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KEYWORDS

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Enhancing institutional quality, particularly in Southern Italy, is crucial for maximizing the effectiveness of the PNRR. Short-term solutions include expert and central government support, while long-term efforts should focus on improving human capital and changing social norms.

Public capital and institutions' quality in the Italian regions

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January 7, 2025

Abstract

The contribution starts from the fact that Southern local institutions will receive significant funding from the Italian PNRR in the coming years, raising concerns among policymakers and analysts about their capacity to manage these resources effectively. The study examines the economic impact of public capital in Italian regions over the past two decades, focusing on the role of local bodies in Southern Italy to assess their ability to realize public investments. The regional public capital stock series has been computed using Territorial Public Accounts (CPT) data, which allows for disaggregation by different administrative bodies. An augmented production function is estimated to assess the impact of public capital on regional value-added, using lagged capital stock and labor as instruments in a 2SLS approach to address endogeneity issues. The results show an overall positive effect of public capital, but investments by local bodies in Southern regions have a much lower impact compared to those in Northern Italy, primarily due to the lower institutional quality in the South. Enhancing institutional quality, particularly in Southern Italy, is crucial for maximizing the effectiveness of the PNRR. Short-term solutions include expert and central government support, while long-term efforts should focus on improving human capital and changing social norms.

Keywords: Public capital; Institutional quality; Regional growth; Public investment; Mezzogiorno

JEL codes: H54; O43; R11; R58

1. Introduction

In the next years, Italy is expected to receive a vast amount of public funding (almost 280 billion euros) from the National Recovery and Resilience Plan (NRRP) for Italy and the new European Union (EU) Cohesion Framework 2021-2027. These plans aim to finance structural reforms to boost the economy by accelerating the green and digital transition and removing barriers to market competitiveness and access to essential services, primarily healthcare and education. It is important to remark that the regional and local administrations will manage a large share of the available financial resources. Moreover, almost half of the funding will be allocated to the eight less-developed Italian Southern regions. From a back-of-the-envelope calculation, the Mezzogiorno's regions are expected to allocate and spend almost 94 billion euros from the NRRP and 30 billion euros from the EU framework in the next five years. An amount of money they have never received before.

In this context, a relevant question raised by political analysts and policymakers is about the actual capacity of the Southern administrations to deal with such an extraordinary task. Some doubts about the capability of the local public bodies in the Mezzogiorno to manage and efficiently spend these financial resources have also been advanced by economists because of the low quality of the local institutions (Albanese et al. 2020, Di Caro and Fratesi 2022).

Rodriguez-Pose (2020), in an inspiring overview of the open issues on the relationship between institutions and territories, highlights that local institutions may have a direct and an indirect effect on regional economic performances. Local institutions leverage the provision of public goods (education, innovation, infrastructures) in their regions, thus directly affecting their economic performance. Moreover, local administrations play a pervasive role in setting the normative and regulatory framework, and consequently, they influence firms' productivity (Lasagni et al. 2015). At the same time, they have indirect effects given their influence on the local effectiveness of other national or European policies (Rodríguez-Pose and Garcilazo, 2015).

This paper aims to contribute to the current debate on public capital effectiveness by distinguishing among the government levels responsible for the expenditure (central and local bodies) and explicitly considering local institutions' quality. Although institutional quality is getting more and more attention within the regional economic literature, accounting for the diversified role played by different government levels has been largely overlooked, mainly because of the limited data availability.

The empirical analysis focuses on regional economic performance in Italy over the past two decades, where a persistent divide between the northern and southern regions has shaped development patterns. The economic divide makes Italy a particularly relevant case for analyzing the relationship between public capital impact and the role played by different institutional levels. To this aim, we first set up a novel database on public capital at the regional level using the investment expenditures of the Extended Public Sector (Settore Pubblico Allargato, SPA) provided by Territorial Public Accounts (Conti Pubblici Territoriali, CPT).

Following the methodology proposed in Marrocu and Paci (2010), we build the series on public capital stock for 21 NUTS2 Italian regions over the period 2000-2019, disaggregated by five levels of institutions responsible for the investments' implementation.

Our econometric specification is based on a standard Cobb-Douglas production function augmented with a measure of the institutions' quality and other intangibles and territorial factors and considering different levels of disaggregation of the public capital. We adopt an instrumental variable approach to deal with the issue of potential endogeneity of the main productive inputs.

The main results highlight the positive impact of public capital on regional product levels with an elasticity higher than the private one. Another remarkable result is that the quality of institutions exhibits the expected positive and significant elasticity, robust to all different specifications. When we disaggregate public capital into central and local bodies, according to the administrative entities in charge of the expenditures, significant differences between Centre-Northern and Southern regions emerge. Central bodies in the Southern regions exhibit an elasticity much higher with respect to the Northern ones. The opposite happens with the local bodies, which appear much less effective in the Southern regions. This finding is mainly due to the fact that the effectiveness of local bodies is a positive function of the level of institutional quality.

Although our analysis focuses on Italy, our results are also relevant to the rest of the European regions, which feature varying levels of institutional quality. In some countries (e.g., Romania, Bulgaria, Hungary, and Greece), institutions responsible for managing and allocating public funding have a quality level very similar to the one exhibited by the Southern Italian regions.[1]

The rest of the paper is organized as follows. In section 1.2 the literature on public capital impact is briefly reviewed. Section 1.3 deals with constructing and describing the public capital stock series and the other variables. Section 1.4 presents the empirical model. The econometric results are discussed in section 1.5, and section 1.6 concludes.

2. Outline of literature background

The impact of public capital on the economic performance of states and regions is increasingly seizing the attention of academic researchers and policymakers alike. In addition to the traditional approach to the effects of public capital and infrastructures, a new stream of the literature has explicitly focused on the impact of public expenditures resulting from the EU structural funds.

[1] According to the European quality of Government index in 2021, the Italian Mezzogiorno has an index of -1.47, Bulgaria and Romania have very similar values (-1.47 and -1.48, respectively), Hungary and Greece a slightly higher one, -1.18 and -1.13. Note that the index ranges from -1.48 (Romania) to 1.68 (Finland).

The foundational approach to studying the impact of public capital on production emerged following Aschauer's (1989) influential work. However, initial studies (Aschauer 1989, Munnell 1990, Sturm and de Haan 1995) provided questionable estimates of the public capital elasticities because of unsolved econometric issues, such as reverse causality and spurious correlation (Romp and de Haan 2005, Holtz-Eakin 1994). In a meta-analysis based on 578 estimates from 68 studies for 1983–2008, Bom and Ligthart (2014) have found an average elasticity of 0.11, showing a major impact of infrastructures realized by the local and regional levels of government. More recently, Núñez-Serrano and Velázquez (2017), in a meta-analysis based on almost 2,000 elasticities from 145 studies, found an average elasticity of 0.13 and 0.16 for the short-term and long-term, respectively.

Over the last two decades, the literature on public capital impact has prospered through cross-countries and within-country analysis. The former studies have proven the positive effect of public capital on economic growth in developed (Kamps 2004, Fournier 2016, Han et al. 2017) and developing countries (Gupta et al. 2014, Agénor and Neandis 2015, Santiago et al. 2020).

Numerous analyses have studied the impact of public capital stock at the regional level, specifically concerning the case of Spain and Italy. In Spain, a positive effect of public capital has been estimated on economic growth by Moreno et al. (2015) and productivity levels by Gómez-Antonio and Fingleton (2012). Furthermore, Aray (2019) found a positive effect of decentralization on the allocation of public infrastructures. In Italy, several contributions have estimated a positive impact of public capital on economic performance. Marrocu and Paci (2010) remarked a higher elasticity in the Northern regions, and Daniele (2009) showed similar results studying public expenditures. The role of public investments in Southern Italy has been analyzed by Papagni et al. (2021), finding a positive impact only between 1951 and 1973. Moreover, Cosci and Mirra (2018) revealed that post-war public investments in road infrastructures had not reduced the economic divide between Northern and Southern Italy.

A second approach has focused on the impact of capital expenditure originated by the European structural funds. The EU has developed its cohesion policies to encourage and support the integration process among the country members by fostering economic growth and promoting development in the less developed regions. It is important to remark that the EU cohesion policies have gained relevance in the last years. Therefore, many researchers have analyzed the impact of EU capital expenditure on economic growth and regional integration. While some contributions highlighted the overall positive influence of such policies, others have emphasized the heterogeneity of these effects across countries (see the meta-analysis by Dall'Erba and Fang 2017). Several authors report that the regional differences depend on national and regional contextual factors, such as the quality of local institutions and human capital endowment (Albanese et al. 2021, Di Caro and Fratesi 2022). Looking at the national intervention model, Crescenzi and Giua (2020) found that EU programs are more effective in enhancing economic growth in Germany, while their impact is weak in the Southern European regions. This result is

coherent with Albanese et al. (2020), who estimated an average null effect of EU structural funds on Southern Italy total factor productivity. On the other hand, Coppola et al. (2020) indicated a positive impact of EU cohesion policies in Italy.
In general, the literature highlighted the relevant role of public infrastructures financed through EU cohesion policies. More importantly, sound evidence has been provided on the fundamental role played by the quality of local institutions in favoring the impact of public capital expenditure on economic performance.

3. Data and descriptive statistics

3.1 Regional public capital stock

The data on public capital stock is not available in Italy at the regional level. The Italian National Institute of Statistics (Istat) provides data only for total capital stock at the national level without distinguishing between private or public expenditure.[2] Therefore, to obtain the series of regional public capital stock, we accomplish the following steps: (i) compute the series of total regional capital stock; (ii) compute the regional capital stock for the public component; (iii) decompose total capital in its public and private components.
The initial value of the capital stock in 1999, which represents the base for the series' reconstruction, is computed considering the annual mean value of the national total capital stock for 1996-1999. Then, we divide the national stock in the base year 1999 among the regions using the methodology in Gleed and Rees (1979), also used by Marrocu and Paci (2010). Next, the total capital series for each region has been computed for the period 2000 to 2019 by applying the perpetual inventory method, which entails that the value of the capital stock at time *t* is equal to the value at time *t-1*, augmented by investment measured at time *t* and diminished by depreciation (we assume a 10% depreciation rate). Regional data on gross fixed investment, published by Istat, are at constant prices.
The second step entails constructing the public capital series using the Extended Public Sector (SPA) investment expenditures. It is important to remark that the SPA includes public administrations and public companies, thus allowing for a more comprehensive assessment of the public investments' impact on the economy.
It is worth remarking that we consider a broad definition of public investments in this paper. In addition to the categories "real estate assets and works" and "movable property, machinery", we also include "capital transfers to households and social institutions" and "capital transfers to private undertakings". In such a way, our definition of public capital embraces the capital

[2] See Table A1 in the Appendix for data definitions and sources.

expenditures financed by the public sector, although the investment is realized by private entities.

The SPA dataset distinguishes five bodies responsible for the investments' implementation. The "central administration" includes the Italian State and government agencies such as the Revenue Agency, CDP (Cassa Depositi e Prestiti), and ANAS (the National Agency for Roads). The "regional administration" encompasses the regional government and the local health units. The "local administration" embraces municipalities, provinces, and other territorial entities such as municipalities' unions, universities, port authorities and national parks. The "national public companies" include firms under the direct control of the government. Often, they are former public monopolies transformed today into private companies listed on the stock exchange, but where the State still owns a relevant share.[3] Finally, the "local public companies" level comprises firms owned by the regional and local administrations, usually operating in local public services (water, transports, energy) and agrarian consortiums and cultural foundations.

This disaggregation is crucial for our analysis, which aims to investigate whether the impact of public capital depends on the level of government responsible for the expenditures. As before, the public capital stock series have been constructed using the perpetual inventory methodology with a 10% depreciation rate from 2000 to 2019. The initial value of regional public capital has been computed using the annual average share of regional public investments on regional total investments between 1996 and 1999. Following the same methodology, we have also obtained a series of public capital stock disaggregated into levels of government.

Finally, in the third step, we compute the private capital component as the difference between total and public capital.

Figure 1 displays Italy's total and public capital stock series over the years 2000-2019. The total capital stock decreased notably (-1.28% yearly) during the observed period. The decline in the capital accumulation process appears even more pronounced after the financial crisis of 2008. On the other hand, the level of public capital remains almost unchanged until 2009 and starts decreasing afterward.

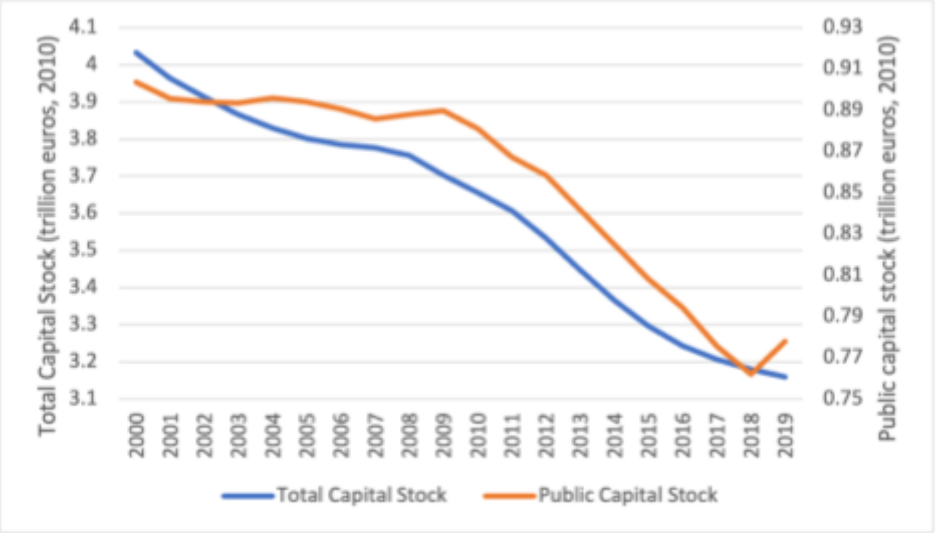
[3] Notable examples are ENI (the energy company), ENEL (the electrical company), Poste Italiane (the postal service), and Ferrovie dello Stato (the railway company).

Table 1. Public capital stock by macro-areas

	North		Centre		South		Italy	
	2000	2019	2000	2019	2000	2019	2000	2019
Share on total stock (%)	17.0	19.5	22.2	26.1	33.9	36.1	22.4	24.6
Per labour unit (index)	82	88	97	99	133	124	100	100
Per capita (index)	92	98	103	107	108	99	100	100

Table 1 reports the share of the public over total capital stock and some summary measures for the public stock of capital, namely index numbers for per capita and per unit of labor. In general, the share of public capital expenditure over the total is persistently increasing, and it reached the value of 24.6 in 2019. The public component of the capital stock is more relevant in

Figure 1: Total and public capital stock in Italy, 2000-2019



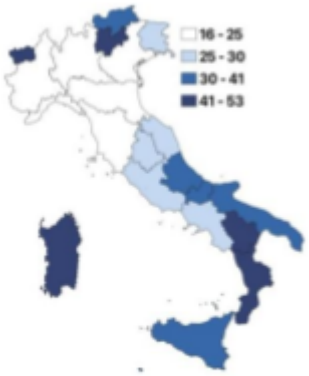
Southern Italy (36% in 2019). Public capital per labor unit is higher in Southern Italy even if they decrease over time, while they increase in the rest of the country.

Figure 2 represents the regional shares of public capital (panel 1), the regional public capital per labor unit (panel 2), and the regional per capita public capital (panel 3) in 2019. The maps show important differences between Northern and Southern Italy in all cases. Together with the small autonomous regions in the Alpes, the Southern regions show a much higher presence of public investment.

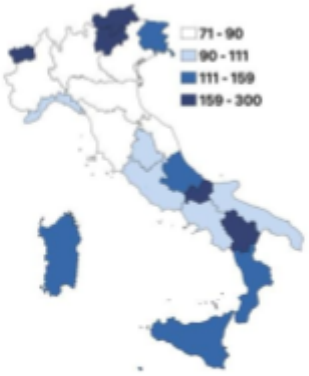
Table 2 describes, for the years 2000 and 2019, the share of public capital stock for the five levels of government responsible for the capital expenditure. Interestingly, local administrations in the North show the highest share of public capital in 2000, while in Southern and Central Italy the highest shares are exhibited by the central administration and national public companies. It is worth remarking that the role of national public companies has strongly increased over time, and in 2019 they manage 36% of national public capital expenditure. On the other hand, the role of local, regional, and central administrations decreases over time (by

-7, -3, and -5 percentage points, respectively). The considerable differences in the share of local public companies among the areas are also interesting: they play a relevant role in the North (15% in 2019), while they control a small share of public capital stock in the Southern regions (5% in 2019).

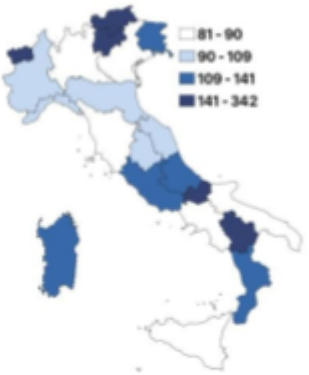
Figure 2: Regional distribution of public capital, 2019



1. Public capital shares on total capital



2. Public capital per labour unit (index, Italy=100)



3. Public capital per capita (index, Italy=100)

Overall, a highly differentiated picture among the regions emerges regarding the government levels responsible for capital expenditures and the sectoral distribution of capital expenditures. We will consider this heterogeneity in the econometric analysis.

Table 2. Public capital stock by institutions and macro-areas (% share)

Bodies	Macro-bodies	North		Centre		South		Italy	
		2000	2019	2000	2019	2000	2019	2000	2019
Central administrations	Central	16.2	15.7	25.3	23.6	34.4	24.0	25.1	20.1
National pub. companies	Central	22.0	33.0	28.2	41.7	16.4	35.5	21.0	35.7
Regional administrations	Local	16.8	12.8	7.6	5.4	15.8	12.6	14.6	11.2
Local administrations	Local	31.6	23.2	27.8	19.2	27.4	22.4	29.2	22.1
Local pub. companies	Local	13.4	15.3	11.2	10.1	6.0	5.4	10.1	10.9

3.2 Regional value-added and control variables

We start by providing a statistical description for the dependent variable, regional value-added, followed by institutional quality and the main contextual variables: human capital, social capital, and technological capital. Table 3 and Figure 3 report the summary statistics of all the variables, while the complete list of the variables and their sources is reported in Table A1 in the Appendix.

The Italian value-added (VA) series shows a sharp decrease after the financial crisis of 2008 (-5.4% between 2008 and 2009) and after the Italian debt crisis of 2011 (-4.2% between 2011 and 2013). Looking at the per capita VA, the Southern regions are well below the national average (index 61 in 2019), while Northern Italy has an average value 13% higher than the national one, confirming the huge and even increasing economic differences between the two areas.

In the econometric analysis, as factors influencing the economic performance at the regional level, we consider the intangible assets whose effect on production has been largely documented in the empirical literature on regional economic growth. Among them, we devote specific attention to the Quality of the Institutions since administrations and public companies implement a large share of public investment at the local level. Seminal contributions have emphasized institutions' role in determining economic system performance (among others, North 1990, Acemoglu et al. 2001, Glaeser et al. 2004).

A high-quality government ensures the provision of more efficient public services, thus supporting local economic development. More recently, the growth-enhancing effect of institutions at the regional level has been remarked by Rodriguez-Pose (2013) and Rodríguez-Pose and Ganau (2022). In this paper, we use the Quality of Institutions (QI) index computed by Nifo and Vecchione (2014) as a composite index based on various measures of corruption, government effectiveness, regulatory quality, rule of law, and voice and accountability.[4]

[4] This index is similar to the Quality of Government Index computed by Gothenburg University for the European regions (Charron et al., 2015).

Table 3. Descriptive statistics, indices (Italy = 100)

	North		Centre		South	
	2000	2019	2000	2019	2000	2019
Value Added (per capita)	113	113	105	102	63	61
Quality of Institutions (a)	135	132	112	118	54	55
Human capital	98	106	116	121	92	81
Social capital (b)	131	127	96	97	61	66
Technological capital	102	110	129	110	70	65

(a) initial year, 2004

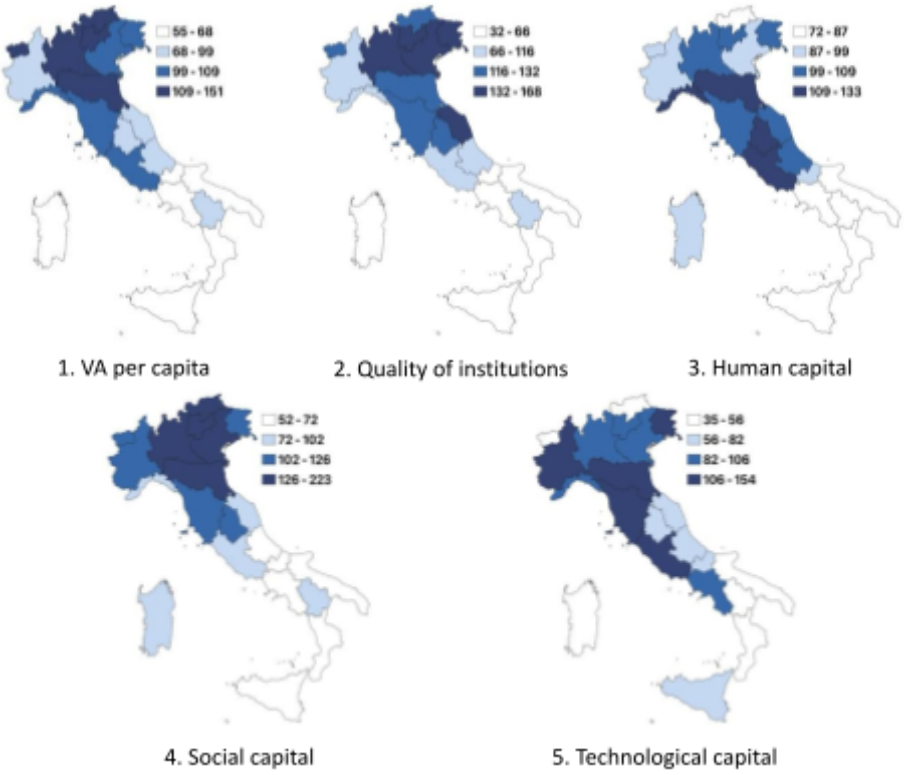
(b) final year, 2018

Table 3 and Figure 3 show a clear dualistic pattern between Northern and Southern Italy for all the exogenous factors considered. In the case of Institutional Quality, the Southern average is about half of the national one, while the Northern average is 2.4 times higher than the Southern one. As expected, institutional quality is particularly low in territories characterized by the presence of criminal organizations such as Sicilia (32), Calabria (32), and Campania (42). Six out of the eight Southern regions are in the lowest quartile of the Institutional Quality index distribution, whereas Centre-Northern regions display much more variability with none of them in the lowest quartile. Social capital shows a less dramatic difference, but the gap between the South and the North is still remarkable, as the two areas are, on average, 65 percentage points apart. The regional differences are very high, with Trento showing in 2019 the highest value, which is 4.3 times higher than the lowest one in Sicilia. Human capital shows a minor difference between Northern and Southern Italy. At the same time, Central regions have the highest level of graduates with an average value of 19% higher than the national one. Differences between Northern and Southern Italy have decreased over time for social capital and institutional quality, whereas they have increased for human capital (6 percentage points in 2000 vs 25 percentage points in 2019). Technological capital is similarly distributed as human capital: Central regions display the highest mean value, even if, in this case, it decreases with time (129 in 2000 vs 110 in 2019). In this case, Southern and Northern Italy show significant and growing differences (32 percentage points in 2000 vs 45 percentage points in 2019).

It is important to remark that intangible factors exhibit positive correlations. This is particularly true for the Quality of Institutions and social capital (0.78). We will consider this issue in the econometric estimations.

4. Methodology

Figure 3: Regional distribution of main variables, 2019
(Indices, Italy = 100)



The role of public capital in the Italian regions over the period 2000-2019 is assessed by estimating a Cobb-Douglas production function considering different levels of disaggregation of the total capital stock and including a set of controls for the regions' intangible factors and territorial characteristics. The general formulation of the model is:

$$Y_{it} = A_{it} L_{it}^{\alpha} K_{it}^{\beta} e^{\varepsilon_{it}}, \quad (1)$$

where the subscript *i* indicates the region, while *t* refers to the time period; *Y* is regional value added in constant prices 2010, *L* are units of labor, *K* is total capital stock; *A* represents the total efficiency level.

As argued in the previous sections, the total factor productivity is assumed to depend on the Quality of Institutions (*QI*), because it exerts a pervasive role in driving economic outcomes, especially when public bodies are directly involved in investment decisions and indirectly by setting the normative and regulatory framework. Moreover, to control for regional heterogeneity, we consider three immaterial factors: the endowments of human capital, social capital, and technological capital, which play a decisive role in enhancing the effectiveness of production inputs. Population density is also included to account for demographic trends and possible agglomeration effects. All the exogenous variables are included with a five-year lag, which allows us to consider a period long enough for the contextual variables to exert their effects on the dependent variable and guard against the potential problem of reverse causality.

As discussed in Section 1.3.1, the total capital stock can be disaggregated into private and public capital. The latter can also be split up according to the bodies in charge of carrying out the investments.

The empirical specification is obtained by log-linearizing Equation (1) and accounting for the lag structure discussed above:

$$\ln ln\left(Y_{it}\right) = \alpha \ln ln\left(L_{it}\right) + \beta \ln ln\left(K_{it}\right) + \delta \ln ln\left(QI_{it-5}\right) + \gamma South_{i} + \lambda_{t} + control. \quad (2)$$

To deal with the issue of potential endogeneity of the main productive inputs, we adopt an instrumental variable approach and the Two Stage Least Squares (2SLS) estimation method. Following Reed (2015) and the common practice usually adopted when it is very difficult to find valid external instrumental variables, we resort to the internal ones; hence, labor and capital stock are instrumented by their own lagged variables in all the estimated models. It is worth noting that lagged variables could not be valid instruments if they are correlated with unobserved confounders (Bellemare et al., 2017), to attenuate this problem, we have considered lags of five years. Although the choice of such a long lag comes at the cost of reducing the estimation sample size, it allows us to tackle endogeneity threats more effectively with respect to the case of shorter lags.[5] Notwithstanding such considerations, all the estimated effects must be interpreted cautiously.

[5] We have also estimated the models with using as instruments for labor and capital stock variables their six-year lagged values. The results remain unchanged.

In a preliminary analysis, we considered estimating Equation (2) by including regional fixed effects. However, such specification resulted in all coefficients of the explanatory variables being not significant at conventional levels. This could be due to the small-time dimension of the panel and to the fact that most explanatory variables exhibit persistent cross-region variation.

To take into account the time-invariant divide between the Centre-North and the Southern areas, we include a dummy variable *South* that takes the value of 1 for the eight Southern regions.[6] Finally, time dummies (λ_t) are included to account for common shocks at the macroeconomic level.

5. Findings – Discussion

Table 4 reports the main results. The first specification considers capital stock at the most aggregate level. The elasticity of labor is 0.6, while the total capital stock shows an elasticity of 0.38. With respect to previous studies on the Italian case covering the pre-crisis period (Marrocu and Paci, 2010) the estimated return appears higher for the capital input and lower for the labor input. The quality of institutions exhibits the expected positive and significant elasticity.

On the contrary, the other intangible assets are not statistically significant; this unexpected result is reasonably due to the high collinearity among the contextual variables. We will return to this issue later. Among the territorial covariates, the population density shows a positive and significant impact signaling the relevance of agglomeration effects, while the dummy South has the expected negative sign, although it is not statistically significant.

Table 4. The effect of public capital on value added, 2000-2019

Dependent variable: value added

	(1)	(2)	(3)
Labour	0.602 ***	0.463 ***	0.461 ***
	(0.090)	(0.069)	(0.065)
Total capital	0.383 ***		
	(0.094)		
Private capital		0.233 ***	0.234 ***
		(0.042)	(0.041)
Public capital		0.362 ***	0.365 ***
		(0.049)	(0.045)
Quality of Institutions	0.039 **	0.096 ***	0.098 ***
	(0.018)	(0.018)	(0.019)
Contextual factors			
Human Capital	0.054	0.098 *	0.096 **
	(0.087)	(0.052)	(0.048)
Social capital	0.066	0.005	
	(0.047)	(0.025)	
Technological capital	0.013	-0.023	-0.023
	(0.028)	(0.023)	(0.023)
Population density	0.068 **	0.094 ***	0.094 ***
	(0.032)	(0.023)	(0.023)
South	-0.060	-0.082 ***	-0.084 ***

[6] In a preliminary analysis we also included a dummy variable for the 9 Northern regions, however no significant differences were found with respect to the reference group of regions, i.e. the 4 Centre ones.

In column 2 we include the capital stock according to its two components, private and public capital. They turn out to be both significant with the public stock displaying a higher elasticity (0.36) than the private one (0.23). The public capital elasticity is three times higher than the one Marrocu and Paci (2010) estimated for 1996-2003. Therefore, it seems that in recent years the role of public institutions in affecting production levels has increased.[7]

Interestingly, the human capital endowment turns out to be significant. The quality of institutions maintains its significance and shows a higher elasticity; this is also the case for population density. In this specification, the dummy South has a negative and significant coefficient signaling that, holding all other variables constant, the Mezzogiorno's regions are less than in the rest of the country.

As expected, the social capital coefficient is still not significant due to the high correlation with institutional quality (0.78). To avoid multicollinearity problems, we exclude the social capital variable in the subsequent analysis. Therefore, in (3) we report the estimation results obtained by excluding this variable.

In Table 5 we propose the results for models in which the public capital stock is included according to the institutional level of the administrative bodies in charge of carrying out public investments. We distinguish between c*entral* bodies (central administration and national public companies) and *local* bodies (regional and local administrations, local public companies). In model (1) of Table 5 we restrict the elasticities of public capital to be the same for the whole country and find that local bodies are slightly more effective (0.079) than central ones (0.060), as in Bom and Ligthart (2014). In model (2), when we allow the elasticities to vary between the two main macro-areas of the country, sizeable and significant differences emerge. Central bodies in the Southern regions exhibit a significantly higher elasticity (0.093) with respect to Centre-Northern ones (0.060), whereas the opposite is the case for local bodies. Northern regions exhibit an elasticity (0.092) much higher with respect to Southern ones (0.064).

Since our models include the quality of institutions and several other factors that are expected to account for North-South differences, varying administrative level elasticities could be due to such variables not being adequate to control for latent traits related to institutional quality (Durlauf, 2002), as they are inherently difficult to measure.

As explained in section 1.3.2, low levels of institutional quality are mostly found in southern regions; thus, to gain more insights and enhance our understanding of how the functioning of the institutions may influence the effectiveness of public investment, we propose an alternative specification in model (3). This is obtained by augmenting model (1) with four interactive variables. Both central and local bodies are interacted with two dummy variables capturing low/high levels of institutional quality. More specifically, the first dummy takes the value of 1

[7] We have also computed a more restricted definition of public capital, excluding the transfers to families and firms. Estimation results using the narrower definition of public capital for the baseline model (model 2, Table 4) are very similar. However, the public capital elasticity using the narrow definition (0.29) is lower with respect to the wider one (0.36).1

when the regional level of institutional quality is in the first quartile of its distribution (low level ofinstitutional quality), whereas the second dummy is equal to 1 for levels of institutional quality in the highest quartile (high levels of institutional quality).

Table 5. The effect of public capital by government bodies, 2000-2019

Dependent variable: value added

	(1)	(2)	(3)
Labour	0.620 ***	0.583 ***	0.477 ***
	(0.077)	(0.055)	(0.076)
Private capital	0.092 **	0.107 ***	0.209 ***
	(0.042)	(0.030)	(0.054)
Public capital:			
central bodies	0.060 ***	0.060 ***	0.069 ***
	(0.019)	(0.017)	(0.013)
local bodies	0.079 ***	0.092 ***	0.084 ***
	(0.012)	(0.009)	(0.011)
central bodies * South		0.033 *	
		(0.021)	
local bodies * South		-0.028 **	
		(0.015)	
central bodies * QI lowest quartile			0.018
			(0.013)
local bodies * QI lowest quartile			-0.018 **
			(0.010)
central bodies * QI highest quartile			-0.045 ***
			(0.013)
local bodies * QI highest quartile			0.027 ***
			(0.009)
Quality of Institutions (QI)	0.078 ***	0.072 ***	0.052 ***
	(0.014)	(0.017)	(0.010)
Contextual factors	yes	yes	yes
South	yes	no	yes

Estimation method: Two Stage Least Squares (labour and capital variables are instrumented with their own 5-year lag)
All variables are log-transformed
Quality of Institutions and contextual variables are 5-year lagged
Contextual factors: human capital, technological capital, population density
South, dummy variable = 1 for the eight Southern regions and 0 for the remaining regions
All models include time dummies and a constant
Robust Standard Error, in parentheses, are clustered at region level
Significance levels: *** (1%), ** (5%), * (10%).
Cross-section observations (regions): 21
Number of panel observations: 315
See Table 2 for the list of bodies

When local bodies are in charge of public investments the effectiveness of public capital significantly increases with the level of institutional quality: the elasticity increases from 0.066 for the lowest levels of QI to 0.084 for the intermediate levels and up to 0.111 for the highest

levels. Therefore, the high quality of regional institutions is particularly relevant for the local level of government.

As for central bodies, no significant differences in public capital elasticity (0.069) are detected between the case of regions with low vs intermediate (second and third quartiles) levels of institutional quality. On the contrary, at the highest level of institutional quality, public capital turns out to be less effective (0.024) compared to the intermediate-level case. Although this result is somewhat unexpected and deserves further investigation in future research, it seems to suggest that in regions with the highest levels of QI, local bodies outperform central ones (public capital elasticity almost five times higher, 0.111 vs 0.024) because they are more capable of leveraging the direct knowledge of their territories and stakeholders and to benefit from a general level of trust in delivering their public interventions.

In general, the differences between central and local bodies could be related to the way of functioning of Italian public administrations, rooted in the country's historical development, so strongly influenced by its geography. As argued by Daniele et al. (2018), the process of modern growth that started in Italy in the late XIX century brought about structural changes, differentiated access to markets agglomeration dynamics that set the two macro-areas of the country on quite diverging paths, with the Northern one more densely interconnected with the wider and competitive European continental markets resulting in a more open and vibrant socio-economic environment (see also Felice 2019). Moreover, national economic policies have favored the Northern regions thus worsening the Italian territorial gap (Viesti, 2021). In recent years this process has been exacerbated by a strong migratory flow of highly qualified young people from the southern to the northern regions (Ballarino et al., 2022). This "brain drain" has further impoverished the endowment of human and technological capital in the South. Such a dualistic development process reasonably had important effects also on the administrative practices and ruling approaches of local government bodies in the North and in the South of Italy, although the legislation and the normative setting have been the same across the whole country. Additional arguments have been advanced by Bigoni et al. (2016) which, using a lab-in-the-field experiment, show that the persisting North-South divide can be explained in terms of a behavioral gap in cooperation due to differences in preferences, expectations, and social norms. At the same time, it can be argued that such a cooperative gap may be in turn the effect of the lack of development factors in the South (public infrastructures and services, human capital, innovation) rather than its cause.

No matter what, in the last three decades, Southern territories were incapable of taking advantage of the regional autonomy, enhanced by the 2001 devolution reform of Title V of the Italian constitution. For the Southern regions, the devolution resulted in a more fragmented political environment, higher pressure from specific stakeholders, and narrow administrative-decision capabilities to deal with the challenges the Mezzogiorno must confront. These include persistent issues, such as demographic trends, brain drain, low attractiveness for external investment, and the new ones brought about by the pandemic crises and the severe

instability of the international scenario. These considerations help in explaining the estimated lower elasticities of Mezzogiorno's public capital once controlling for the positive role of institutional quality.

6. Policy implications and recommendations

This study has analyzed how the public capital stock and the institutions' quality influence regional economic performance. Such analyses are crucial to advance our understanding of the effectiveness of European and national economic growth policies and to assess the ability of the local institutions in Italy to efficiently invest the vast NRRP resources they are about to receive to boost the economy after the pandemic crisis.

The first result is that public capital stock plays a positive role in driving the production level, with a higher elasticity than the private one. A second important finding is the role played by the quality of institutions; a factor often neglected in previous studies on production function estimation because of a lack of reliable data. The positive and significant elasticity exhibited in all specifications remarks the importance of public institutions for fostering the development processes and enhancing economic growth. On this regard, more research is needed to disentangle the complex mechanisms through which local institutions, directly and indirectly, influence the regions' economic performance (Rodriguez-Pose, 2020).

Considering the disaggregation into government levels, it turns out that in Southern Italy, central bodies display a higher elasticity than the Centre-North. The opposite result is found for the local bodies, which prove much less effective in the Southern regions. Our analysis provided sound evidence that the effectiveness of public capital managed by local bodies significantly increases with the level of institutional quality, which has been persistently low in the Mezzogiorno of the country.

This might be rooted in the country's historical development strongly influenced by its geography. Moreover, the macroeconomic factors and the economic policy choices of the national governments contributed to worsen the North-South gap triggering a vicious circle. The Southern regions have been characterized by less development, less provision of public services and infrastructures, less employment opportunities, brain drain, and further reduction of human capital and innovation. The combination of these deep-root factors with current economic dynamics could also have shaped the different ways of public administrations functioning across the macro-areas of the country.

The low elasticity estimated for the public capital stock realized by Southern local administrations cast shadows on the success of NRRP and other cohesion policies. More than 120 billion euros should be invested by the local institutions in the Southern regions respecting the EU rigorous rules in the next years. The inefficiency and inadequacies that characterized

Southern local administrations might have determined the policy's failure, losing a unique opportunity to narrow the economic gap between North and South Italy.

To avoid these negative consequences, it is necessary to act urgently at least in two directions. In the short run, since the programs must be in place immediately and the expenditures completed in a few years, the central government must help the local administrations by making available in each Southern region a task force of experts to follow the implementation phases of the programs.

At the same time, it is imperative to urgently adopt long-term policies to address the profound and structural issues related to the low institutional quality of the Southern regions in Italy. As our results have shown, Mezzogiorno's low quality of institutions is one of the most relevant factors that continue to slow down its development. As previously discussed, the causes of such negative features are numerous, complex, intertwined, and deep-rooted in the historical and economic development of the South. Therefore, improving the quality of the local institutions is not an easy task, as demonstrated by decades of failures of the North-South territorial rebalancing policies in Italy. If local institutions' quality is rooted in the country's historical development and in decades of vicious economic twist, it cannot be simply changed or improved by a central government law. What is needed is a profound change in the Southern regions in people's social norms and individual behaviors, which can be attained, in our opinion, only through a long-term education policy. Investing, for a long period, considerable human and financial resources in the schooling and university system in the Southern regions seems the only policy able to break the persistent territorial divide in Italy and activate a virtuous and self-reinforcing mechanism by which increasing levels of human capital create a more favorable local environment for families and firms and contribute to further enhance the quality of institutions.

Finally, it is worth noting that our results also have external validity. Several European regions, or even countries, share with the Italian Mezzogiorno similar structural gaps – in terms of human capital, quality of institutions, innovative capacity, and per capita income – and have to confront the challenge of effectively managing the EU Next-generation funds to recover from the pandemic crisis and to counterbalance the international scenario instability.

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8. Technical Appendix

Table A1. Data sources and definition

Variable	Primary Source	Years	Definition
Value Added	Eurostat	2000-2019	Millions euros, constant price 2010
Labour	Eurostat	2000-2019	Units of labour, thousands
Gross fixed capital	Istat	2000-2019	Millions euros, constant price 2010
Public investment	Conti Pubblici	2000-2019	Millions euros, constant price 2010
Total capital stock	Own calculation	2000-2019	Millions euros, constant price 2010
Public capital stock	Own calculation	2000-2019	Millions euros, constant price 2010
Private capital stock	Own calculation	2000-2019	Millions euros, constant price 2010
Quality of Institutions	Nifo & Vecchione (2014)	2000-2019 **	Composite index based on Corruption, Government effectiveness, Regulatory quality, Rule of law,
Human Capital	Eurostat	2000-2019	Population aged 25-64 with tertiary education (Isced 5-8) over total population 25-64, %
Technological capital	Eurostat	2000-2019	R&D expenditure over GDP (%, variables in 2010 prices). R&D computed as 3-yeras moving average
Social capital	Istat, Multiscopo	2000-2018 *	People aged 14 and over who volunteered on the total population aged 14 and over (percentage)
Population density	Eurostat	2000-2019	Persons per square kilometre

* Year 2019 has been assumed equal to 2018

** Years 2000-2003 have been computed using the time dynamics over the years 2000-2004 for the available simple indicators