}\), we derive two specifications which stress the cross-section and the time-series dimension of the data, respectively. However, in any case we properly estimate a panel. In particular, equation (1) is estimated for the economy as

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15 Note that in principle we should regress labor productivity on the stock of public capital per employed. Thus our estimate is correct if the stock of public capital per capita or per unit of land area is a reliable proxy for the stock of public capital per employed.

16 Several studies, which can be framed within the convergence debate, estimated an equation like (1). However, the time dimension of data is usually filtered out by regressing the average growth rates of \(Y_i\) across the whole time-series sample, on average values for the \(X\)'s and proxies for differences in initial conditions. The main drawback of this procedure is that the country-specific effects cannot be accurately taken into account, and extreme assumptions must be made for OLS to apply (see, for example, Evans - Karras, 1996).

17 If the starting point of our analysis is a production function with labor, private capital, and the flow of services from the government sector, a possible explanation of equation (1) is supplied in the Appendix. In this case, public consumption may be taken as a proxy for that part of public services not explained by public capital. However, apart from this and the interest in studying the effect of public consumption on productivity as such, there is another reason to include public consumption in the estimated equation, too. Public consumption can be used as a control variable if we assume that supply-side effect of government sector can be just traced to public investment while demand-side effect is caused by total public spending. If the coefficient of public investment is significant, while that of public consumption is not, this can be seen as an indirect evidence of supply-side effect of public capital.

18 Remember that each variable is taken as deviation respect to the national counterpart.
a whole and for Manufacturing and Energy, both averaging over subperiods and with yearly spanned data.

When using pooled cross-section, time-series data, the main issue that arises is related to the structure of $\varepsilon_{i,t}$. It is important to allow for time-invariant component, which in our framework corresponds to region-specific effect, and to understand whether such component can be correlated or not correlated with the explanatory variables.\(^{19}\) Usual tests can be performed to discover the correct specification with respect to the inclusion or not of the region effects, and to test whether they are correlated with other regressors. However, it is acceptable to assume in the present context that the region-specific effects are correlated with the explanatory variables. The autocorrelation of the left side variable entails a natural correlation between the effects and the lagged endogenous variable, while the redistribution implies correlation of the effects with government policy variables. If we ignore the error component structure, the correlation between the lagged dependent variable and region specific effects would bias upward the OLS estimator of $\eta$, and toward zero those of the $X$'s. Moreover, redistribution (and the correlation between effects and the $X$'s) could induce reversal causation. We will tackle with these problems in different ways.

Consistently with other papers in the literature, equation (1) is firstly estimated by averaging over subperiods of five years, that is $\tau = 5$, with $t_0 = 1965$.\(^{20}\) In this case, both public investment and government consumption, for the interval $[t - \tau, t]$, are taken as average over the five years preceding $t$. We assume $\varepsilon_{i,t} = \gamma_i + \upsilon_{i,t}$, where $\gamma_i$ are region effects which are assumed to stay constant for given $i$, while the variable $\upsilon_{i,t}$ represents those unobserved factors that vary over time and regions. Moreover, we take explicit account of the dependence between regional effects and other right side variables by letting $\gamma_i = b GH_i + \eta_i$, where $GH$ is an index of the stock of infrastructure capital and education at 1970.\(^{21}\) Given the framework of our analysis, this index seems an appropriate measure of region characteristics.\(^{22}\) Thus, equation (1) becomes:

$$Y_{i,t} - Y_{i,t-5} = a + b GH_i + \eta_i Y_{i,t-5} + \phi_1 CG_{i,t} + \phi_2 AL_{i,t} + \xi_{i,t}.$$  \(^{(2)}\)

Equation (2) explains differentials of regional productivity in two different ways. The relative productivity in region $i$ at time $t$, $Y_{i,t}$, is determined by government policy which reflects in the size of government intervention in a region and by differences in the allocation of a given amount of public expenditure between consumption and infrastructure investment. At the same time, we also allow $Y_{i,t} \neq 0$ as due to time-invariant differential or regional characteristics which can only change slowly.

\(^{19}\) Least Square Dummy Variables (LSDV) or Generalized Least Square (GLS) estimators are commonly used, respectively. In the latter case, the time-invariant component is usually assumed not being correlated with the explanatory variables included in the model.

\(^{20}\) The last period is 1990-93. We assume that the sum of the growth rate of technology and the depreciation rate of public capital is 0.1.

\(^{21}\) The index is based on public capital (as for the index at 1995) and education relative to the dimension of the region (for details, see Di Palma, 1990). We are aware that it should be better an index dated at 1965 as part of the variables are measured between 1965 and 1970; however, we do not have this piece of information. In any case, results do not change significantly if we start the sample period at 1970.

\(^{22}\) In a different specification, we also use a proxy for the initial stock of human capital, namely the percentage of population over six years with high school level at 1961, 1971, and 1981, instead of the growth rate of employment. Results do not change qualitatively.
Looking at the relationship between productivity and public spending, estimates by ordinary least square (OLS) seem to suggest that public investment stimulates productivity growth; the coefficient $\phi_1$ is estimated positive and significant for the economy as a whole and for Manufacturing (Table 1). On the contrary, the coefficient of public consumption turns out to be negative and significant. The coefficient $\eta$ is always estimated negative and significant. If we interpret it as measuring conditional convergence between Italian regions, then the specification adopted implies a convergence rate roughly of the same magnitude as the coefficient estimated by Caselli - Esquivel - Lefort (1996) using the Summers-Heston data set. Finally, results show that the coefficient of GH is positive and highly significant. The latter is clearly consistent with the hypothesis that infrastructure capital has a positive impact on productivity and growth.

Averaging across periods, the policy variables at time $t$ cannot be assumed to be predetermined for $\xi_{it}$, mainly when we refer to All Sectors. We deal with the endogeneity problem estimating (2) by IV (Instrumental Variable), where instruments are lagged values of the policy variables. Looking at public investment, the main result is that, for Manufacturing, the point estimate of the coefficient increases substantially and remains highly significant. At the same time, for All Sectors the magnitude of the point estimate of coefficient reduces drastically and the $t$-statistics becomes roughly zero. The coefficients of public consumption remain negative and significant. It is interesting to note that, for Manufacturing, (apart from the sing) the coefficient estimates of the two public spending variables are roughly of the same magnitude. Any positive impact of public investment on productivity seems to be equally counteracted by public consumption. Finally, the two coefficient estimates of lagged productivity are quite similar; the implied convergence rate is about 9-10%.

Previous evidence can be summarized as follows. Public spending could have counteracting effects: on one side infrastructure investment stimulates the growth of an economy, on the other government consumption could hamper it. The results of instrumental variable estimates and the different impact on regional growth of the two public spending variables would suggest that the causal direction is from public spending to growth.

The positive impact of public investment on productivity in Manufacturing is a result expected. When asked manufacturing companies argue that inadequate provision of infrastructure acts as a constraint to the achievement of minimum cost and as a constraint on the level of output and employment. The negative but not always significant relationship between productivity and public consumption is in line with the findings at a country level. In a regional context, however, it is more difficult to explain this result as due to the negative effect of taxation, if poorer regions pay for tax less than they receive as public spending. A plausible explanation is that large public transfers may foster low growth habits and give rise to assistential type of economies. A further explanation, suggested by Barro - Sala-i-Martín (1995), is that such variable is a proxy for corruption or other aspect of bad government.

23 Note that in this paper the number of regions we refer to is 19 instead of 20, because Valle d’Aosta and Piemonte have entered the regressions as a single observation.
24 Note that, as expected, endogeneity bias strongly affects OLS estimates for Buildings, which we do not report. In this case, the IV estimate of the coefficient of public investment is much lower than the OLS one.
25 The coefficient of $\Delta L$ is negative as expected. However, the magnitude is not irrelevant to assumptions on growth rate of technology and public capital depreciation rate.
5.2. Estimation Issue and Results: Part Two

The main results reported above are that the coefficient of public investment is positive and highly significant for Manufacturing, while that of public consumption is negative. In this second part of the empirical analysis, we explore more properly the time dimension of the data by using yearly spanned data, in order to provide further empirical evidence on these relationships. The estimated equation now becomes:

\[ Y_{i,t} - Y_{i,t-1} = \eta Y_{i,t-1} + \Phi_1(D)IG_{i,t} + \Phi_2(D)CG_{i,t} + \Phi_3(D)\Delta L + \epsilon_{i,t} \]  \hspace{1cm} (3)

where \( \Phi_r(D) \) is a polynomial in the lag operator D. Moreover, we model \( \epsilon_{i,t} \) as consisting of a region specific intercept and a region specific trend, that is \( \epsilon_{i,t} = \gamma_{1,i} + \gamma_{2,i} t + \upsilon_{i,t} \). In this context, the deterministic trend is included to capture any convergence process in the relative productivity of a region (Carlino - Mills 1993). Convergence requires that if a region starts above its equilibrium differential, as determined by specific characteristics and by government policy, it should grow relatively more slowly than the country. As for the cross-section approach, productivity differentials are related to initial conditions, regional characteristics, and government activity.

Two important issues in the specification of equation (3) at time \( t \) relate to the presence of contemporaneous values for the policy variables, that is values of public consumption and public investment at time \( t \), and to the degrees of the polynomials in D, that is the number of lags of the policy variables. As said before, we are interested in finding out the relevance, if any, and the sign of long-lasting effect of public spending shock, that is effect which is still relevant at least five years after the shock arises. Therefore, the basic specification of (3) contains five lags of both policy variables and two lags for the growth rate of employed, without contemporaneous effects.\(^26\) We are mainly interested in ascertaining if the coefficients of the policy variables sum to zero. In particular, when \( \Phi_r(1) \neq 0 \), for \( r = 1, 2 \), this implies that the long-run productivity level relates to values of the policy variables. However, to ascertain the robustness of our main results to the choice of lag length, we estimate (3) with five, six, or seven lags for the policy variables, also adding one or two further lags of the productivity level among the right-hand side variables. In any case, we test whether \( \Phi_r(1) = 0 \).

[Insert Table 2] Equation (3) is estimated by OLS for the entire set of 19 italian regions.\(^27\) Table 2 reports estimates of \( \Phi_r(1) \) when (3) is estimated with five or six lags for the policy variables, and two lags for labor productivity and \( \Delta L \). The first order serial correlation coefficient estimates of residuals suggest that, in general, estimated residuals are not correlated. Estimates again indicate a positive impact of public spending for infrastructure on labor productivity for the economy as a whole and for Manufacturing. Government consumption, instead, does not appear to have any effect on productivity; growth rate of employed has negative impact as expected.\(^28\) In particular, as we modeled

\(^{26}\) Further lags of employed growth rate do not appear to be significant in any specification.
\(^{27}\) Please, note that estimation of slopes consists in estimating a regression with data of each region centered over the time dimension. Therefore, coefficient estimates should not reflect reversal causation due to re-distributive activity of government. However, in general a bias naturally arises as due to the correlation between the residuals and the lagged endogenous variable in the transformed model. The consistency of estimators requires that both N and T are sufficiently large. We assume that the time and cross section span of our sample fulfills this requirement.
\(^{28}\) Regressions, not reported, also included investment in machinery and equipment (private and public), but the coefficients were always not significantly different from zero. Note, however, that these findings
the error component of (3) allowing for region-specific trend and intercept, the estimated positive relationship is not due to correlation of trending variables and we can infer that greater public capital leads a region to be more productive. Thus, results confirm previous evidence that infrastructure investment can be an effective policy tool.\textsuperscript{29} As our specification does not yield estimates of the effect of private capital, we cannot recover however an estimate of the output elasticity with respect to public capital. If we assume output elasticity of private capital is 1/3, which is a conventional assumption, the estimated coefficients imply that the output elasticity of public capital is lower than estimates from other studies. Estimates for the Manufacturing sector with six lags imply an elasticity of 0.06.

[Insert Table 3] As documented in section II, the regions of Italy present large differences in per-capita GDP and labor productivity at 1993 yet. Moreover, the ranking in terms of productivity largely reflects that in terms of the stock of infrastructure capital. To the extent that the needs of relative poorer regions for infrastructure capital are greater than those of richer regions, because the existing stock of capital is inadequate, the impact of public investment in infrastructure in the low-income regions may be greater than in the high-income regions. As Pesaran - Smith (1995) show this can induce a bias in our estimates that do not correctly measure the average among regions of long-run relationships. Thus, in order to avoid this problem and to investigate previous hypothesis we re-estimate (3) by grouping regions of Italy into two groups, that is Low and High, in terms of income per-capita or the stock of infrastructure capital.\textsuperscript{30} In particular, the Low group is defined as the lowest 8 regions ranked by the stock of infrastructure capital at 1970 or the level of per-capita GDP at 1963. The ranking in terms of per-capita GDP implies that the low-income group contains the 8 Southern regions of Italy, while Northern regions are part of the high-income group (11 regions). The analysis (Table 3) shows that the impact of public investment in the Low group is noticeably greater than in the High group for the Manufacturing sector.\textsuperscript{31} In fact, the results suggest that the positive correlation between productivity and public investment, previously estimated with the whole set of regions, is due to the positive impact of increasing the stock of infrastructure capital among low-income regions. Moreover, results not reported show that this conclusion is strengthened if the Low group is defined in terms of the stock of infrastructure. By assuming the output elasticity of private capital is 1/3, estimates for the Manufacturing sector imply that the output elasticity of public capital in the South is 0.1.

do not mean that such a variable does not explain growth in Italy; it does not explain performances of a region different from its average over the period.

\textsuperscript{29} If we estimate (3) for Market Services the coefficient of infrastructure investment turns out to be positive, too.

\textsuperscript{30} In principle, equation (3) could be estimated unit by unit, that is region by region, if one believes that each region is characterized by proper parameter values. However, we do not believe that a region is so different from each other to justify this approach which reduces degrees of freedom too much. We believe that two units are enough to obtain unbiased estimates.

\textsuperscript{31} Remember that Valle D’Aosta, a very small region, and Piemonte enter the regressions as a single region. Our results, in terms of the significance of infrastructure investment, however, would be stronger than those reported if we treat the two regions separately. Public investment appears to have a stronger impact on productivity than that reported in Table 2 and Table 3; in particular, when we look at the high-income group, coefficient estimate of infrastructure investment is positive and highly significant if Piemonte and Valle D’Aosta enter the regression separately. This result, however, strongly depends on the presence or not of Valle D’Aosta in the group. Results related to the market Services sector do not show any particular differences among groups.
5.3. Which Type of Public Capital is Productive?

Results reported above suggest that, within the Manufacturing sector, the impact of public investment on productivity is noticeably stronger for the low-income group of regions than for the high-income ones. At this point an exercise that appears to be particularly relevant for policy prescription rests on ascertaining the effects of single categories of public capital and if there is a particular category of public capital that determines the aggregate result. Thus, we estimate equation (3) for three categories of infrastructure capital: Transports (roads, airports, and railways); Buildings (public buildings, schools, and public spending devoted to private buildings); SER (sanitation, energy, and reclamation).32

In general, results confirm previous conclusion that public capital elasticity is significantly different from zero among Southern regions. In particular, Transports as well as SER clearly appear to be growth enhancing; coefficients related to these categories of infrastructure capital are estimated positive and significant (Table 4). On the contrary, the coefficient of Buildings is estimated negative (and significant with six lags). Moreover, it is evident that among the Center North regions there is no impact of whatever category of infrastructure investment on productivity. As said before, if infrastructure services are subject to decreasing returns regions characterized by a relative high stock of infrastructure capital will get a negligible benefit from further increment. Finally, note that the point estimates of coefficients of Transports and SER for the South, that is 0.0484 and 0.0434 respectively, are very similar and both lower than the estimate of the single coefficient for aggregate investment, that is 0.0722. This evidence could suggest the presence of spillover effects across categories of public capital.

The mixed results in the South appear of interest as they suggest that the positive effect on productivity of increasing infrastructure capital should be mainly related to supply side effect. In fact, if demand side effect would be the main part of the story, we would expect a positive coefficient for all categories of infrastructures. Services of the Transports and SER categories contribute to economic welfare of households and to firm returns. Moreover, the positive impact of Transports confirms what Easterly - Rebelo (1993), Canning - Fay (1993), and Sturm - Jacobs - Groote (1999) found at country level. Easterly - Rebelo report robust evidence that Transport and Communication investment are positively correlated with growth in a large set of developing countries. Sturm - Jacobs - Groote consider two groups of infrastructure investment that roughly correspond to our categories Transports and SER and they find that infrastructure, mainly Transports, positively Granger-caused GDP in the Netherlands during the second half of the nineteenth century.

6. Efficiency of Public Expenditure and Policy Implications

The empirical results show a positive and significant effect of infrastructure capital on productivity and a negative relationship, even if not always significant, between productivity and public consumption. In particular, within the Manufacturing sector the impact of infrastructure investment is estimated to be stronger among Southern regions.

32 The aggregate amount of infrastructure investment, that is the variable we referred to in the previous section, contains telecommunications plants and other minor categories, too.
than in the rest of Italy. This evidence suggests that the lack of infrastructure capital among Southern regions is the more immediate explanation of productivity differentials. In fact, notwithstanding the relative large amount of public investment for infrastructure capital devoted by the central government to the South, the stock of infrastructure capital in the South is still below the national average. Moreover, as shown before, in the last decade the composition of total public spending the South benefited has changed in favor of public consumption. According to our results, this type of expenditure does not improve regional performance.33

The positive relationship between productivity and infrastructure capital is in line with empirical evidence surveyed above and with common opinion. In general, a relative low level of infrastructure capital would induce a relative low return to private investment and labor productivity level.34 This reduces the attractiveness for inside and outside firms to make investments within infrastructure capital poor regions, implying that differentials among rich and poor regions could be self-sustaining.35 In this case, a clear policy implication aimed at reducing disparities among Italian regions rests on letting the South to benefit of a larger amount of public spending for investment in order to increase the stock of infrastructure capital faster than in the rest of the country.36 It is important to recognize, however, that the efficacy of this policy is strongly related to the efficiency of public expenditure; of course, an increase of the public investment rate does not imply an equivalent increase of infrastructure services. It is well known that there are examples of infrastructure projects which are not completed at all many years after the start, and infrastructures which are underutilized. At the same time, it can be the case that part of a given amount of public spending tied to a particular project finances bribes and corruption. To give a rough idea of the latter point, Fig. 7 shows the cross-plot of the number of corruption crimes and the average ratio of public investment over GDP.37 The twenty points seem to trace a positive relationship between the two variables for the period 1970-91. Thus, any redistributive policy which implies a large amount of public spending should be implemented with care.38 [Insert Fig. 7]

The negative sign of the relationship between public consumption and productivity, which is common with other empirical studies, is somewhat surprising. Expenditure in health care, education, and public order, which are part of public consumption, should induce a positive impact on regional performance. Starting on the premise that we do not have detailed data on the composition of public consumption across regions for the period of interest, we can just offer a possible explanation of our result. This rests on the hypothesis that, at least for the Italian case, the higher is the

33 During the 1963-79 the per capita real public investment in the South was much higher than in the North, while the two values became very similar during the eighties.
34 For example, investment in transportation leads to faster connections which, in turn, increase firm productivity.
35 As people and firms do not expect that investments in poorer regions will have a sufficiently high private return in the future they devote their efforts in other regions thus reducing, further in the future, the incentives to develop market activities among poorer regions. A related point is investigated in Acconcia (1996).
36 A counter-argument applies too. Better infrastructure in the South may favor further agglomeration in the North with cheaper transports of goods for consumption in the South, increasing disparities.
37 Barro - Sala-i-Martin (1995), and Shleifer - Vishny (1993) stress the negative linkage between the activity of the public sector and the growth rate of an economy due to the detrimental role of corruption.
38 Note that the relationship between public investment and corruption suggests an explanation of why the output elasticity of public capital estimated with public investment is substantially lower than that estimated exploiting the effective stock of infrastructure.
ratio of government consumption on GDP the higher is the share of unproductive expenditure. In other words, the high amount of public spending can largely overestimate the effective flow of public productive services. In fact, a given amount of public spending can generate different amounts of productive services depending upon the quality of both local and central governments, their objectives, and the weight of corruption, namely the amount of bribes on government transactions. Comparing the North with the South, for public institutions such as hospitals and schools, it is evident that the quality of public services among Southern regions is worse than among Northern ones, and that in the South the ratio between employees and users is sometimes higher for administrative and low-income jobs and lower for qualified jobs (for example, doctors and teachers) than in the North. In many cases, this is the effect of policies aimed merely at increasing the level of employment instead of the quality of public services. Moreover, as for the case of public investment we cannot neglect that sometimes the aim of politicians has been devoted to rent-seeking illegally, that is by means of bribes. Thus, as counterpart for a given amount of public spending for consumption, any firm in the economy takes advantage of a lower amount of productive public services than could be otherwise possible.

7. Conclusion
The main results of the econometric analysis documented above can be summarized as follows. (i) The distribution of regional productivity in steady state is very well represented by the distribution of infrastructure capital. (ii) Conditioning on the initial level of productivity, there is a positive cross-sectional relationship between regional growth and infrastructure capital that mainly holds for the Manufacturing sector. (iii) Within the Manufacturing sector, the impact of public investment on productivity is noticeably stronger for the low-income group of regions than for the high-income group of regions; roads, sanitation, energy, and reclamation appears to be the most important categories of public capital. (iv) It is usually estimated a negative relationship between productivity and the ratio of public consumption on GDP, even if there is no systematic evidence of the significance of the coefficient. Thus, the allocation of public funds between types of expenditure can be a decisive policy tool for determining the performance of a region. Any policy aimed at improving the performance of poorer regions should be targeted, among others, to an increase of the stock of infrastructure capital. Infrastructure capital is complementary to private investment and so it is beneficial for growth. At the same time, one must be very careful to use resources in order to expand public consumption because, given our econometric results, this type of expenditure does not improve regional performance. Moreover, it is important to recognize that infrastructure investment do not automatically have a beneficial impact on private investment and growth. The quality of public services and the possibility of negative indirect effects should be taken into account. Finally, further research is required to understand the negative correlation between growth and investment in Buildings and to disentangle the positive effect of other categories of public capital.
Appendix

A.1. List of regions (C-N states for Center-North and S for South).

Piemonte – Valle D’Aosta (C-N)
Lombardia (C-N)
Trentino Alto Adige (C-N)
Veneto (C-N)
Friuli Venezia Giulia (C-N)
Liguria (C-N)
Emilia Romagna (C-N)
Toscana (C-N)
Umbria (C-N)
Marche (C-N)
Lazio (C-N)
Abruzzi (S)
Molise (S)
Campania (S)
Puglia (S)
Basilicata (S)
Calabria (S)
Sicilia (S)
Sardegna (S)

A.2. Data Sources

*Gross Domestic Product, Value Added, Units of Employed Worker, and Public Spending for Consumption*; Prometeia.

*Public Spending for Infrastructure at Current Prices*; roads, highways, airports, railways, schools, public buildings, residential buildings, sanitation (hospitals, water systems, sewers, and water filtering), land reclamation, land transformation, water and electrical power, telecommunications plants, gas facilities, docks, canals, others; Statistiche delle Opere Pubbliche, Istat.


*Number of People with High-School Level*; Sommario Storico di Statistiche sulla Popolazione, 1951-87, Istat.

*Corruption Crimes Reported to Police*; Annuario di Statistiche Giudiziarie, Istat.
A.3. Derivation of the estimated equation.

Here we derive equation (1) in section 5.1. The model is a version of Barro (1990), and Holtz-Eakin and Schwartz (1995). Assume for each region a Cobb-Douglas production function with constant returns to scale, \( Q_t = K_t^\alpha G_t^\beta (A_t L_t)^{1-\alpha-\beta} \), where \( K_t \) is the stock of private capital, \( G_t \) is the stock of public capital, and \( A_t L_t \) denotes labor in effective units. Both \( A_t \) and \( L_t \) grow at constant rates \( (n+x) \). Public capital evolves according to the following expression:
\[ \dot{G_t} = \psi Q_t - \delta G_t \]
where \( \psi \) is the fraction of output devoted to public sector capital accumulation, and \( \delta \) denotes the depreciation rate of public capital. Previous assumptions imply a steady-state level of labor productivity, for a given level of \( K_t / A_t L_t \):
\[ (Q / AL)^* = \left( \frac{\psi}{n+x+\delta} \right)^{\beta/1-\beta} (K/AL)^{\alpha/1-\beta}. \]

Given perfect competition and private capital mobility, the steady-state level of labor productivity in each region can be expressed as follows:
\[ (Q / AL)^* = \left( \frac{\psi}{n+x+\delta} \right)^{\beta/1-\beta} c \]
where the constant term \( c \) depends on the aggregate (national) private capital output ratio.

Proxing growth rates with log-differences, the public capital accumulation equation implies (a first order approximation around the steady state):
\[ \ln(Q / AL)_{t+1} = \ln(Q / AL)_{t} + \lambda [\ln(Q / AL)^* - \ln(Q / AL)_{t}] . \]

Substituting out the expression for the steady state level of \( Q_t / A_t L_t \) and rearranging we obtain an equation similar to equation (1):
\[ \ln(Q / L)_{t+1} - \ln(Q / L)_{t} = \gamma_{t+1} + \eta \left[ \frac{\beta}{1-\alpha-\beta} \ln \left( \frac{\psi}{n+x+\delta} \right)_{t+1} \right] + \eta \ln(Q / L)_{t}. \]
References


Table 1
Estimation results of equation (2)

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<th></th>
<th>All Sectors</th>
<th>Manufacturing</th>
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<tr>
<td></td>
<td>OLS IV</td>
<td>OLS IV</td>
</tr>
<tr>
<td>Y</td>
<td>– 0.088 (8.10)</td>
<td>– 0.080 (7.14)</td>
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<tr>
<td>GH</td>
<td>0.013 (4.23)</td>
<td>0.011 (3.51)</td>
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<tr>
<td>IG</td>
<td>0.004 (2.01)</td>
<td>0.001 (0.20)</td>
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<tr>
<td>CG</td>
<td>– 0.035 (6.42)</td>
<td>– 0.026 (3.75)</td>
</tr>
<tr>
<td>ΔL</td>
<td>– 0.040 (5.55)</td>
<td>– 0.042 (5.89)</td>
</tr>
</tbody>
</table>

Notes: Estimates are relative to 19 regions of Italy during 1965-93. The dependent variable is the deviation from the national mean of the average regional growth rate of gross domestic product per employed worker or value added per employed worker. The former refers to the column labeled “All sectors”. OLS denotes estimates by ordinary least square, while IV denotes estimates obtained by instrumenting the two public spending variables at time t with lagged values. Numbers in parentheses denote absolute values of t-statistics. The number of observations is 114.

Table 2
Basic estimation results of equation (3)

<table>
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<tr>
<td></td>
<td>Five Lags</td>
<td>Six Lags</td>
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<tr>
<td>IG</td>
<td>0.0133 (2.18)</td>
<td>0.0104 (1.52)</td>
</tr>
<tr>
<td>CG</td>
<td>0.0740 (1.28)</td>
<td>0.0602 (0.93)</td>
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<tr>
<td>ΔL</td>
<td>– 0.0130 (0.91)</td>
<td>– 0.0150 (1.03)</td>
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<td>AR(1)</td>
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<td>– 0.019</td>
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<tr>
<td>Obs.</td>
<td>494</td>
<td>475</td>
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</table>

Notes: The dependent variable is the deviation from the national value of the annual regional growth rate of gross domestic product per employed worker or value added per employed worker. The former refers to the column labeled “All sectors”. Results refer to the case with two lags of labor productivity among the regressors. IG denotes the estimate of the sum of coefficients on infrastructure investment as a share of GDP, that is Φ₁(1). CG denotes the estimate of the sum of coefficients of public consumption as a share of GDP, that is Φ₂(1). ΔL denotes the estimate of the sum of coefficients of growth rate of employed (depreciation rate of public capital and growth rate of technology). Lags denote the number of lags of infrastructure investment and public consumption. AR(1) denotes an estimate of the first order serial correlation of residuals. Numbers in parentheses denote absolute values of t-statistics.
### Table 3
Basic estimation results of equation (3) for Manufacturing

<table>
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<tr>
<th></th>
<th>Low (South)</th>
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<td>Six Lags</td>
<td>Five Lags</td>
<td>Six Lags</td>
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<tr>
<td>IG</td>
<td>0.048 (2.53)</td>
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<td>– 0.0097 (0.83)</td>
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<tr>
<td>CG</td>
<td>– 0.016 (0.11)</td>
<td>– 0.0496 (0.42)</td>
<td>– 0.0284 (0.51)</td>
<td>– 0.0192 (0.32)</td>
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<tr>
<td>∆L</td>
<td>– 0.027 (1.59)</td>
<td>– 0.0318 (1.87)</td>
<td>– 0.0105 (0.92)</td>
<td>– 0.0171 (1.47)</td>
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<td>AR(1)</td>
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<td>0.016</td>
<td>– 0.040</td>
<td>– 0.012</td>
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<tr>
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<td>275</td>
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Notes: See Table 2.

### Table 4
Basic estimation results of equation (3) for Manufacturing for different categories of public capital

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<tr>
<td>Transports</td>
<td>0.0371 (3.03)</td>
<td>0.0484 (3.49)</td>
<td>– 0.0157 (1.75)</td>
<td>– 0.0172 (1.66)</td>
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<tr>
<td>Buildings</td>
<td>– 0.0202 (1.69)</td>
<td>– 0.0268 (2.04)</td>
<td>0.0015 (0.22)</td>
<td>– 0.0029 (0.35)</td>
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<tr>
<td>SER</td>
<td>0.0202 (1.25)</td>
<td>0.0434 (2.48)</td>
<td>– 0.0043 (0.65)</td>
<td>– 0.0123 (1.72)</td>
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Notes: The dependent variable is the deviation from the national value of the annual regional growth rate of value added per employed worker. We report only estimates of the sum of coefficients of infrastructure investment as a share of GDP, that is $\Phi_1(1)$. Transports includes roads, airports, and railways; Buildings includes public buildings, public spending devoted to private buildings, and schools; SER includes sanitation, energy, and reclamation.
Fig. 1  Not too much convergence in Italy

Fig. 2  Persistence of regional disparities in Italy
Fig. 3 Measures of Government Policy Intervention: Infrastructure Investment on GDP

Fig. 4 Measures of Government Policy Intervention: Government Consumption on GDP
Fig. 5 Ratio of Government Consumption on GDP between South and Center-North

Fig. 6 Ratio of Infrastructure Investment on GDP between South and Center-North
Fig. 7 Corruption and Public Spending: 1970-91

Infrastructure Investment on GDP

Log (total number of corruption crimes on average POP)