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Keywords: Social capital, Regional convergence, Economic growth, Decentralization

JEL Classification: O4, N9, R5

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Abstract

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1. Introduction and motivations

In the Italian government's official document outlining the National Recovery and Resilience Plan (NRRP), the Plan is referred to as "an invaluable opportunity for development, investment, and reforms..."[It] can be the occasion to resume a path of sustainable and lasting economic growth by removing the obstacles that have hindered Italian growth in recent decades." Among its objectives, the Plan aims to reduce inequalities, with the top priority being the gap between the South and the rest of the country. To this end, "approximately 40 percent of the plan's territorially allocable resources are destined for the Mezzogiorno, demonstrating attention to the issue of territorial rebalancing." ¹

The North-South gap is one of the main and most persistent problems in the Italian economy. Since the early 1970s, the gap, measured in terms of GDP per capita, has fluctuated between 60 percent and 55 percent, with the latter value tending to prevail in more recent years. About 50 percent of this gap is due to the low level of productivity in the southern regions (De Phillipis et al., 2022).

From 1970 to the present day, none of the numerous policies implemented by both central and local governments have managed to initiate a sustained convergence process (Iuzzolino, 2009). Given this background, it is crucial to question whether the NRRP will succeed where many other public interventions have not. From 1970 to the present day, none of the numerous policies implemented by the central and local governments have been able to initiate a noticeable convergence process (Iuzzolino, 2009). With a background of this type, it is important to question whether the NRRP will succeed where many public interventions have failed.

A key factor of this persistent difficulty is that public investments, which drove strong growth in the South between 1950 and 1970, lost their driving role after 1970 (Papagni et al., 2021). This is due, at least in part, to the reform around 1970 that introduced political and administrative decentralization in favor of emerging regional governments (D'Adda and de Blasio, 2017; Mauro et al. 2023). This reform took place in a context characterized by a high level of variability in the efficiency of local and regional public institutions, a situation that continues to persist. This discrepancy disproportionately impacts the South. Charron et al. (2014) estimate that, on average, the quality of local governments in the South is 2.4 times worse compared to the rest of the country.

¹ Governo Italiano (2022), p. 4. The citations are taken from the official presentation document of the NRRP by the Italian Government, available on the website: <https://www.governo.it/sites/governo.it/files/NPRR.pdf>.

This institutional disadvantage gains further significance due to the fact that it reflects deeply entrenched cultural differences rooted in history (social capital, from now on), which tend to be remarkably persistent.² Social capital is particularly low in the southern regions, a factor that exposes their public policies to manipulation by vested interests and misappropriation (Putnam et al., 1993; Guiso et al., 2004).³ Given this large and persistent gap in institutional quality at the local level, it is unsurprising that decentralization, executed with weak central oversight, has historically played a substantial role in diminishing the efficacy of investments made in the South.⁴

Given that the decentralization reform remains in effect, the effectiveness of the NRRP in the southern regions is potentially at risk. To address this challenge, the Plan's governance incorporates support from central bodies for regions where local institutions encounter significant implementation challenges. Consequently, the success of the NRRP in achieving its goal of narrowing the North-South divide largely depends on how effectively this centralized support will compensate for the shortcomings of public action in the weaker territories.

The aim of this study is to simulate the long-term effect of the NRRP on the current labor productivity divide, the most relevant variable for this type of analysis.⁵ We will assess this effect under two alternative scenarios: one characterized by significant control by the central government over the planned investments, and the other in which such control is absent or ineffective.

Our theoretical framework is based on a version of the endogenous growth model developed in Mauro et al. (2023) adapted to focus on labour productivity. In this model, the accumulation of public capital contributes to growth both directly and by increasing the productivity of private capital. The effectiveness of investments in promoting growth can be significantly limited by the presence of rent-seeking activities or corruption. In the presence of devolution, the level of these activities depends on the local level of social capital. When social capital is low, illicit activities have a lower probability of being sanctioned, and part of the investment expenditure is embezzled. In this case, strict central control aimed at countering misappropriation activities enhances the impact of investment spending on the economy.

² Other factors play a role. Human capital is one of them. On its likely influence on the North-South divide in institutional quality, see Section 5 below.

³ See the influential definition of social capital given by Guiso et al. (2011), namely “those persistent and shared beliefs and values that help a group overcome the free rider problem in the pursuit of socially valuable activities”. See Bisin and Verdier (2010) on how persistence can be sustained by mechanism of cultural transmission.

⁴ From a quantitative perspective, the results presented and discussed in Mauro et al. (2023) show that among the likely causes of the exhaustion of the convergence process in the South, the devolution of the 1970s plays a primary role.

⁵ We set aside the other significant factor in determining GDP per capita, the level of employment in the labor force. This factor is influenced by more immediate factors that impact the labor market. For a full analysis of the labour market within the framework adopted in this paper, see Mauro et al. (2023). More on this in section 5 below.

Our quantitative analysis starts from the characterization of the dynamic equilibrium of the model. This equilibrium implies a steady-state value of the ratio between private and public capital (k/p) and a value that defines the proportion of public investments that are dispersed due to various opportunistic behaviors (s).

In this setting, the impact of the NRRP on productivity can be measured as follows. The NRRP represents a one-time large increase in the level of the stock of public capital. In terms of our model, this increases p and reduces the k/p ratio compared to its steady-state value. Due to this shock, the system temporarily operates away from the equilibrium point. From that point onwards, the economy will converge back to its dynamic equilibrium, following the stable manifold to the right of the steady state of the system.

The "time elimination method" developed by Mullighan and Sala-i-Martin (1991) allows us to numerically evaluate this transitional path caused by the initial shock: the growth rates achieved along this path are higher than the steady-state towards which they converge. Consequently, when the path is completed, the level of productivity obtained is consistently higher than what would have been achieved in the absence of the NRRP. This allows us to measure the increase in productivity attributable to the investments of the Plan and the associated long-term elasticity of output with respect to the stock of public capital. In other words, our methodology quantifies a permanent effect (on productivity) achieved by means of a temporary policy, the NRRP. Clearly, the impact is more pronounced when the initial variation of p is larger. In low social capital regions, devolution increases misappropriation and by doing so reduces the actual increase in p and the positive effect on productivity.

The quantitative results we obtain by applying this methodology is as follows. In the absence of strong monitoring, control, and support from the central structures of the State, the effect of the NRRP on productivity gap (currently at 75%) ranges from 74,9% to 75.5% (a minor improvement).⁶ In other words, with decentralization, the proportionally larger share of public investments allocated to the South (40%) is offset by the malfunctioning of local institutions, leading to significant losses of public resources designated for investment.⁷

In the second hypothetical scenario, with full central control, the enhanced management of resources reduces their dispersion, resulting in a stronger effect of the NRRP on the South and a more significant reduction in the North-South gap. However, even in this

⁶ The calculation was made assuming that, in the absence of the NRRP, the gap would have remained unchanged at 75%.

⁷ The importance of considering, in growth analyses, this difference between investment expenditures and actual realizations has often been emphasized, starting from Pritchett (2000), Caselli (2005), and continuing with Dabla-Norris et al. (2012), Sanjeev et al. (2014), Baum et al. (2020).

best-case scenario, our results suggest that the narrowing of the gap (from 75% to 76.4%) could be disappointingly small.⁸

In conclusion, it's important to emphasize that, in line with the provisional nature of the Plan and its governance, the quantification of the effects discussed thus far has been determined while keeping the structural parameters of the model constant. The results would be significantly different if the model of multilevel governance adopted to manage the investments of the Plan became permanent, as this would change the *structural* conditions under which the economy operates. In our calculations, this would result in an effect that, in terms of reducing the South's productivity gap, would be up to 5 times greater — and within a significantly shorter timeframe — than the impact solely attributable to the NRRP's actions.

The paper is organized as follows. In Section 2 we discuss the relevant literature. The model is discussed in Section 3 and our quantitative results in Section 4. Section 5 is dedicated to a discussion of how our analysis would be affected by considering a number of factors that our model has ruled out by assumption. Conclusions are in Section 6.

2. Related literature

Recent studies offer forecasts on the impacts of NRRP investments using calibrated growth models. Specifically, two working papers from the Ministry of Economy and Finance (MEF) deliver complementary macroeconomic impact analyses. In the first paper, Di Bartolomeo and D'Imperio (2022) focus on a timeframe ending in 2026, the year the Plan is set to conclude. Their main result concerns the prediction that public investments implemented by the NRRP will generate a 3.4 percentage point increase in GDP in 2026 compared to the level that would have been obtained in the same year without the Plan. This work does not take into account the potential long-term effects of the reforms envisaged by the NRRP, a topic addressed by D'Andrea et al. (2023). In their calculations, the implementation of the planned reforms will lead to an overall 10% increase in GDP over thirty years.

It's worth noting that these studies do not directly address the two primary issues highlighted in the present paper. First, the forecasts pertain to GDP changes, with no specific simulations focusing on productivity. Second, there are no simulations examining the potential effects of the NRRP on the North-South divide.

Regarding both points, further information, though indirect, is available in the Government's document on the NRRP (Governo Italiano, 2022). Specifically, Table 4.5

⁸ Our result appears to be considerably smaller than the one reported in the official documents of the Italian government, according to which “the Plan will significantly reduce the gap between the South and the rest of the country”. Governo Italiano (2022), p. 267.

displays the projected changes in GDP and employment for the years 2024-26, estimated at 3.1% and 3.2%, respectively. This suggests that the expected change in productivity during the initial implementation years would be close to zero. Regarding the impact of the NRRP on the North-South gap, the forecast is that the southern share of national GDP should rise from 22% to 23.4%, a result that would imply a significant reduction (from 55% to 60% according to our calculations) in the North-South gap of per capita GDP.

Compared to these predictions, our contribution differs in several respects. Firstly, we study the long-term effect of public investments on productivity. Secondly, the forecast of the impact of the NRRP on the North-South gap proposed by the government document seems to be based on a dual assumption: first, that the planned investments take place in the most optimistic scenario, in terms of efficiency, among the three hypothesized in the document; second, and more important, that there is no efficiency difference between the North and the South in implementing the projects. Our work significantly diverges from this approach. Its central point is, in fact, the well-documented negative difference in the efficiency of public investments in the southern regions.

Our work uses concepts and addresses topics, each of which has been analyzed in numerous contributions in the relevant literature. Regarding the role of social capital in determining persistent differences in the functioning of local institutions in Italian regions, our work draws inspiration from Putnam et al. (1993). De Blasio and Nuzzo (2009), Guiso et al. (2016) have written about the persistence of this relationship. Nifo and Vecchione (2015) confirm the existence of a significant North-South gap in the quality of local institutions.

The growth model we used to quantify the effects of the NRRP is a development of Futagami et al.'s (1993) models chosen for its focus on public investment as an engine of long run growth and modified to include embezzlement that in turn is affected by institutional design. Many economists have empirically analyzed the relationship between levels of social capital and corruption, both at the international level (examples include Knack and Keefer, 1997; La Porta et al., 1997) and for the Italian case (Del Monte and Papagni, 2001 and 2007; Golden and Picci, 2005). Other works have studied the relationship between social capital and the effectiveness of public policies in Italian regions (Giordano and Tommasino, 2013; Felice and Lepore, 2016; D'Adda and De Blasio, 2017). Acconcia et al. (2022) have written about the relationship between institutional changes and social norms. Papagni et al. (2021) provide evidence supporting the hypothesis that public investments drove growth in the South during the period 1951-1970, but not subsequently. Aresu et al. (2023) show that centrally managed public investments have greater effects in the South than locally managed ones. Rodríguez-Pose and Ezcurra (2011) have analyzed the effects of decentralization on growth in OECD countries. Helliwell and Putnam (1995), Felice and Lepore (2016), and D'Adda and De Blasio

(2017) present evidence that the quality of public intervention worsens following devolution to the regions.

3. The model

The model discussed in this section is based on Mauro et al. (2023), with two major differences: first, we focus on labour productivity ignoring the analysis of how unemployment may arise in an imperfect labour market; second, to quantify the impact of temporary shocks such as the NRRP, our emphasis will be on the transitional dynamics of the model. In the first part of this section we describe the dynamic equilibrium of the system, its stability and how it depends on the main parameters, including social capital and the associated level of misappropriation. In the second part, we study the model's transitional dynamics.

3.1 The model and its stationary growth path

Following Futagami et al. (1993), who built on Barro (1990), the average productivity of a generic economy depends on the stocks of private and public capital.

$$(1) \quad y = Ak^\alpha p^{1-\alpha}$$

where k and p are per worker private and public capital, respectively, and A represents a productivity parameter. The amount of labour is normalized to one. Labour and private capital are assumed to be immobile⁹ but we allow for fiscal transfers. In equation (1), the exponents of the two accumulable factors enable endogenous growth.

The government taxes income and uses the revenue (τy) to finance public investment or lump sum transfers to households. As said, fiscal transfers among the regions (v) are possible, so that the resources available for the public sector in any region are equal to $(\tau + v)y$. Clearly, v can be either positive or negative and is zero for the country as a whole.¹⁰

Public investment projects are performed through public procurements. The government calls for tender and risk-neutral contractors bid to win these tenders. However, not all the funds are transformed into actual public capital since the contractors can decide if and to what extent to embezzle a share of the funds, cheating on costs or materials, overrunning the prices or defrauding.

⁹ The implications of this assumption are discussed in section 5 below.

¹⁰ The following constraint holds: $\sum_1^n \tau_i y_i = \sum_1^n (\tau_i + v_i) y_i$, where n denotes the number of regions in the country and $\sum_1^n v_i y_i = 0$. Moreover, in the aggregate, $\sum_1^n \tau_i y_i = \sum_1^n \gamma_i (\tau_i + v_i) y_i + \sum_1^n (1 - \gamma_i) (\tau_i + v_i) y_i$.

The amount of public resources illegally seized by the contractors is the outcome of a rational choice that depends on the risk of being caught, which in turn depends on a combination of contractors' decisions and the socio-economic environment in which they operate. We assume that the share of a project that a contractor seizes, s , increases this risk. Regarding the socio-economic environment, contractors take into account the level of social capital within which the institutions managing public policies operate. These institutions can be part of the central level of the government or of the regional one. Which governmental level will oversee public policies depends on the extent of devolution envisaged by the state's organization. If the projects are overseen by the central government, the country's average social capital determines the effectiveness with which oversight is implemented. If, on the other hand, responsibility is attributed to local authorities, the social capital prevailing in the territory or region is the one that determines how effective the projects are. Many scholars underline, both theoretically and empirically, the positive link between the quality of institutions and social capital (among others: Bjornskov, 2011, 2003; Glazer and Glazer (1989); Uys and Smit (2016); Golden and Picci, 2005; Del Monte A. and Papagni E. ,2001, 2007). In general, data from the World Value Survey dataset (Inglerhart et al., 2020) confirm that in societies with low social capital, there tends to be greater tolerance towards misappropriation, corruption, or misuse of public resources. Whistleblowing is less common, and reporting illegal behavior can be very costly for individuals and the media.

To summarize, in our model, the quality of institutions is critically influenced by the level of social capital in the government's location. Section 5 delves deeper into this assumption. We define the probability for a contractor of being caught as:

$$(2) \quad pr = P(\text{Being Caught} \mid s, S_k) = s \cdot S_k$$

where $s \in [0,1]$ is the amount stolen from a project of value one and $S_k \in [0,1]$ is social capital. Thus even if a contractor embezzles almost all of the project, the probability of being caught can be low if social capital is very low.¹¹ Using (2) and (3), the representative contractor's problem for a project of value one is, therefore:

$$(3) \quad \text{Max } E(\pi) = [(1 - s \cdot S_k)s - s \cdot S_k (f \cdot s)], \text{ w.r.t. } s$$

where f is the fine parameter and $f \cdot s$ is the total fine per project (of value one). Given the values of f and S_k , the risk-neutral contractor maximizes the expected illicit profit for a project by solving eq. (4) with respect to s :

¹¹ As in Nussim and Tabbach (2009) where crime is modelled along these lines.

$$(4) \quad s^* = \text{Min} \left(\frac{1}{2(1+f)S_k}, 1 \right).$$

In this model, s^* can be thought of as a sort of “iceberg cost” in that it represents the loss of resources (per unit of capital expenditures) along the “journey” from tax revenues to the actual achievement in terms of additional public capital stock. The evidence yielded by Golden and Picci (2005) strongly supports our view. They compare the flows of resources allocated to investment in infrastructures to the actual realizations of those investments and show the existence of a large amount of “missing capital” in the South’s stock of public capital. Moreover, their measure of inefficiency, which varies widely across regions, is correlated with the regional levels of social capital, as our model postulates.

Central to our model therefore is that the chosen level of devolution can amplify or dampen the effect of local social capital as a determinant of the level of misappropriation of public resources in each location. A simple way to capture how devolution affects the level of the social capital that matters for public action is to define social capital as a weighted average of the country’s one (S_k^c) and the local one (S_k^l) with the weight d depending on the degree of devolution:

$$(5) \quad S_k = S_k^c (1 - d) + d S_k^l$$

where $d \in [0,1]$ is our devolution index: full decentralization corresponds to $d = 1$, while a centralised setting implies $d = 0$.

To complete the supply side of our growth model we assume that price-taking firms which equalize marginal productivities to factor costs (Barro and Sala-i-Martin, 2003). Each household in the macro regional economy solves a standard inter-temporal maximization problem, where agents’ preferences are proxied by a standard iso-elastic utility function of consumption.

It can be shown (see Mauro et al., 2023, sections 3.2-3) that the equations of motion of per capita consumption and private capital are respectively:

$$(6) \quad \dot{c} = \frac{1}{\theta} c((1 - \tau)r - \rho)$$

$$(7) \quad \dot{k} = Ak^\alpha p^{1-\alpha} D - c - D \delta k$$

where $r = \alpha Ak^{\alpha-1} p^{1-\alpha} - \delta$ is the marginal productivity of capital and $D = [(1 - \tau) + (1 - \gamma)(\tau + \nu) + (1 - s^* \cdot S_k)s^*(\tau + \nu)\gamma]$.

Assuming the same depreciation rate of the private capital, the law of motion of public capital with iceberg costs is:¹²

$$(8) \quad \frac{\dot{p}}{p} = (1 - s^*)\gamma(\tau + \nu)A \left(\frac{k}{p}\right)^\alpha - (1 - s^*)\gamma(\tau + \nu)\delta \frac{k}{p} - \delta.$$

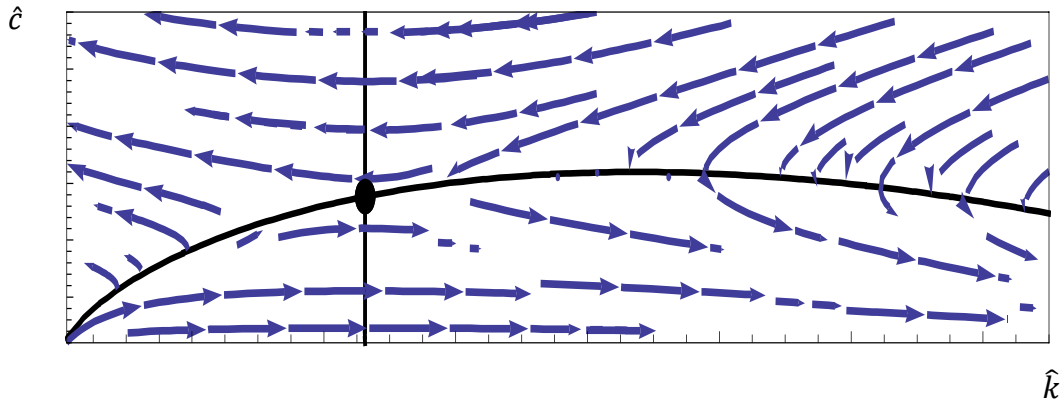
The dynamic steady state of this economy can be described by rewriting the equations (6), (7) and (8) in terms of consumption to public capital ratio (c/p) and private to public capital (k/p). In the following, these ratios will be denoted as \hat{c} and \hat{k} respectively. Subtracting the growth of public capital and using (8) the following system of nonlinear differential equations summarizes, together with the optimal value of s^* , the model:

$$(9) \quad \frac{\dot{\hat{c}}}{\hat{c}} = \frac{1}{\theta} (\alpha A \hat{p}^{1-\alpha} (1 - \tau) - (1 - \tau)\delta - \rho) - \frac{\dot{p}}{p}$$

$$(10) \quad \frac{\dot{\hat{k}}}{\hat{k}} = A \hat{p}^{1-\alpha} D - \hat{c} - D \delta - \frac{\dot{p}}{p}$$

The phase diagram of this system, based on the parameter values used in the forthcoming quantitative analysis (see section 4 below), is depicted in Figure 1 and shows that the model is saddle path stable.¹³

Figure 1. Dynamic Equilibrium



Once the balanced growth path is reached, \hat{k}^* and \hat{c}^* are stationary values, with c , k , and p that grow at the same constant rate. Thus, the long-run growth rate of the economy can

¹² For simplicity, we assume that the revenue from fines is spent in managing the judiciary system.

¹³ A linear approximation of the system around \hat{k}^* and \hat{c}^* yields two eigenvalues of opposite sign, implying saddle point stability.

be analyzed by focusing on the equation of motion of public capital only. In the long-run growth, therefore, our regional economy grows at the following constant rate:

$$(11) \quad g^* = (1 - s^*(S_k, \cdot))\gamma(\tau + \nu) A \hat{k}^*{}^\alpha - (1 - s^*(S_k, \cdot))\gamma(\tau + \nu)\delta \hat{k}^* - \delta$$

The main point worth emphasizing at this stage is that g^* depends positively on S_k , so that devolution – for the reasons given above – may harm growth in the low social capital regions. We now turn to the analysis of the transitional dynamics of the model.

3.2 Transitional dynamics with a temporary shock in public capital

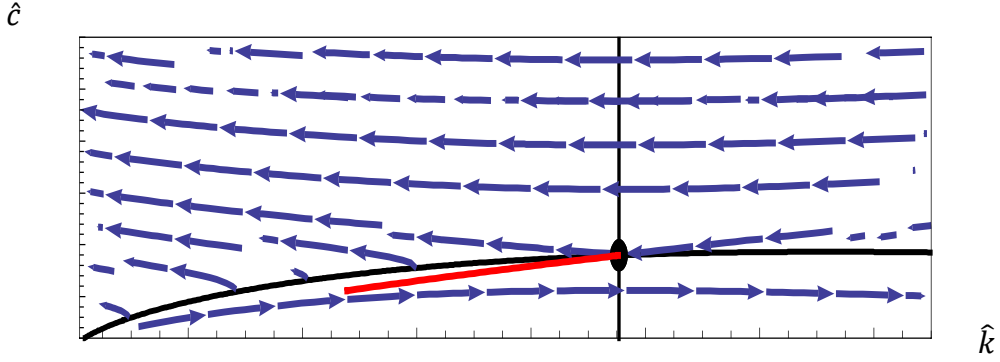
Regarding the model's transitional dynamics, two stable manifolds exist to the right and left of the steady state. These can be numerically evaluated using the time-elimination method as described by Mulligan and Sala-I-Martin (1991). From (9) e (10), dividing the growth of \hat{c} by the growth of \hat{k} one gets the slope of the policy function $\hat{c}(\hat{k})$, i.e., the stable manifold that allows the system to move toward the steady state starting from an initial condition $\hat{k} < \hat{k}^*$. That slope implies an autonomous differential equation that can be solved numerically once a final (or initial) condition is defined.¹⁴ In our case, the final condition is the steady state of the economy, a condition that will be temporarily affected by the sudden increase in the public capital stock. The stable manifold to the left of the steady is shown in Figure 2. It has been obtained numerically using the parameter values used in the model calibration discussed in Section 4 below. The magnitude of the shock determines how far \hat{k} moves south-west of its steady state value along the policy function. Once the new value is reached, the system moves back to its stationary position. The growth rates along this path differ temporarily from the steady state one. They can be computed as follows. Once the optimal trajectory for \hat{c} and \hat{k} are quantitatively defined, the out-of-steady-state productivity path can be obtained taking the log of equation (1), and differentiating it, and using (8) and (10) to calculate:

$$(12) \quad 1/y \, dy/dt = f(t)$$

As expected, the trajectory of growth rates is decreasing along time as the economy approaches the steady state from the left. The resulting path is shown in Figure 3. We will use equation (12) to evaluate the NRRP shock to the existing stock of public capital and the associated long run impact on productivity. This is accomplished in the next section.

¹⁴ We used Mathematica 13 together with the package VisualDSolve to perform it. The entire program is available upon request.

Figure 2. Transitional dynamics



4. Quantitative analysis

The first part of this section, 4.1, is dedicated to calibrating our model using the productivity growth rates in the two macro regions as our targets. This allows us to obtain the steady state values for the two areas, as well as the values of \hat{k}^* . These latter values will serve as the starting point for our analysis on the potential impact of the NRRP. The investments foreseen in the Plan temporarily modify the steady-state value of \hat{k} and trigger a process that, by bringing the system back to its dynamic equilibrium, generates permanent increases in the productivity level. This off-steady-state analysis will be explored in Section 4.2.

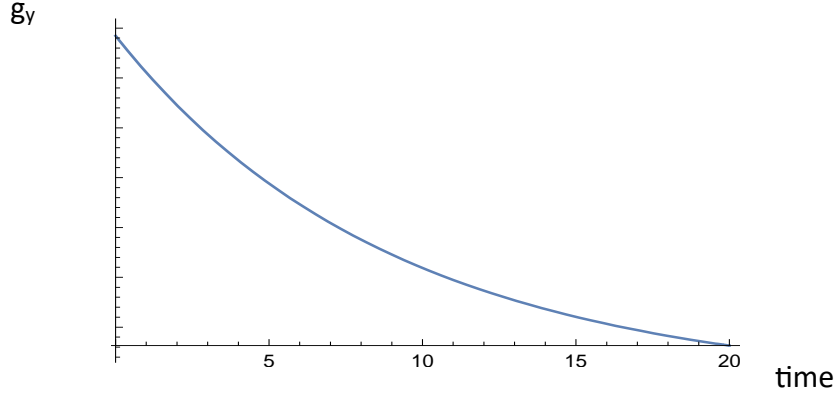
4.1 Calibration of the Steady State

Productivity growth in Italy has experienced stagnation or even negative trends over the past two decades, depending on the metric used.¹⁵ De Philippis et al. (2022) report a productivity growth rate of 0.1% for the Center-North and 0.05% for the Mezzogiorno. These values will be used as our targets for calibrating the steady-state growth rates of the two macro regions up to 2021, which aligns with the initiation of the NRRP.

In the following paragraphs, we provide a brief overview of the external sources utilized to determine the values of several of the model's parameters. They include the preference parameters θ and ρ , the technology parameters α and δ , the policy parameters $\tau, \gamma_s, \gamma_n, v_s, v_n$, and the social capital index S_k^{it} (where the superscripts it, s and n represent Italy, the South and the North respectively).

¹⁵The Istat productivity index (Istat,2021) based on Value added per hours worked net of public sector show a value 0.4% in the period 1995-2021 and 0.3% in the period 2002-2021 but regional disaggregation is not available. In contrast, according to IMF (2022) productivity measured as GDP per workers displays a negative trend for all macro regions of Italy with only a slight recovery of the Northern ones in recent years (see also Scope, 2022) but data are not public.

Figure 3. Convergence to the steady state



Regarding the relative risk aversion of households (θ), we set it to a value of 2, which falls within the range found in the literature (Attanasio and Weber, 1995; Gomme and Lkhagvasuren, 2013). Following Barro and Sala-i-Martin (2003), we set the discount rate (ρ) to 0.02, which is also consistent with Gomme and Lkhagvasuren (2013). The parameter α is assigned a value of $2/3$, a commonly used value in growth literature when human capital is not explicitly included as an input in the production function (see Barro and Sala-I-Martin, 2003, p. 59). The depreciation rate (δ) is set at the standard value of 5% (Barro and Sala-I-Martin, 2003). The parameter τ in our model represents the average national tax revenues and is set to 41%, based on national data from the OECD (2022). The parameters for interregional transfers of public resources or fiscal residuals, v_s and v_n , are determined using Petraglia and Scalera (2019), which report values of 18.5% for the South and -7% for the Center-North, indicating a large net positive flow of resources from the rest of the country to the Mezzogiorno. Total public resources allocated to region i are $y_i(\tau + v_i)$. A share of this total, γ_i , is allocated to accumulate public capital. To pin down the values of γ_i , we use the "Conti Pubblici Territoriali" published by the Italian Government Agency for Territorial Cohesion. In this source, public capital expenditures as a share of total public expenditures, including those by government-controlled firms, are equal to 9.8% for the Mezzogiorno and 8.4% for the North.¹⁶ Table 1 provides a summary of the external parameters used in our analysis.

¹⁶ An alternative measure can be obtained using data available in Banfi and Galli (2019). In this case, the values of are approximately 12% for the Mezzogiorno and 11% for the Center-North. Using these alternative values in our quantitative analysis would not determine significant changes in our main results.

Table 1: Externally Defined Parameters

α	δ	θ	ρ	τ	γ_n	γ_s	v_n	v_s
2/3	0.05	2	0.02	0.41	0.084	0.098	-0.07	0.185

The measures of social capital for the two areas and for Italy are obtained as an average of the indexes by Cartocci (2007) and Felice (2012). The two indexes have been normalized using the value of the top-ranking region, so that the obtained index is within the zero-one interval as required by our model. It is worth noting that the magnitude of the ratio between Italy’s average social capital and the South’s one (2.0) is notably akin to the ratio obtained using the institutional quality index (2.3) developed by Charron et al. (2014). This corroborates that utilizing social capital as a determinant of the persistence of the North-South institutional quality gap also accurately reflects the magnitude of the latter.

Table 2: Social Capital

S_k^{it}	S_k^n	S_k^s
0.51	0.63	0.26

The remaining parameters – namely, f , A_n and A_s – are calibrated internally using three moments as targets. As for f , the proportional fine for cheating, we derived it as follows. First, we assume that the fine is set at the national level, which means that the value of social capital used in equation (4) represents the entire country. Second, the value of f is calibrated targeting the average “missing capital” of Italy as reported in the literature on the efficiency of public investment. (Dabla-Norris et al., 2012; Pritchett, 2000; Sanjeev et al. ,2014; Baum et al. , 2020).¹⁷ Its value is set to 30% (see below for further discussion). The values of the two parameters A are obtained by targeting the observed productivity growth rates in the two macro regions.

The calibration results are displayed in Table 3. As expected, the growth rates of the model closely align with the (targeted) real rates. Interestingly, in our calibration, the untargeted values of s and \hat{k} are also in line with their respective real counterparts.

¹⁷ For a discussion on “missing capital” and its quantification, see section 4.2.2 below.

Regarding the values of s in the two macro regions, it is noteworthy that the values we obtain are very close to the ones implied by the Golden and Picci (2005) dataset – namely, 23% for the North and 64% for the South.¹⁸ Regarding the values of \hat{k} , estimating their real value is a more complex task. In the following we focus on the average value recorded at the national level. In our model, the numerator of \hat{k} includes both private physical and human capital, while the denominator includes public capital net of the portion lost due to misappropriation. An estimate of the numerator can be obtained using several sources. De Philippis et al. (2022) estimate that the value of physical private plus public capital is three times that of GDP. In Buseti et al. (2019), public capital is estimated to be 56% of GDP, while the stock of the Italian human capital, estimated by the OECD in 2006 (ibid., 2006), is reported to be eight times the GDP (Liu, 2011). These ratios allow us to obtain an estimate of the numerator in terms of GDP, which turns out to be equal to 10.44. Considering the above-mentioned ratio of public capital to GDP, the resulting estimate of \hat{k} is 18.6. However, in this estimate the value of public capital is computed using the Permanent Inventory Method (PIM), which does not consider the part of public funding that is lost due to misappropriation. If we further take into account that the ‘missing capital’ in Italy is, as we noticed above, around 30% of the total, the estimated real value of \hat{k} becomes 26.6, a close match with the values generated by our model.

Table 3: Steady State: Calibrated parameters and results

<i>Internal parameters</i>	<i>North</i>	<i>South</i>
A	0.40	0.38
f	2.26	2.26
<i>Main predictions</i>		
s	0.24	0.58
\hat{k}	28.7	26.8
Growth rates	0.001	0.0054
<i>Actual growth rates</i>	<i>0.001</i>	<i>0.005</i>

All things considered, from a quantitative standpoint, the model exhibits a good fit with respect to some important untargeted moments of the two regional economies. In the upcoming parts of this section, we will use this characterization of the steady state as the basis for our analysis of the effects generated by the shock generated by the NRRP.

¹⁸ Our own calculations on data from Golden and Picci (2005). The values we report are obtained by assuming that in most efficient region there is no missing capital in public investment.

4.2 Assessing the NRRP impact on the North-South divide

We can proceed with the analysis of the impact of the NRRP on the two macro-regions and, more specifically, on the regional productivity divide in Italy. As mentioned earlier, the NRRP determines a temporary imbalance between private capital and public capital. This positive shock to \hat{k} provisionally pushes the economy away from its dynamic steady state value \hat{k}^* . Afterward, the economy converges gradually back towards its dynamic equilibrium along the policy function. It is important to note that, in the analysis that will follow, the structural parameters that determine the stationary state of the model are not affected by the exogenous shock in \hat{k} . This is consistent with the fact that we are dealing with an intervention that increases public investments through the NRRP only for a limited period.¹⁹

Given the initial condition determined by the increase in the stock of public capital brought about by the investments of the NRRP, and the terminal condition given by \hat{k}^* , we identify a path along the stable manifold $f(t)$, which can be numerically estimated by solving the differential equation. To quantify the overall effect of the NRRP, therefore, we measure the cumulative gains achieved by productivity along this path, and we compare the final outcome with the one that would have been achieved, in the same period of time, in the absence of the NRRP. T periods after the positive fiscal shock of the NRRP, the achieved level of productivity can be determined as follows. :

$$(13) \quad y'(T) = C e^{\int_0^T f(t)dt}$$

In the absence of the NRRP, productivity at time T would be instead:

$$(14) \quad y(T) = C e^{gT}$$

Thus, the would-be relative gain in productivity due to the NRRP can be quantify as follows:

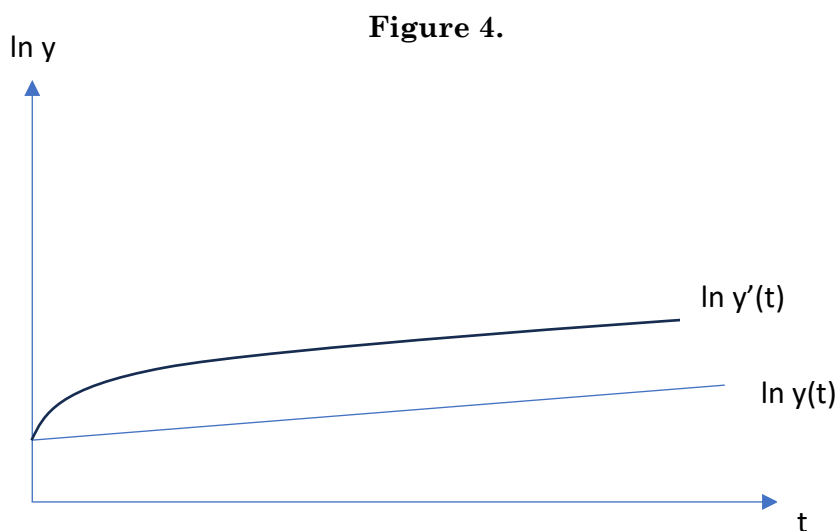
$$(15) \quad \frac{y'(T)}{y(T)} = e^{\int_0^T f(t)dt - gT}$$

¹⁹ The intended improvement in governance, which we will consider later, is also designed to be temporary and therefore will leave the fundamentals of the economy unchanged. The additional effects that the reforms envisaged in the Plan might bring about, and that might affect in the long run the parameters of the model, is a matter that goes beyond the scope of this work.

Figure 4 visualizes the above methodology. It depicts the two implied trend paths with and without the NRRP implemented at time zero. It also clarifies how a temporary policy, the Plan's investments, generates a permanent outcome in terms of productivity levels.

The magnitude of this outcome is determined by the relative increase induced by the NRRP in the actual public capital stock, which is reflected in the ratio k/p . The more the economy shifts to the left of its dynamic steady state \hat{k}^* , the higher the out-of-steady-state transition and the cumulative effect on productivity.

It is important to note that both the present and past efficiency of public investment play a role in defining the relative variation of public capital (\dot{p}/p). Past efficiency affects the stock of public capital, which is the denominator of the ratio, while the NRRP efficiency affects the flow of public capital, which is the numerator. Therefore, to understand the long-run impact of the NRRP, it is crucial to consider both the efficiency of current public investment and the historical efficiency of the process of public capital accumulation that has led to a certain level of capital stock. These factors jointly determine the relative variation in \hat{k} and drive the dynamics of our model and the overall effect on the economy.



4.2.1 The NRRP and the existing stock of public capital

The NRRP implies an additional public expenditure equal to 191.5 billion euros, which includes investments and other smaller components. According to official documents, 62% of the total is explicitly classified as "public investment" (Governo Italiano, 2022). Additionally, we interpret the component allocated to education, which accounts for 6.6% of the total, as public investment in human capital. Therefore, the portion of the NRRP that we attribute to public investment amounts to 68.4%. This corresponds to 131 billion euros that will potentially be added to the public capital stock. The public investment envisaged by the

NRRP accounts for approximately 7.9% of Italy's GDP in 2020, which is more than double the normal average share of public investment. Out of this figure, 40%, equivalent to 52.4 billion euros, is allocated to the South, while the remaining 78.6 billion euros is allocated to the Center and Northern regions. Similarly, the part of the funds allocated to subsidies for private firms, 18.7% of the total, are again attributed to the two regions following the 40%-60% rule.

To quantify the change in \hat{k} brought by the NRRP investment plan, we need first to estimate the current regional stocks of public capital. We proceed as follows. The public capital stock of the Italian economy is estimated to be stable at around 56% of GDP (Busetti et al., 2019; IMF, 2021). This implies a value of approximately 950 billion euros.²⁰ To divide the capital stock between the two macro regions, we proceed as follows. First, we calculate the per capita value of public capital for Italy. Aresu et al. (2023) provide the indexes of per capita public capital for the macro regions relative to Italy, with Italy's value set equal to one. This allows us to determine the absolute values of per capita public capital in each macro region. Finally, we multiply this value by the population of each macro region to obtain their stock of public capital. Based on our calculations, the public capital amounts to approximately 634 billion euros for the North and 318 billion euros for the Mezzogiorno.

Let's compare the public investment brought by the NRRP to the existing public capital stocks in the two macro areas. For the time being, this is done without considering the corrections necessary to address the "missing capital" issue (discussed below). The impact of the NRRP on the public capital of the Mezzogiorno is significant, with an increase of 16.4% for the South and 12.4% for the North. These figures are noteworthy for the entire country, and even more so for the South. The relative changes in public capital stocks become even larger if we adjust those stocks – as we do below – to account for the "missing capital" generated by misappropriations and inefficiencies.

4.2.2 Dealing with the “missing public capital” issue.

As mentioned earlier, there is evidence to suggest that the existing stocks of public capital, estimated using the permanent inventory method (PIM), may be overestimated. This overestimation also applies to the contribution of the NRRP to the formation of public capital. In the following, we deal with these issues in detail.

As for the capital *stocks* and the "missing capital" problem, let's first consider Italy as a whole before addressing the two macro areas. Sanjeev et al. (2014) demonstrate that once inefficiencies are taken into account, the figures for public capital stock obtained using the

²⁰ In 2020 and 2021 according to ISTAT the total GDP of Italy was around 1653 and 1782 billions respectively. Applying the IMF share and averaging we obtain a value of public capital of 950 billions of which 78% is produced by the Center-North and the South accounts for 22%.

International Monetary Fund (IMF) are significantly reduced. Baum et al. (2020) report that, on average, 21% of public investment is wasted in European countries, with some countries experiencing up to 32% inefficiency. This inefficiency is closely linked to corruption measures across different countries. Considering that Italy ranks low in terms of perceived corruption among developed countries (European Commission, 2014; OECD, 2016), we assume that the overall capital stock for Italy is diminished by 30% compared to the PIM estimates²¹ (this is the value that was used to calibrate the parameter f in Section 4.1).

Regarding the two macro areas, the level of "missing capital" is significantly higher in the South, as documented by Golden and Picci (2005). As observed, the North-South difference measured by these authors closely aligns with the values of s_n and s_s obtained through our benchmark calibration in section 4.1 (see Table 3 above). Consequently, one possibility is to utilize s_n and s_s and to apply them retroactively to correct the PIM estimates of the regions' stocks of public capital.

However, this approach assumes that the institutional context under which the stocks have accumulated has remained constant. As we know, in reality the governance of regional policy shifted from highly centralized to highly decentralized around 1970 (Mauro et al., 2023), with an important impact on investment efficiency in the South. In the centralized case, the "missing capital" should reflect the Italian average value (30%), while in the decentralized case, it should reflect the local conditions and the associated value of s_s (58%). Hence, an alternative approach to correct the PIM estimates of the South's public capital stock is to adopt an average level of inefficiency, which amounts to 44%. Both methods will be used in our quantitative assessment of the potential effects of the NRRP, and the resulting outcomes will be compared.²²

We now turn our attention to the link between the NRRP *public investment* and the "missing capital" problem, which does not only pertain to the past history and the stocks of public capital, but also to the investment flows planned under the NRRP. In theory, the NRRP includes a temporary measure of tighter central control over planned investments. The coordination undertaken by the central government aims to establish intervention guidelines, gather and assess projects suggested by local entities (based on these guidelines), and oversee their implementation. In the event of failure to meet the deadlines or other shortcomings, the central government is obliged to intervene and assume control of the process. This represents a significant innovation in the governance of public investments. If this new model of

²¹ Afonso et al. (2003) estimate that inefficiency in Italy results in a dispersion of resources equivalent to 34% of public expenditure.

²² As for the North, its "missing capital", in all our forthcoming quantitative assessments, is determined by the value of s_n , 24%.

governance is fully implemented, it implies that investments in the South will be operated under centralized control. In terms of our model, this translates to a low or zero level of devolution ($d = 0$ in equation (5)) and a lower level of "iceberg costs". On the other hand, if the governance of the NRRP is not adequately implemented, the absence of central support and control allows for traditional, decentralized management of public investments ($d = 1$), with higher "iceberg costs". Consequently, in the former case, we expect a reduction of 30% in the resources allocated to the South, while in the latter case, the reduction is estimated to be 58%. This applies to the funds allocated both to private enterprises, which affect the numerator of \hat{k} , and to public investments, which have a large impact on the denominator.²³

As for the North, we assume that the level of "missing capital" is determined by its own level of inefficiency, s_n , which is lower than the national average. In other words, we expect central control to intervene only in cases where the level of inefficiency at the local government level exceeds the national average.

Having completed the description of the methodology we adopt to address the "missing capital" issue, both for the stocks of public capital and the current flow of investments planned under the NRRP, we now turn to the quantitative results regarding the long-term effects of the Plan.

4.2.3 Long run effects of the NRRP: a quantitative assessment

The quantifications of the potential effects of the NRRP on the North-South productivity gap presented in this section we exploit the fact that the NRRP temporarily deviates \hat{k} from its steady-state value \hat{k}^* , and that the magnitude of this deviation depends on the proportion between the amount of investments realized by the NRRP and the existing stock of public capital. Since these two quantities are themselves influenced by how the "missing capital" issue is addressed, Table 4 shows the results obtained, for $T = 30$, under the various hypotheses discussed in Section 4.2.2. Column 1 identifies the adjustment applied to the stock of public capital corresponding to each hypothesis. Regarding the NRRP investments, we present, in line with the previous discussion, two results for the South based on different institutional scenarios: one related to the case of a limited central control ($d = 1$), and the other related to the opposite case ($d = 0$).

The NRRP effect on productivity levels is, not surprisingly, more favorable for the South under a more centralized institutional setting, which leads to a substantial

²³ The resources allocated by the NRRP to private enterprises are significantly lower compared to those dedicated to public investments (less than 20% versus nearly 70%, respectively), while the stock of private capital is approximately 27 times larger than that of public capital.

improvement in the efficiency of investments in the region. This is true, of course, regardless of the method used to estimate the initial value of public capital.

Table 4: Long run Impact of NRRP measured as $\frac{y'(T)}{y(T)} - 1$. ($T = 30$)

Missing Capital stock %	North	South	Divide	South	Divide
		$d = 1$		$d = 0$	
(a) N=S=30%	1.23%	1.08%	74.9% *	1.82%	75.4% **
(b) N=24%; S=44%	1.14%	1.35%	75.2% **	2.26%	75.8% **
(c) N=24%; S=58%	1.14%	1.78%	75.5% **	2.98%	76.4% **

* Divergence ** Convergence

Before commenting on the effects of the NRRP on the North-South divide, it is interesting to assess whether the magnitude of these productivity gains is reasonable. To answer this question, we need to refer to the empirical literature on the long-run output elasticities of public capital. As noted by Governo Italiano (2022), these elasticities reflect the efficiency of investment projects. With high efficiency, the elasticity is quoted to be 0.17, and 0.07 with low efficiency. Our results closely match these numbers: referring back to Table 4, the three results for the South under the low efficiency case ($d = 1$) have an average elasticity of 0.08, while the results of the more efficient case ($d = 0$) imply an average elasticity of 0.14.²⁴

In Table 4, the most positive impact on the South's productivity correspond to the case in which the highest estimate of "missing capital" is used (see row (c) in the table). While this outcome may seem counterintuitive, it is not surprising. In this case, the substantial reduction of the southern stock of public capital due to the large "missing capital" makes the variation of \hat{k} caused by the NRRP in the South particularly large. Notice that the degree of devolution still plays an important role, as we observe in the South a productivity increase of 1.78% under devolution and 2.98% under centralization.

This has obvious implications for the impact of the NRRP on the productivity divide. In general, the more than proportional allocation of resources to the South appears to be only

²⁴ de Jong et al. (2017) present a meta-analysis according to which from 68 papers on the topic the average output elasticity of public capital is on average 0.106.

marginally capable of reducing the gap, currently at 75%. Quantitatively, from the South's viewpoint, the scenario with no devolution shows a significant improvement compared to the one with devolution (76.4% vs 75.5%, in the more favorable hypothesis). This is our main result: it confirms the idea that the Mezzogiorno consistently benefits in terms of public investment efficiency when the projects are centrally governed. As stated in Mauro et al. (2023), the design of the government can make a difference not only in ordinary development policies but also in the case of extraordinary and temporary measures like the NRRP. If reducing the productivity gap is a key objective of the NRRP, it is crucial for the central oversight to play a very active role.

Having said that, it's important to note that in all scenarios, even the most favorable ones, the reduction in the productivity divide is minimal. Despite the large scale of the investment plan, its temporary nature is likely a contributing factor to its limited long-term economic impact, along with inefficiencies. This is not encouraging news for those who see the NRRP as an extraordinary opportunity to bridge the gap between the North and the South.

Better results are to be expected if the NRRP's innovative implementation design and increased central control become a model for a permanent reform of the regular public investment governance in the less efficient regions.²⁵ In our model, such an institutional reform would raise the steady-state growth rate of the economy, so that its long-term effects can be quantitatively assessed. This is what we do in section 4.3 below.

4.3. What if an increased central control became permanent?

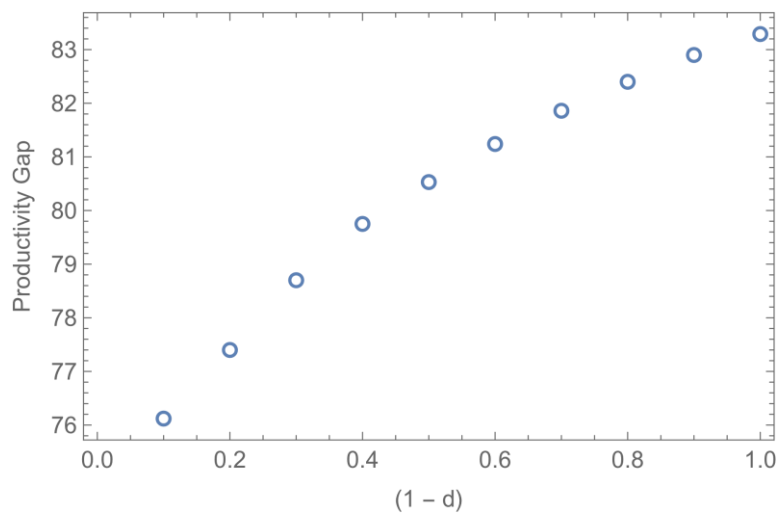
In this work we have defined an analytical framework to study the potential effects of the NRRP, a temporary intervention. In this final section, we propose a brief "what if" exercise to get an idea of the quantitative effects that could be achieved if certain aspects adopted in the management of investments outlined in the NRRP were to become permanent.

In the previous sections, we have assessed the potential effects of the NRRP on the North-South productivity gap, using two different models of multilevel governance: one with a high level of decentralization and another with a strong central control. The structural parameters of the model were left unchanged during those quantitative evaluations. In other words, once the NRRP is completed, it is assumed that governance will return to its previous mode of operation, a highly decentralized system (formally, $(1 - d) = 0$ in terms of equation (5)).

²⁵ The centralization of the management of public investment projects in the most inefficient regions may sound as a return to the approach of "Cassa del Mezzogiorno", the central agency in charge of public investment in the Mezzogiorno from 1950 to 1984. We do not see it as pitfall. In fact, in the early period the "Cassa del Mezzogiorno" played a crucial role in reducing the Italian divide in the 1950s and 1960s and it can be seen as a best practice (Mauro et al., 2023).

The "what if" exercise presented here aims to measure the potential effects of making the greater central control envisaged by the NRRP over public investments in the southern regions permanent. Figure 5 shows how the current productivity gap of the South (75%) would vary at time $T = 15$, as the degree of central control (and the corresponding social capital influencing public action) increases. On the horizontal axis, $(1 - d)$ moves from the value that identifies a level of decentralization with no central control, $(1 - d) = 0$, to increasing values of central control with a gradient of 0.1.

Figure 5.
The productivity gap as the degree of devolution diminishes ($T = 15$)



The x-axis corresponds to the gap level achieved by the NRRP in the most positive scenario for the South.

Clearly, in this context of a central oversight that stays in place well beyond 2026, the gains for the South in reducing the gap are potentially much greater than those associated with the NRRP alone, even in the case of very limited central interventions. For example, with $(1 - d) = 0.2$, a gap of 77.5% would be achieved, a level significantly higher than what the NRRP would generate in twice the time (76.4%). Formally, the reason for this is that the gains generated by the NRRP occur in a context where central oversight is in effect only during the transitional path leading to a steady-state growth rate that remains constant. In the case of permanent intervention, the structural parameter of social capital shifts upward, consequently increasing the steady-state growth rate.

In general, our findings are in line with Mauro et al. (2023): economies with low levels of local social capital are not condemned to perpetually lag behind, provided that proper institutional design can compensate for weak local governance.

5. Discussion

In our model, the potential effects of the NRRP are assessed through a mechanism in which social capital determines significant differences in institutional quality across regions. To simplify the formal analysis, we have necessarily overlooked various factors that might play a role. For instance, regarding the disparity in institutional quality between the North and South, an alternative hypothesis to our story based on social capital is that it may arise from a lower level of human capital among public employees in the Southern regions. Additionally, we have assumed the immobility of capital and labor, a point that needs careful discussion. Lastly, our focus on the long-term effects of the Plan on productivity led us to assume full employment, excluding potential variations in employment levels and the output gap from our analysis. In this section we address each of these points.

The central role of social capital in our approach is based on two main components. The first concerns the *persistence* of the observed wide North-South difference in social capital stocks. The second is the role of this difference as a determinant of the quality of local institutions in the two macro regions. Concerning the first point, we refer to the substantial literature that began with Putnam et al. (1993) and has since garnered significant supporting evidence, as seen in works by de Blasio and Nuzzo (2009), Accetturo and de Blasio (2014), and Guiso et al. (2016) among many others.

On the importance of social capital as a determinant of institutional quality, this relationship is again at the core of Putnam et al.'s (1993) analysis, and has been the subject of numerous cross-country and cross-region empirical analyses.²⁶ Examples of the first type include classic works by La Porta et al. (1997), Knack and Keefer (1997), Knack (2002), and more recent studies by Bjornskov (2011) and Becker et al. (2016). Tabellini (2010) and Charron et al. (2014) specifically focus on European regions. Regarding Italian regions, Charron et al. (2014) found that the positive relationship between trust and government quality, observed for European regions, weakens significantly when Italian regions are excluded. Other researchers like Sabbatini (2008), Nannicini et al. (2010), Giordano and Tommasini (2013), Camussi et al. (2018), and Batinti et al. (2019) have further emphasized the importance of the relationship between social capital and various public spending quality indicators in Italian regions, highlighting various underlying mechanisms."

An implication of the reliance of institutional quality on social capital is that, at the local level, the former tends to remain unchanged in response to potential short-term policy

²⁶ In general, the fact that social capital plays a significant role in this realm is hardly surprising, given that, by definition, it influences each of the pillars composing the World Bank's World Governance Indicators, namely, control of corruption, rule of law, government effectiveness, voice and accountability (Kaufman et al., 2009).

measures.²⁷ Acknowledging this, however, should not lead to the wrong conclusion that areas with low social capital are doomed to inefficiency in public actions. The state's capacity to delegate investment management to the best-performing level of government — choosing between centralization and decentralization — is crucial for achieving short-term efficiency in areas with underperforming local institutions.

The situation might differ if the disparity in institutional quality were caused by other factors. A possibility is that it could arise from a deficiency in human capital within the public administration of the South.²⁸ Indeed, data from MEF²⁹ shows that the percentage of graduates in public administration in the south is 26%, compared to the Italian average of 33%. However, the low number of graduates among public employees in the South does not seem to be constrained by an inadequate supply.³⁰ An alternative explanation is that it might be the result of selection procedures which in the South may prioritize factors other than meritocracy.³¹ If this is the case, the shortage of graduates in southern public institutions would not contradict our central hypothesis. To the contrary, it would offer another example of the southern regions' limited ability to address the free-riding problem when allocating public resources and therefore would support our choice to consider the observed differences in the quality of local institutions as the result of the underlying differences in social capital.³²

Let us now examine the assumption regarding the immobility of private capital (both human and physical) and labor. For physical capital to fully exert its influence on productivity convergence, several conditions must be met. Firstly, for capital to flow to poorer areas, those areas must not have significant disadvantages in factors such as human capital, public infrastructure, or technology levels (Lucas, 1990). Traditionally, this condition is not met in

²⁷ There certainly are policies to foster social trust in a society, but they are notoriously complex and decidedly long-term ones (Bisin and Verdier, 2010).

²⁸ We thank an anonymous referee for prompting a discussion on this alternative scenario to our proposed explanation.

²⁹ Our own elaboration on MEF data from: <https://contoannuale.rgs.mef.gov.it/web/sicosito/struttura-personale/titoli-di-studio>.

³⁰ Despite having a workforce of approximately 370,000 public employees, universities in the South produce an annual output of about 100,000 graduates. <http://dati.ustat.miur.it/dataset/laureati/resource/88acd482-9d75-44d1-ab16-aa04524f5d94>.

³¹ See Accetturo et al (2022), p. 77: in the South "the selection of professional profiles might have favored less qualified categories. The significant tendency to 'stabilize' long-term temporary workers rather than recruiting new ones, for example, is an indication of suboptimal selection criteria. (...) the incidence of stabilizations on the total of hires was significantly higher in local entities of the Mezzogiorno than in those of the Central North, compared to less recourse to hires through competitions".

³² Further support to this conclusion can be found in empirical evidence that show that, even in cases of no differences in the share of graduates involved, the quality of the public service provided varies significantly according to the social context. Di Liberto et al. (2022), for example, show that in the Italian schools, the level of teachers' absenteeism is inversely correlated with the local level of social capital.

the Mezzogiorno. Furthermore, our simulations regarding the limited impact of the NRRP on the productivity gap suggest that the Plan will likely be unable to alter this sufficiently to generate a strong flow of capital toward the South. Second, a perfect capital market is also required. However, persistent regional differentials in passive interest rates suggest, at the very least, the existence of imperfect capital mobility (Angelini, 2022). Third, in addition to the above, a well-functioning labor market is necessary. Imperfections and rigidities in the labor market can prevent the neoclassical diminishing returns mechanisms from exerting their influence on factor prices, thus preventing the stimulation of capital inflows into less developed regions. This condition is not met in Italy (more on this shortly). Given that most of these conditions are likely to remain unfulfilled in the post-NRRP period, we believe that assuming capital immobility does not compromise our results.

Labor, both unskilled and skilled, is also assumed to be immobile in our model. In this case, on one hand, the mobility of raw labor is supposed to favor convergence by altering the capital intensity in the two macro-areas (Dolado et al., 1994). On the other hand, the migration of educated/skilled workers from the lagging-behind regions increases divergence (Dolado et al., 1994; Fratesi and Percoco, 2014). If the NRRP will obtain a reduction of both migratory flows, this would generate two effects of opposite sign. Consequently, on one hand, it is not possible to provide a clear answer regarding the direction in which our results would change in the presence of this type of mobility; on the other hand, it is possible to hypothesize that the overall impact of these two partially offsetting forces could be marginal.

Finally, the imperfections of the Italian labor market are evident in the existing large and persistent unemployment gap between the North and the Mezzogiorno. In the economic literature, this has primarily been attributed to the profound changes that took place in the labor market institutions around 1970, when there was a shift from decentralized to centralized bargaining. Boeri et al. (2021) and MPC (2023) both provide extensive analyses of the links between labor market institutions and regional disparities in unemployment and income. Consequently, we expect that significant variations in unemployment levels in the South will depend less on variations in relative productivity and more on changes in labor market regulations³³ — i.e., a factor that is *not* an explicit aim of the NRRP.

Despite the limitations and potential distortions arising from the necessary simplifying assumptions of our model, we believe our approach aptly addresses the problem of the North-South productivity divide and therefore fills an existing gap in analyzing the potential impact of the NRRP.

³³ This conjecture aligns with a quantitative exercise conducted using the model described in Mauro et al. (2023). When holding the Italian labor market regulation (as defined in that model) constant, the increases in productivity (TFP) of the order displayed in Table 4 above do not reduce the unemployment in the South.

6. Conclusions

The NPRR presents a significant fiscal shock to the Italian economy, and in the short run it is expected to have positive effects on aggregate GDP and employment. Additionally, due to its allocation of resources, the plan may temporarily help narrow the North-South gap, particularly benefiting the Italian South.

However, when considering a longer time horizon, the crucial factor to examine is productivity. The stagnation of productivity is what has caused the decline in Italy's real per capita income over the past thirty years, and the relatively stable productivity gap between the North and South has contributed to the lack of per capita GDP convergence.

Thus, the focus of this paper is to assess the impact of the NRRP on long-term North-South divide in productivity levels. Building upon the findings of Mauro et al. (2023), we have calibrated an endogenous growth model that emphasizes the accumulation of public capital. In addition, we have incorporated two crucial factors for the success of development policies: social capital and the governance structure responsible for plan implementation.

We were able to formulate a relatively simple and manageable growth model that, once calibrated using external information on parameters, has yielded interesting quantitative results. We find the long run impact of the NRRP on the productivity levels of the two Italian macro areas is rather limited (ranging from +1% to +3% in the South, and less than that in the North). Moreover, the impact on the North-South divide does not appear to make a significant difference. These findings may disappoint those who view the NPRR as an exceptional opportunity to reduce regional disparities in Italy.

Nevertheless, in our attempts to model the NRRP, it becomes apparent that the Plan represents a clear and interesting institutional discontinuity. The plan's design includes various innovative elements leading to a higher level of centralization compared to the standard governance of public investments. So, we have analyzed the long-term growth effects of potentially making permanent the tighter control of the central government over projects and their implementation envisaged by the Plan. When the NRRP governance model is extended to encompass all public investments over a long period of time, we find that a substantial growth effect is achieved, and that the South's relative productivity improves significantly.

In conclusion, our findings suggest that the NRRP itself constitutes a fiscal shock with limited long-term effects on productivity growth and only minor impacts on the North-South

gap. However, it has the potential to become an extraordinary institutional shock if replicated and expanded upon.

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