Industrial growth and spatial spillovers in XIX century Italy*

Carlo Ciccarelli†
Università di Roma "Tor Vergata"
Stefano Fachin‡
Università di Roma "La Sapienza"

April 24, 2014

Abstract

This paper represents a first attempt to investigate the early steps of Italian industrialization at the local level accounting for spillovers. The analytical framework is the conditional convergence model augmented to account for spatial effects. The geographic unit of analysis is constituted by provinces (NUTS 3 units) and the time period considered goes from 1871 to 1911. The simultaneous presence of positive spillovers (the estimates show that a ten percent increase in the industrial growth of the neighboring provinces implies approximately a three percent increase of provincial growth) and positive effects of the own initial level of industrial value added suggests that the polarization between dynamic, high-growth areas and backward areas goes back to the very beginning of Italy's economic history. The conditional convergence model augmented with human capital, social capital, and social overhead capital suggests that education, a cooperative culture, and spatial spillovers are able to explain, other things being equal, much of the variability of value added growth in the manufacturing industry in 19th century Italy.

*__Paper prepared for the SIE's 55th Annual Meeting - University of Trento, 23-25 October, 2014.__ We thank Brian A'Hearn for kindly providing data an age-heaping. Research supported by MIUR PRIN (Programmi di Ricerca Scientifica di Rilevante Interesse Nazionale) grant 2010J3LZEN. **PRELIMINARY VERSION. PLEASE DO NOT QUOTE. COMMENTS WELCOME.**

†Università di Roma "Tor Vergata", Dipartimento di Economia e Finanza, Via Columbia 2, I-00133 Rome, Italy; email: carlo.ciccarelli@uniroma2.it.

‡Università di Roma "La Sapienza"; email: stefano.fachin@uniroma1.it.

The making of Italy – the merging of its elementary components, the harmonization of the South and the North – is a complicated task. It is more difficult than dealing with Austria and the Catholich Church.

(C. Cavour, Prime Minister of Italy, 1860)

1 Introduction

The North-South divide is possibly the most dramatic feature of the Italian economy, at the point that Italy has become somehow the prototype of an economy plagued by unequal development of its regions (see, *e.g*, Boltho *et al.*, 1997, Sinn, and Westermann, 2001). Whether the origins of the regional divide should be traced back at some point far back in the past, such as the country's unification of 1861, or even earlier, is an open question. Clough and Livi (1956), and Eckaus (1961) are generally credited to have given the first quantitative accounts of the North-South differential in the aftermath of Italy's unification (1861). Estimates by Daniele and Malanima (2007), subverted the above findings, suggesting that the economic gap between Northern and Southern regions was, at the time of the country's unification, negligible. However, the new regional estimates by Brunetti *et al.* (2011) for 1871 show that per capita GDP of Northern regions was on the average about 25 percent higher than that of Southern regions, thus supporting earlier Eckaus view. The establishment of the basic facts of the case, even before that their analysis, seems thus still a matter of debate among the experts of the field.

Part of the literature suggests to consider beside economic factors (such as per-capita GDP, taxes, and share of labor force by sector of activities) the relevance of more general socio-economic indicators as potentially able to account, at least partially, for the extent of the regional divide. Ciocca (2007) documents for instance that in the early 1860s Northern and Southern regions were different ever since along many dimensions, including educational levels, social participation, and respect for the rule of law, all affecting the growth potential of the two macro regions. The matter is not new moreover. Contemporaries (see *e.g*, Franchetti, 1875, p. 40) noticed that besides economic factors the North and the South were different in terms of "intellectual and moral" terms.

The above account of the literature on the origins of the Italian regional divide is surely partial, and a section of this paper will give a more extended review of the main contributions. But the relevant point at this time is that while the literature on the Italian regional divide is sizeable, to say the least, the number of quantitative contributions is relatively limited and, above all, the geographical disaggregation of the data examined is typically low: at most *regioni*, NUTS 2 level. As a consequence, the geographical dynamics has not been so far evaluated adequately. This gap may now be partially filled thanks to provincial (NUTS 3) value added estimates for pre-WWI census years by Ciccarelli and Fenoaltea (2013), which offer a wealth of new insights on the early stages of XIX century Italian industrial development.

Anticipating things a bit, Figures 1-3 illustrate the geographical distribution among Italy's provinces of per capita value added at 1911 prices in the manufacturing industry evaluated at the census years 1871 and 1911. Even a quick glance at the value added maps gives the impression that considerable income divergence took place between the unification of the country and WWI.[1] This impression is corroborated by the analysis of a few basic descriptive statistics: the ratio between maximum and minimum provincial per capita industrial value added was about equal to 3.4 in 1871, and to 5.7 in 1911. During the same period, the Gini concentration index passed from 0.17 to 0.25 and the coefficient of variation (standard deviation/mean) from 0.32 to 0.50 (see Table 1 below). It thus seems that the extent of the *Mezzogiorno* (Southern Italy) problem had been at least enhanced during the decades here considered. Clearly, the maps suggest a variety of additional research questions that go well beyond the analysis of economic disparities between macro-areas, as non negligible growth differentials are visible also within the group of the Northern and Southern provinces.

The basic research question this paper attempt to address is why industrial growth in XIX century was more sustained in some Italian provinces than in others? To provide possible answers we resort to the long established conditional convergence tool, one the cornerstones of the growth and regional economics literature of the last decades (see, e.g., Magrini, 2004). In its standard version this model relates income growth of a group of regions to both initial level of income and a set of conditioning variables. Albeit this model has proved to be powerful, it (surprisingly) ignores a fundamental dimension of regional dynamics, namely spatial spillovers[2], which are explicitly considered in the generalised version introduced by Rey and Montuori (1999). The aim of this paper is thus to use this conditional convergence model enriched to allow for spatial spillovers to study industrial manufacturing valued added growth in the Italian provinces (NUTS 3 units) from 1871 to 1911. The dataset used has been largely compiled from primary historical sources, and is thus mostly original. The conditioning variables include both material (roads and railways) and non-material capital (measures of educational levels, and of social and political participation). We find that the divergence process can be largely explained by these conditioning variables. In other terms, consistently with the results by and Rey and Montuori (1999) and Bauer *et al.* (2012) for an entirely different dataset, namely the US states in the second half of the XX century, we find that both knowledge and spatial spillovers matter. Northern provinces, above all sub-alpine ones, grew more than those of the South because, other things being equal, were endowed with labor forces with better educational levels, with a stronger social participation, and surrounded by more dynamic neighbors. The paper is organized as follows: in Section 2 we provide a brief summary of the literature on the XIX century Italian industrial development, and the North-South divide; in Section 3 we describe the data; in Section 4 we present the estimated model; in Section 5 we draw tentative conclusions.

[1] Although the major source of income stemmed from the agricultural sector, development patterns are clearly more easily visible in the rapidly developing sectors of the economy. Additional reasons for focusing on manufacturing instead of GDP in the context of convergence analysis are given in Rodrik (2013).

[2] Interestingly, Capello (2009) points out that the concept of spatial spillovers is implicit in many growth theories (*e.g.*, the celebrated potential development theory of Isard, 1954, and Giersch, 1949) but it was largely ignored until the early '90s, when it was pushed by the developments of spatial econometrics.

2 A review of the literature on early Italian industrial development:

Cliometric studies on Italian industrialization started in the late 1950s, when the national institute of statistics (Istat) published the first long term statistical reconstructions of the national accounts.

Clough and Livi (1956) and Richard Eckaus (1961) are generally credited to have given the first quantitative accounts of the North-South differential in the aftermath of Italy's unification (1861). Both studies consider a wide set of indicators (including construction of railroads, tax receipts, state expenditures, share of labor force by sector of activity, and number of joint stock companies) and conclude that "a difference in per capita income between North and South of between 15 and 25 percent seems plausible" (Eckaus, 1961, p. 300). Estimates by Daniele and Malanima (2007), subverted the above findings, suggesting that the economic gap between Northern and Southern regions was, at the time of the country's unification, negligible. However, the new regional estimates by Brunetti et al. (2011) for 1871 show that per capita GDP of Northern regions was on the average about 25 percent higher than that of Southern regions, thus supporting Eckaus view. The echo of Eckaus quantifications were amplified by Luciano Cafagna who claimed repeatedly that the origin of the North-South divide, particularly evident in the pre-WWI year, dated well before the country's unification of 1861. The secular tradition of textile exports was taken as an example of the ability Northern regions (above allo Lombardy) to compete in international markets.

A recent study (Fenoaltea, 2001) proposed an alternative story of the regional imbalances. Based on brand new diachronic estimates of industrial value added at the regional level (for years 1871, 1881, 1901, and 1911) the author suggests that, contrary to conventional wisdom, the regional divide that characterized Italy in the early years after its unification was that between the Western and Eastern part of the country. The author notices that industry was then largely artisanal and concentrated necessarily near the capitals (Turin, Florence, Rome, Naples, and Palermo) of pre-unitarian states, distributed along the Thyrennian side of the pensinsula. It was only decade later, at the eve of WWI, with the development of proper industrial plants tied to the mechanization of the production processes and the related reduction in transport costs that the "industrial triangle" (the regions of Piedmont, Liguria, and Lombardy) emerged as, by far, the most industrial region of the country.[3]

Beside economic factors (such as per-capita GDP, taxes, and share of labor force by sector of activities), part of the literature suggests to consider the relevance of more general socio-economic indicators as potentially able to account, at least partially, for the extent of the regional divide. A recent contribution (Ciocca, 2007) documents that in the early 1860s Northern and Southern regions were different ever since along many dimensions, including educational levels, social participation, and respect for the rule of law, all affecting the growth potential of the two macro regions, thus supporting Cafagna's view.[4]. Similarly,

[3]Fenoaltea (2001) focuses on industrial value added at the regional level. Interestingly enough, Brunetti et al. (2011), focusing on regional GDP, confirms his findings that in the aftermath of its unification Italy was characterized more by a West-East divide than by a North-South one.

[4]The classic references on this line are Banfield (1958) and Putnam (1993). Farneti (1971),

Felice (2012, and 2014) points to social participation and institutions as relevant variables to look at when investigating the long-term development of the North-South divide. A quantitative account on the issue is given in Zamagni (1990), p. 40, showing that northern regions scored better than southern ones in terms of a battery of socio-economic indicators (ranging from railways and streets extension measured in km, to illiteracy rates, and to enrollment rates in primary and secondary school.) The point that social variables matter is moreover not new. Contemporaries (see *e.g*, Franchetti, 1875, p. 40) noticed that besides economic factors the North and the South were different in terms of "intellectual and moral" terms.

A final remark in order here is that in 19th century Italy was divided in 16 regions and 69 provinces, and the vast majority of the quantitative literature on the origin of industrial and economic divide in Italy focuses on regions. Quantitative evidence on Italian industry at the provincial level is instead very recent (Ciccarelli and Fenoaltea, 2013). The study presented the first ever estimates of industrial value added at 1911 prices for the case of the manufacturing industry, with a disaggregation including 12 sectors. Interestingly, Cafagna's claim that at Unification industry was already more developed in the north than in the south, which received no support from previous regional estimates, was supported by these new provincial estimates."[5]

3 Modeling early Italian industrial development

From the summary of the literature on regional imbalances of the previous section one learns that while the North-South divide that characterizes Italy in present day is out of dispute, the debate on its origin and causes is instead still alive, and that social variables, in addition to those of economic nature, are also considered as relevant part of the story. This paper contributes to the above debate by considering for the first time the early steps towards Italy's industrialization within a spatial analysis framework. Following Rey and Montouri (1999), our benchmark model is the conditional convergence model with no spatial effects, which we be later on generalized to allow for spatial spillovers. In the benchmark model the growth of industrial value added, in per-capita terms, from 1871 to 1911 is modeled as as function of the starting level of industrial value added, and a set of conditioning variables (or *controls*) including education, social participation, political participation, and, to account for infrastructure endowment of the various provinces, postal offices, roads and railways extension.[6] Formally:

$$\Delta y_j^{71-11} = \alpha + \phi y_j^{71} + \sum_{i=1}^{k} \beta_i X_{ij}^{71} + \varepsilon_j, \tag{1}$$

A'Hearn (1998), and Felice (2012) provide, among others, contributions concerning 19th century Italy

[5] For a more detailed survey of the quantitative literature on the local economic development of 19th century Italy we refer the reader to Daniele and Malanima (2011), Ciccarelli and Proietti (2013), Ciccarelli and Missiaia (2013), and the more recent Felice (2014).

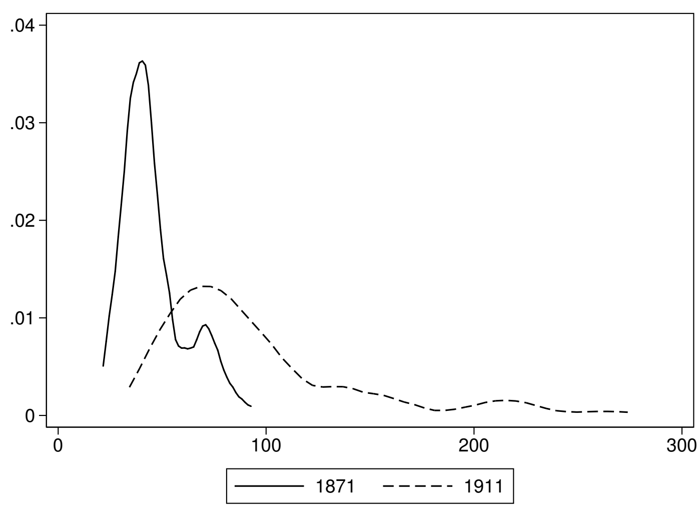
[6] Note that Venetia and Rome and its region, Latium, were annexed to the country only in 1866 and 1870. Quantitative information for these regions are usually very limited so that, as if so often the case in the prevailing literature, our analysis starts with the year 1871.

where the index $j = 1, 2, \ldots, 69$ denotes provinces, y_j^{71} industrial value added per capita .[7], in the manufacturing sector in 1871 (the starting year of our analysis), Δy_j^{71-11} its end-to-end (from 1871 to 1911) growth, and X_{ij} represents control i in province j. As already anticipated, we concentrate our analysis on the manufacturing sector alone, and consider value added in per capita terms. The data are taken from Ciccarelli and Fenoaltea (2013). The quantitative information on the socio-economic variables at the provincial level for 1871 is instead entirely new; a detailed description of the data definitions and sources is reported in the Appendix, while in the next subsection we discuss the spatial distribution of the data.

3.1 Spatial distribution of the manufacturing industry

Non-parametric estimates of the density functions of per capita value added in the manufacturing industry at end-points are reported in Figure 1. The 1871 density resembles clearly that of a mixture of two different distributions, as if in the early step of Italy's industrialization the various provinces belonged to two different populations.[8]. In 1911, after the generalized mechanization of production processes and the diffusion of modern industrial plants, the distribution shifted to right and both location and scale parameters are considerably higher than in 1871. In fact, from Table 1 we can see that the ratio between value

Figure 1. Per capita value added in manufacturing industry, 1871 and 1911 (lire at 1911 prices) [a]



[a]Non parametric kernel density estimate with Silverman (1986) plug-in smoothing parameter. *Source: see text.*

[7]Two remarks are in order here: first, population acts purely as a scaling term capturing the size of the provinces; second, in the rest of the paper we will often refer to this variable simply as value added.

[8]It should be remarked that this provides strong support to Cafagna's view of the North-South divide

added in 1911 and in 1871 is about 1.8 for the poorest provinces (Table 1, col. 1), approximately two for the average ones (Table 1, col. 2), and nearly three for the richest ones (Table 1, col. 4). Both dispersion and concentration, as measured respectively by the standard deviation (normalized by mean values), and by the Gini coefficient, also increased considerably (about 1.5 times, Table 1, coll. 5 and 6).

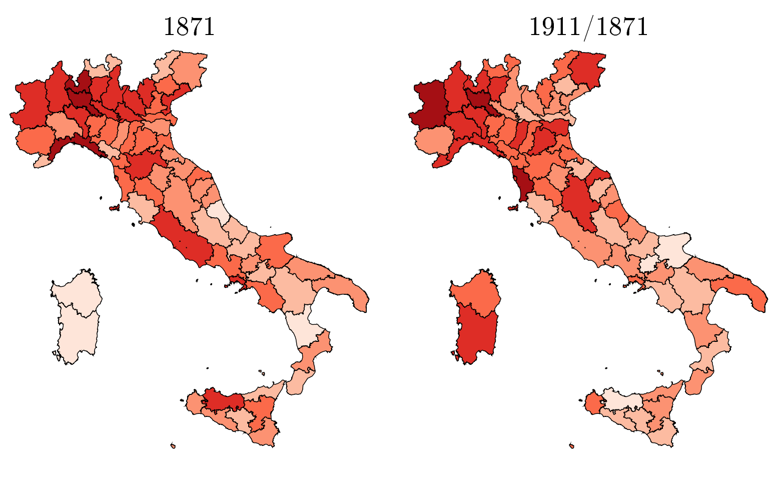
Table 1. Manufacturing industry: per capita value added, descriptive statistics.[a]

	(1) *min*	(2) *median*	(3) *mean*	(4) *max*	(5) $\sigma/mean$	(6) *Gini*
1871	25.78	41.15	45.67	88.59	0.32	0.17
1911	46.03	81.12	94.75	262.20	0.50	0.25
1911/1871	1.8	2.0	2.1	3.0	1.6	1.4

[a] Lire at 1911 prices. The 1911/1871 row at the bottom of the table reports the (rounded) ratio of figures appearing in the preceding rows (so that for instance 1.8 = 46.03/25.78).
Source: see text.

Figure 2 presents things from a spatial perspective. The left hand side refers to 1871 and illustrates the geographical distribution of y_j^{71}, the "initial value" of per capita value added in manufacturing. A North-South divide is clearly evident, with northern provinces typically belonging to the upper part of the distribution (see again Figure 1 from this perspective). With the exception of

Figure 2. Per capita value added in manufacturing (lire at 1911 prices) [a]



[a] The maps use as a class breaks the percentiles 5, 25, 50, 75, 95 of the distributions of manufacturing value added (map on the left hand side) and of end-to-end growth rate (map in the right hand side).
Source: see text.

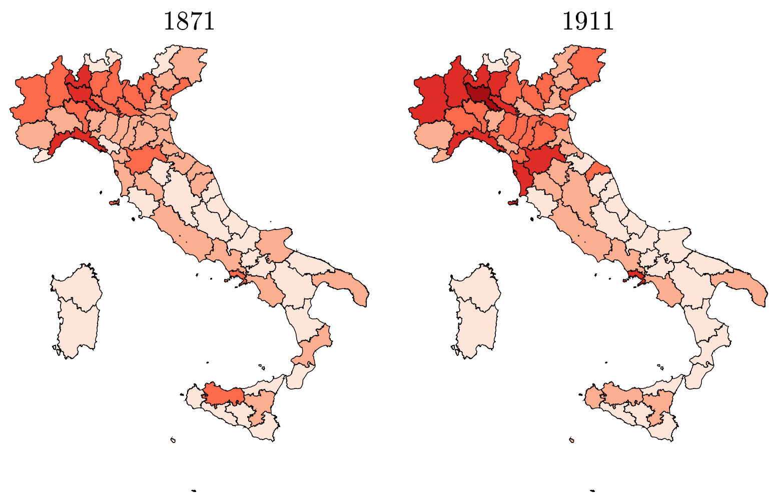
Naples and Palermo (the capitals of the former Kingdom of two Sicilies) the only provinces above the third quartile of the distribution (about 50 lire per capita in 1871, corresponding to the province of Rome) belong to the North. Within "advanced North" only Genoa (in Liguria) and Milan (in Lombardy) are above the (arbitrary) threshold of 80 lire and represent clear outliers.[9] But there is more than that. The considerable amount of within North heterogeneity reveals that the simplistic partition of the country between North and South, so often adopted in the historical literature on the so called *Mezzogiorno* problem, seems unappropriate. Within Piedmont, northern provinces (Turin and Novara) score better of southern provinces (Alessandria and Cuneo). Within Liguria, the provinces of Genova – harbor of the House of Savoy, with celebrated industrial plants such as the Ansaldo factory, and more generally queen of Italy's early engineering – and Porto Maurizio appear as sisters belonging to different families. Similarly, within Venetia Alpine provinces appear relatively backward when compared to industrial Vicenza, point of convergence of important textile centers, and Venice. Lombardy, the last region forming the industrial triangle, presents instead a more homogeneous distribution of industrial value added with six out of eight provinces above (in two cases, Milan and Como, well above) median values. A North-South divide thus, but with a few caveats. The map also confirms the early West-East gradient in the early stage of Italy's industrialization, a point dear to economic historians.[10] The gradient is admittedly not particularly pronounced, still it dovetails nicely with the artisanal nature of early industry closely tied to marked proximity and thus located near the capitals (Turin, Florence, Naples, Rome, and Palermo) of preunitarian states.

The map on the right hand side of Figure 2 gives a geographical representation of Δy_j^{71-11}, that is the dependent variable of our convergence regression models. It shows that in the four decades between 1871 and 1911 the growth of per capita value added has been considerably unequal across provinces, with provinces of the North-West rising their shares of the total. The considerable industrial growth occurred in Italy in the four decades here considered is, with a few exceptions, driven by north/western provinces. Within the industrial triangle formed by the regions of Piedmont, Lombardy, and Liguria, the provinces of Turin and Milan score particulary well.

Finally, Figure 3 reports the indices of value added obtained by using the minimum values of 1871 and 1911 as reference level. The normalization of each provincial value added by the minimum value of the distribution (registered as a matter of fact by the province of Sassari, in northern Sardinia both in 1871 and 1911) highlights more clearly that in 1871, and even more in 1911, the North, and above all the provinces of North-West, stands out from the mass. In this metric, industry in 1871 appears largely concentrated in subalpine provinces, less so in northern provinces of the Po valley (essentially the part of northern Italy going from the province of Cuneo, at the western border with France, to the provinces of Ferrara, Ravenna and Rovigo on the east side of the country, along the Adriatic coast). With the exception of the province of Naples, an end-to-end darkening of the map is registered only by (the majority of) provinces above the 43rd parallel north and – with the marked diffusion of industry in Emilia (in the Po valley) – within North heterogeneity reduces over time. Below 43rd parallel north the map present mainly "light" colors; a set of provinces along the adriatic coast down to Calabria, the toe of the Italian boot, form the less

[9] A detailed map with the names of the provinces is reported in the Appendix.
[10] On this point see Fenoaltea (2001).

Figure 3. Per capita value added in manufacturing (lire at 1911 prices): indices (min = 100) [b]



[b] The maps report indices of manufacturing value added (minimum provincial value in 1871 and 1911 equal to 100); the six intervals are defined by the values 100, 150, 200, 300, 500, and 600.
Source: see text.

industrialized part of the country. Let us now move to the model estimates.

3.2 Model estimates

The explanatory variables entering the conditional convergence model represented in Equation (1) are usually interpreted as, other things being equal, the determinants of growth. Things are relatively easy to handle in case of cross-country studies a là Barro concerning modern times. Less so in historical settings when information at the sub-national level are generally scanty. With the aim of capturing dimensions such as social participation, human and social capital, and infrastructure endowment we collected data from historical sources ranging from population censuses, to official railways and electoral publications, to individual contributions. As a result, the present piece represents, to the best of our knowledge, the first attempt ever to investigate the main determinants of local industrial growth in XIX century Italy in a well defined quantitative setting. In order to increase the efficiency of our estimation procedure in some cases we resort to principal component analysis (PCA), a common way to reduce the dimensionality of the problem (for instance, it is used in a very similar set-up by Tabellini, 2010). Technical details, also including references to the historical sources, are given in the Appendix.

Before entering into the details we should point out that while we have some measures of human and infrastructure capital no data whatsoever are available for material capital. Of course, this is not surprising, as data for this variable are often missing or troublesome even for modern economies. This said, let us discuss the different variables collected, distinguishing between human capital, social capital, and social overhead capital. Maps are provided in Figure 4.

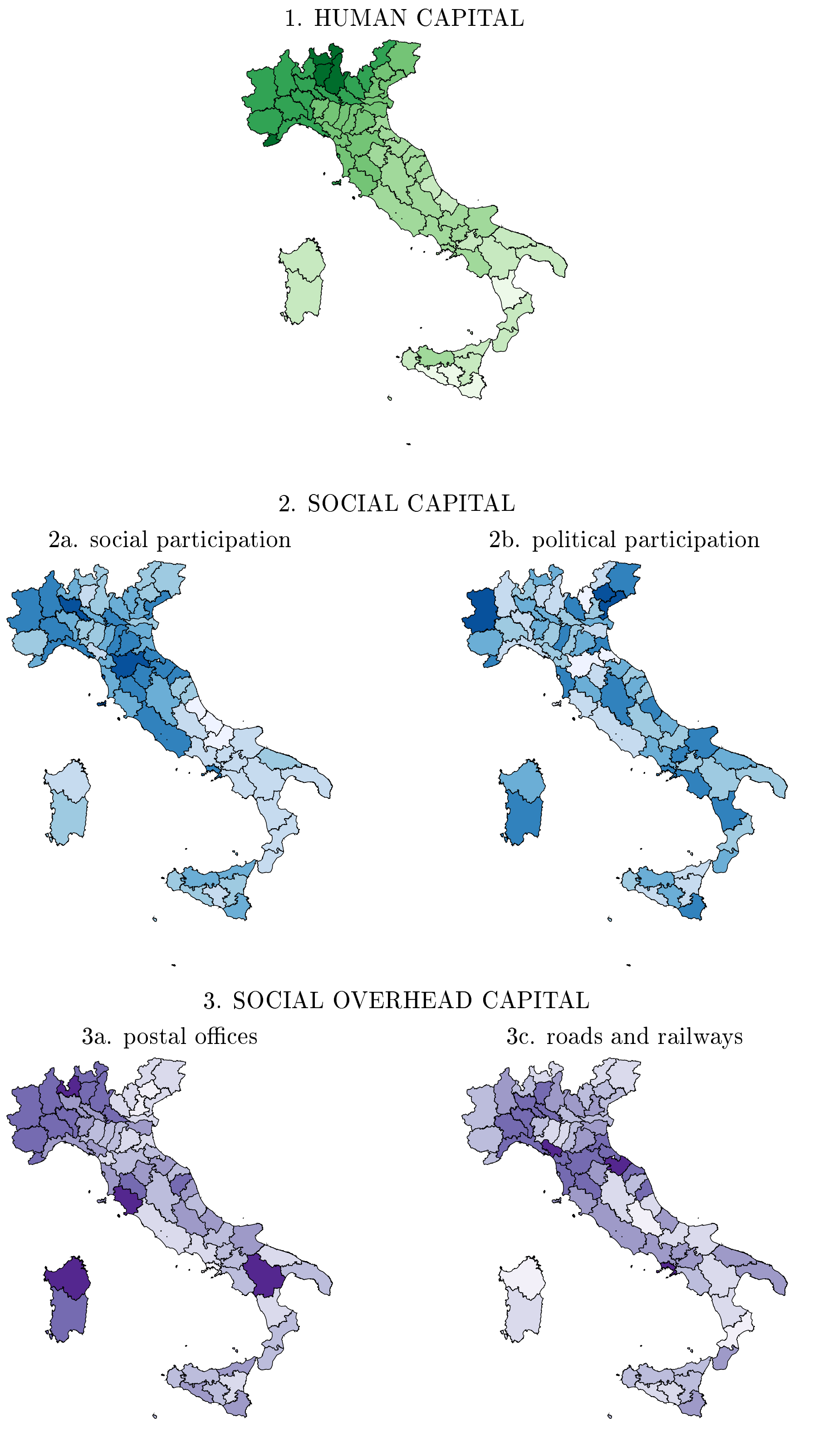
Human capital. The human capital control used in the regression models is the first principal component emerging from PCA on the logs of (standardised) illiteracy rates, age heaping, number of pupils and number of teachers in primary school. “Age heaping” (A’Hearn *et al.*, 2013) is defined as an estimate of the excess frequencies of population reporting age in round numbers. This phenomenon is obviously in an inverse relationship with the numeracy of the population of all age groups; hence, age heaping and illiteracy rates measure the education level of the population, while number of pupils and teachers measure the size of the education sector. A North-South divide is clearly evident. Within Lombardy and Venetia (part of the Habsburgh empire till 1866) northern provinces score particulary well. Similarly for the case of Piedmont. At the opposite side of the distribution, provinces of southern Sicily performs instead poorly.[11]More details are given in the appendix.

Social capital. The social capital controls can be divided in two groups: (i) social participation; (ii) political participation. The first group includes the number of newspapers and magazines sold, and membership of mutual societies (both suitably standardized by the population size); the second group includes the number of voters (per 100 registered voters) in the local and national elections of mid 1860s and 1870. PCA suggests to keep these two groups separated, so that we constructed a Social participation variable as the simple average of the number of newspapers and magazines sold and membership of mutual societies, and a Political participation variable as the simple average of the number of voters (per 100 registered voters) in the local and national elections of mid 1860s and 1870. More details are given in the appendix.

Social overhead capital. Infrastructure capital includes local and national roads and railroad extension (all measured in linear km’s per square km of provinces surface, as in Capello, 2009) and Post offices (standardized by the population size). In this case also PCA suggested to keep separated the two types of variables, so that we included in our regressions both the simple average of (standardized) roads and railways and Post offices per 100.000 habitants. More details are given in the appendix.

[11]For reasons of space, provincial maps for illiteracy rates, age heaping, number of students, and number of teachers in primary school in 1871 are not reported. They are available upon request.

Figure 4. Control variables used in regression models (year = 1871 ca.) [a]



[a] The maps use as a class breaks the percentiles 5, 25, 50, 75, 95 of the relevant distribution.
Source: see text.

The starting step of our study is the simplest growth model[12] with the initial level of per capita value added as the only explanatory variable. Taking as dependent variable the average growth for a decade, $\Delta y_j^{71-11} = (y_j^{11} - y_j^{71})/4$,where y is log value added, denoting in boldcase the $N \times 1$ vectors of the various variables, and letting $\varepsilon = \begin{bmatrix} \varepsilon_1 & \dots & \varepsilon_N \end{bmatrix}'$:

$$\Delta \mathbf{y}^{71-11} = \phi \mathbf{y}^{71} + \varepsilon \tag{2}$$

Estimates are reported in Table 2, panel A, col. 1. In view of the descriptive analysis of the previous section the positive sign of the coefficient is of course not surprising: we have seen that provinces with higher starting income grew more than those with a lower one. However, we need to check carefully for the presence of spatial spillovers, as relatively poor provinces may have benefited from the development of rich neighbors. To establish notation let us briefly recall the foundations of spatial modeling. First of all, let $\mathbf{W}$ be a $N \times N$ spatial weights matrix which "expresses the strength of potential interaction between each observation and its neighbors" (Anselin and Rey, 1991, p. 117); the simplest example is the binary contiguity matrix with elements $w_{ij} = 1$ if i and j have a common border, and 0 else. Then a first way to introduce the spatial dimension is allowing for spatial dependence in the errors of (2), obtaining the spatial error model (SEM, see, e.g., Rey and Montuori, 1999, eq. 6-8):

$$\Delta \mathbf{y}^{71-11} = \phi \mathbf{y}^{71} + \varepsilon \tag{3a}$$

$$\varepsilon = \rho \mathbf{W} \varepsilon + \eta \tag{3b}$$

where ρ the spatial autoregressive coefficient and η a random noise $N(\mathbf{0}, \sigma^2 \mathbf{I})$. Substituting from (3b) into (3a) we obtain

$$\Delta \mathbf{y}^{71-11} = \phi \mathbf{y}^{71} + (I - \rho \mathbf{W})^{-1} \eta \tag{4}$$

From equation (4) it is clear that the spatial error model emphasizes shock propagation, as a shock to a given province is assumed to spill over to the province's neighbors according to the weights given by the elements of the matrix $(I - \rho \mathbf{W})^{-1}$.

Alternatively, we can augment model (2) with a spatially lagged dependent variable, obtaining the spatial autoregressive model (SAR, see, e.g., Rey and Montuori, 1999, eq. 9):

$$\Delta \mathbf{y}^{71-11} = \rho \mathbf{W} \Delta \mathbf{y}^{71-11} + \phi \mathbf{y}^{71} + \varepsilon \tag{5}$$

in which the question of if, and how, growth in one province has been influenced by growth of its neighbors can be directly tackled.

We can test for the presence of spatial autocorrelation in the regression residuals with three different statistics: Moran's I, which does not assume a specific form of spatial dependence, LM^{SEM} against the alternative of spatial error dependence, and LM^{SAR} against the alternative of spatial lag model (see, e.g., Anselin, 2008, Anselin and Rey, 1991). The spatial weights matrix used has been constructed assuming all provinces with a distance smaller than a

[12]Since we know that divergence forces have in action we prefer to refer to model (2) as "growth model," rather then as "$\beta-$convergence model," as standard in the literature.

threshold c to be neighbors (hence, $w_{ij} = 1$ if $d(i,j) < c$, 0 else). The threshold c has been fixed *ex-post* at the value maximizing spatial interaction, i.e. the spatial autocorrelation statistics. This value turned out to be 100 km, a plausibile distance. The two provinces of Sardinia, which obviously have as a unique neighbor the other province of the island, have been dropped from the sample. Finally, the distances are measured from the administrative centers, an acceptable simplification in view of the small dimension of the provinces. As to be expected, two of these statistics suggest strong residuals spatial autocorrelation (Table 2, panel B, col. 1). The simplest possible way to allow for regional effects is to include regional dummies for the constant. From Table 2, panel A, col. 2 we can appreciate that allowing for different average growth in the North, Center, and South has the effect of halving the divergence effect of 1871 value added. Interestingly, average growth does not appear to be much different in the North and in the Center, while in the South it is definitely lower. The spatial autocorrelation diagnostics are now marginally not significant (Table 2, panel B, col. 2), so that this rather naive model may be considered a reasonably good explanation of regional industrial growth in XIX century Italy. However, both initial conditions and spatial spillovers deserve to be explicitly modeled. Income clearly acts as a proxy for the many dimensions of productive capacity, while spatial interaction occurs at a much finer level than those three broad areas. SEM and SAR model estimates are reported in Table 2, panel A, cols. 3-4. The estimated coefficients of the initial level of manufacturing value added (y_j^{71}) are positive and significant pointing to divergence. Turning to spillover effects, the estimated coefficient (Table 2, panel A, col. 4), is about 0.4, suggesting that a ten percent increase in the industrial growth of the neighboring provinces implies approximately a 4 percent increase of provincial growth.

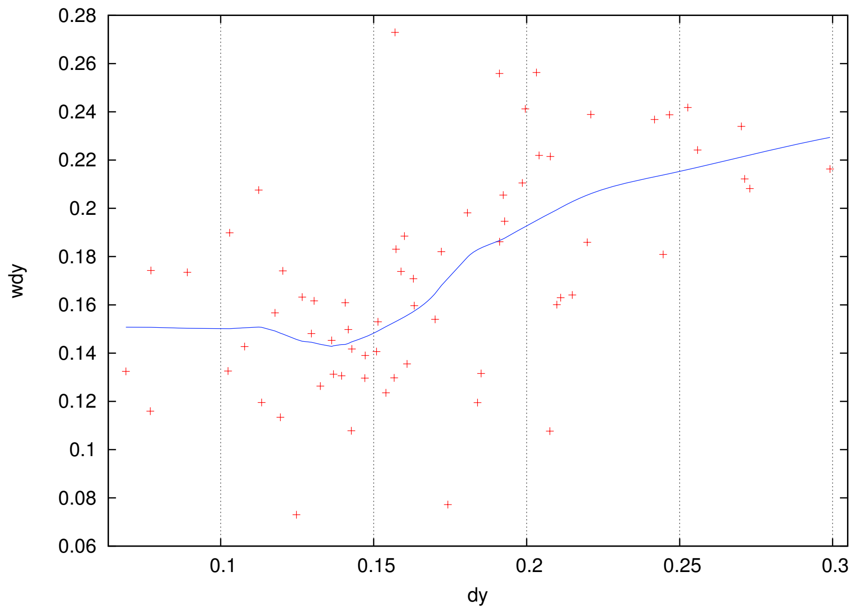
As a subsequent step we relate per capita value added growth over 1871-1911 to the controls discussed in the previous section: starting levels of per capita log value added (y_j^{71}) and Education (Edu_j^{71}), Social participation (Soc_j^{71}), Political participation (Pol_j^{71}), Post offices ($Post_j^{71}$), Roads and railways (RR_j^{71}), hence considering the conditional growth model

$$\Delta y_j^{71-11} = \alpha + \phi y_j^{71} + \beta_1 Edu_j^{71} + \beta_2 Soc_j^{71} + \beta_3 Pol_j^{71} + \beta_2 Post_j^{71} + \beta_5 RR_j^{71} + \varepsilon_j \quad (6)$$

where $j = 1, \ldots, 69$. The model can be readily generalized to allow for spatially autocorrelated errors or a spatially lagged dependent variable along the lines described above.

Model selection on the basis of significance of the individual coefficients and minimization of AIC suggests for the conditional growth model (6) the restricted specification reported in Table 3, Panel A, col 1. The retained variables are Edu (educational system) and Soc (social participation), with RR (roads and railways) only very marginally significant. Thus, non-material capital seems to matter more than communication infrastructures. This may appear puzzling, but we should not forget that the vast majority of the Italian railways were built after 1870 and are thus not included in RR. Remarkably, all diagnostics are largely non significant (Table 3, Panel B, col. 1). Since the spatial autocorrelation tests rely on asymptotic distributions it is nevertheless instructive to estimate the two specifications explicitly allowing for spatial effects. Maximum Likelihood estimation of the error and spatial models with starting values given by either OLS estimates or random numbers generated from a uniform distribution, yields very similar results (Table 3, Panel A, cols. 2-3). Essentially, the coefficients *Edu* and *Soc* are very similar to those obtained earlier, and the marginally significant spatial effects replace the RR variable (which in fact had a $p-$ value of 0.16 in the conditional growth model). AIC is minimized by the simpler conditional convergence model with no spatial effects, but the explanatory power of both models with spatial effects is obviously much higher than that of the base model. We can now draw some reasonably robust conclusions. First, quoting Bauer *et al.* (2012), "knowledge matters": the variable *Edu*, which synthetizes size and quality of the educational system is always strongly significant. This finding is of course consistent with many other empirical results. Di Liberto (2008) shows that improvements in literacy rates had a strong impact on the growth of Southern Italian regions in the 1960s, when the income differentials with the rest of the country temporarily shrank (on this, see Paci and Saba, 2008). On a much larger scale, Gennaioli *et al.* (2013) show that education is the single most determinant of the current world regional development differentials, and Tabellini (2010) that the literacy differentials can have highly persistent effects on income differentials, up the the point regional per capita output in the European regions at the end of the XX century is significantly related to literacy rates of over a century before (according to Tabellini the link is the effect of literacy on the shaping of culture and institutions). Second, active citizenship also matters: press diffusion and social awareness, as measured by the diffusion of mutual societies, have a significant effect on growth. This is also consistent with Tabellini (2010), whose estimates emphasize the positive effects on growth of the cultural aspects often labeled "social capital" which our two variables attempt to measure. Third, the initial endowment of roads and railways did not seem to have a significant influence on development As anticipated above, most of the Italian railways were built after 1871, so this is actually not surprising. Fourth, consistently with what found by Rey and Montuori (1999) for the US states in the XX century, spatial spillovers matter. In other words, the polarization of the distribution, with inequality growing strongly between 1871 and 1911, seems to have been a consequence of the fact that the provinces of the North had not only higher starting values of value added, but also superior human capital endowments, a cooperative culture, and were on average more exposed to positive spatial spillovers. This last point raises an interesting question: are these spillover effects possibly non linear? A first answer is provided by the so-called Moran scatterplot, a plot of the average growth of the neighbors, $\mathbf{W}\Delta\mathbf{y}^{71-11}$, versus $\Delta\mathbf{y}^{71-11}$ which is reported in Figure 5 along with a non parametric loess estimate of the regression function. From the scatterplot and the estimate of the regression function it is evident that for low values of income growth (approximately lower than 15 percent for decade) there is no essentially no relationship between growth in one province and that of its neighbors, while for higher values there is almost a one-to-one relationship. Not surprisingly, most of the provinces of the Center-North (more precisely, 37 out of 44) are in the higher growth group; it is thus interesting to estimate the spatial models restricting the sample to these provinces only. From columns 4 and 5 of Table 3, Panel A, we can see that, as expected, the estimates of the spatial effects are larger and, above all, much more significant. Note that the spatial error model seems to suffer from heteroskedasticity and, surprisingly, spatial autocorrelation of the residuals; however, it delivers estimates very close to those of the spatial lag model, whose diagnostics do not signal any problems.

Figure 5. Moran scatterplot. Manufacturing: growth vs neighbors growth, 1871-1911.



4 Conclusions

The paper presented estimates of the conditional convergence model augmented to account for spatial effects. The geographic unit of analysis is constituted by provinces (NUTS 3 units) and the time period considered goes from 1871 to 1911. The simultaneous presence of positive spillovers (the estimates show that a ten percent increase in the industrial growth of the neighboring provinces implies approximately a three percent increase of provincial growth) and positive effects of the own initial level of industrial value added suggests that the polarization between dynamic, high-growth areas and backward areas goes back to the very beginning of Italy's economic history. The conditional convergence model is then augmented to include various socio-economic variables (human capital, social capital, and social overhead capital). Preliminary results suggest that education, a cooperative culture, and spatial spillovers are able to explain, other things being equal, much of the variability of value added in the manufacturing industry in 19th century Italy.

Table 2. Basic growth models, 1871-1911. Dependent variable: $\Delta y_j^{71-11} = (y_j^{11} - y_j^{71})/4$.

A: regression results [a]

	(1) base model	(2) base model + regio dummies	(3) SEM	(4) SAR
y_j^{71}	0.071	0.035	0.048	0.051
	0.002	0.020	0.019	0.018
	[<0.010]	[0.09]	[0.01]	[0.01]
center = 1	n.a.	-0.003	n.a.	n.a.
		0.014		
		[0.85]		
south = 1	n.a.	-0.050	n.a.	n.a.
		0.014		
		[<0.01]		
constant	0.882	0.543	0.611	0.615
$\mathbf{W}\varepsilon$	n.a.	n.a.	0.207	n.a.
			0.060	
			[0.01]	
$\mathbf{W}\Delta\mathbf{y}^{71-11}$	n.a.	n.a.	n.a.	0.381
				0.098
				[<0.01]

B: goodness of fit and diagnostic tests [b]

	(1) base model	(2) base model + regio dummies	(3) SEM	(4) SAR
goodness of fit:				
R^2	0.16	0.33	0.94	0.95
$LogL$	109.74	117.12	115.36	115.99
AIC	-215.48	-226.24	-222.72	-223.98
diagnostic tests:				
$White$	1.42	6.48	4.27	4.28
	[0.49]	[0.37]	[0.64]	[0.64]
I	2.78	1.04	1.12	-0.52
	[<0.01]	[0.15]	[0.13]	[0.70]
LM^{SAR}	0.70	.62	9.81	2.06
	[0.40]	[0.43]	[<0.01]	[0.15]
LM^{SEM}	7.84	2.39	1.49	0.81
	[<.01]	[0.12]	[0.22]	[0.37]

[a] The variable y represents per capita value added in the manufacturing industry at 1911 prices. All variables in logs. Figures underneath the estimates represent asymptotic standard errors. Figure in brackets represent p-values of t-tests of significance.
[b] Figure in brackets represent p-values of t-tests of significance. $White$ denotes White's heteroskedasticity test. I, LM^{SAR}, LM^{SEM} are test statistics of spatial autocorrelation tests, and H_0 : no residual spatial autocorrelation; $I : H_1$: residual spatial autocorrelation; LM^L : H_1 : spatial lag model; LM^E : H_1 : spatial error model.
Source: see text.

Table 3. Conditional growth models, 1871-1911. Dependent variable: $\Delta y_j^{71-11} = (y_j^{11} - y_j^{71})/4$.

A: regression results [a]

	(1)	(2)	(3)	(4)	(5)
		Italy		Centre-North	
	base	*SEM*	*SAR*	*SEM*	*SAR*
y_j^{71}	-	-	-	-	-
Edu_j^{71}	0.013	.011	0.010	0.013	0.012
	0.003	0.004	0.003	0.006	0.006
	[<0.01]	[<0.01]	[<0.01]	[0.03]	[0.03]
Soc_j^{71}	0.012	0.015	.010	.023	.020
	0.007)	0.007	.003	0.011	0.011
	[0.11]	[0.03]	[<0.01]	[0.03]	[0.05]
Pol_j^{71}	-	-	-		
$Post_j^{71}$	-	-	-		
RR_j^{71}	0.016				
	0.011	-	-		
	[0.16]	-	-		
constant	0.167	0.155	0.139	0.140	0.132
$\mathbf{W}\varepsilon$	*n.a.*	0.009	*n.a.*	0.170	
		0.066		0.077	
		[0.13]		[0.03]	
$\mathbf{W}\Delta\mathbf{y}^{71-11}$	*n.a.*	*n.a.*	0.193		0.221
			0.116)		0.116
			[0.10]		[0.06]

B: goodness of fit and diagnostic tests [b]

	(1)	(2)	(3)	(4)	(5)
		Italy		Centre-North	
	base	*SEM*	*SAR*	*SEM*	*SAR*
goodness of fit:					
R^2	0.42	0.95	0.95	0.95	0.96
LogL	122.05	121.00	121.19	78.67	77.45
AIC	-236.10	-232.00	-232.38	-139.35	-144.88
diagnostic tests:					
White	5.16	5.23	4.75	17.37	3.33
	[0.52]	[0.51]	[0.58]	[0.01]	[0.77]
I	0.63	0.45	-0.04	1.35	0.94
	[0.26]	[0.33]	[0.52]	[0.09]	[0.17]
LM^{SAR}	0.24	1.89	0.43	22.31	0.23
	[0.63]	[0.17]	[0.51]	[0.01]	[0.63]
LM^{SEM}	0.51	0.18	0.17	1.59	0.60
	[0.48]	[0.67]	[0.68]	[0.21]	[0.44]

[a],[b] All abbreviations and symbols: see legend at the bottom of Table 2.
Source:see text.

Appendix: Sources and methods.

This appendix documents the sources and the methods behind the provincial dataset used in this paper.

Manufacturing industry: provincial value added, 1871-1911

Industrial value added estimates at 1911 prices for the 69 Italian provinces, for the years 1871 and 1911, are from Ciccarelli and Fenoaltea (2013), available at http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0289.2011.00643.x/suppinfo.

The authors report a breakdown of industry into its four major components (extractive, manufacturing, constructions, and utilities). Below we explain why this paper focuses on manufacturing industry and expresses value added figures in per capita terms. We here focus on the manufacturing industry alone for three reasons. First, the extractive industries of coal-less Italy were locally concentrated (particularly in Sardinia and Sicily) and most of the production was exported more than processed by the national industry. Second, the utilities industry in 1871 consisted in the distribution of water through a supply network often dating back to the ancient Rome; in 1911, the end-point of our analysis the utilities include instead electricity, by the end of the 19th century standards a new born industry, as important component. So the extractive industries are here excluded in that were not tied to the hearth of Italy's industry while the utilities are not included due to the relevant change of the internal mix of the industry itself. For the sake of caution we also excluded the the construction sector from our benchmark analysis (from 1871 to 1911) of industrial growth. The construction sector, and this constitutes the third reason to focus on manufacturing alone, is simply too cyclical and characterized by wide fluctuations: in 1871 the construction sector was at the early stage of a rising cycle of moderate size while in 1911 it was at the top of a sizeable boom characterizing the *belle époque* decade. As a result of the above selection process, the industrial sectors included in our analysis are foodstuffs, textiles, clothing, leather, wood, metalmaking, engineering, non-metallic mineral products, chemicals and rubber, paper, printing, and sundry manufacturing.[13]

Ciccarelli and Fenoaltea (2013) obtained their estimates by allocating existing regional value added estimates to the various provinces with the provincial share of regional (census-based) labor force, separately by sector of activity. For this reason we accounted for the different size of Italian provinces by simply dividing value added by population, separately by province.

We next turn to the description of sources and methods related to the control variables. As illustrated in the main text, In an effort to capture dimensions such as human capital, social participation, and social overhead capital we collected data from historical sources on a number of "elementary variables." To increase the efficiency of the estimation procedure, rather than including directly all the

[13] For technical reasons we also excluded the tobacco sector from the analysis. The sector was of very limited size. In terms of value added in 1911 it accounted for about one percent of the whole manufacturing sector. The tobacco sector was managed by the State under monopoly conditions and the production was concentrated in a dozen of industrial plants. From a practical point of view, the particular institutional setting behind the tobacco sector produced too many "missing values" for provincial value added, suggesting its exclusion from our empirical analysis. Table 1 of Ciccarelli and Proietti (2013) report a detailed quantitative summary of Italian industrial sectors for the years 1871, 1881, 1901, and 1911.

elementary variables in the regressions, we constructed some summary indicators using Principal Components Analyses (PCA). Below we list the historical sources and examine the results for each group of variables in turn (provincial maps, not reported here for reason of space, are available on request).

Human capital

The data on illiterates for 1871 are from Ministero di Agricoltura, Industria e Commercio (1874–76), vol. 2, Introduzione, pp. B-I. Data on primary education in 1871 (number of students, and number of teachers) are from Antonielli (1872), pp. 282-283. The data on age heaping in 1871 were kindly provided by Brian A'Hearn (see A'Hearn *et al.* 2013).

The elementary variables used as inputs to the principal component analysis providing as output the human capital indicator used in the convergence models are:

1. Illiteracy rate (*Illit*)
2. Age heaping (*Age*)
3. Primary school pupils divided by population in the 5-12 age bracket (*Pupils*)
4. Primary school teachers divided by population in the 5-12 age bracket (*Teach*)

The last two variables measure the size of the education sector, while the first two the quality of its output (with a negative sign). The results of applying PCA on the logs of these elementary variables are summarized in Table A1.

Table A1. Human capital: Principal component analysis

	elementary variables			
	Illit	*Age*	*Pupils*	*Teach*
first princ. component:				
weights	-0.451	-0.521	0.524	0.500
variance explained (%):	83.7			

Source: see text.

The first principal component turns out to be able to explain over 80% of the variance of the elementary variables set. All variables have approximately the same weights in absolute value, with opposite signs as to be expected for the first and the second pair. We thus decided to include the first principal component, identified as *Edu* (Education), in the convergence regressions. The provincial distribution of the Education indicator (*Edu*) is illustrated in Figure4, panel 1.

Social capital

Data on the sales of journals and magazines are from Ottino (1875), Allegato 4, "Prospetto statistico della stampa periodica, della tipografia e della libreria in Italia." Data on the member of mutual society are those given in Ministero di Agricoltura, Industria e Commercio (1875), pp. 200-203. Data on the number of voters in local and national elections of 1865 are those given in Antonielli

(1872), p. 146 (but also see Ministero di Agricoltura Industria e Commercio (1867) were useful information, beyond data, are given). Exceptionally, data for the province of Rome, annexed to the country in 1870, refers to the national elections of 1870 and the local elections of 1872, as reported in Correnti (1873), pp. 87b and 86.

The elementary variables used as inputs to the principal component analysis providing as output the social capital indicators used in the convergence models are:

1. Number of journals and magazines published per 100.000 residents ($Journals$)
2. Members of mutual societies per 100.000 residents ($Mutual$)
3. number of voters at local elections per 100 registered voters ($Local\_vot$)
4. number of voters at national elections per 100 registered voters (Nat_vot)

The results of applying PCA on the above elementary variables are summarized in Table A2.

Table A2. Social capital: Principal component analysis

	elementary variables			
	$Journals$	$Mutual$	$Local\_vot$	Nat_vot
first princ. component:				
weights	-0.375	-0.550	0.543	0.511
variance explained (%):	46.1			

Source: see text.

The first principal component turned out to be able to explain only half of the variance of this set of variables. As it can be seen, press diffusion and membership of mutual societies have positive weights, while the rate of participation to local and national elections negative ones. Hence, there is no obvious interpretation. We thus opted for splitting this set of variables in two pairs, with the simple means of the $Journals$ and $Mutual$ (suitably standardized to have unit standard deviation) capturing Social participation (Soc) and that of voters to the two elections Political participation (Pol).

$$Soc = 0.5(\frac{Journals}{\sigma_{Journals}} + \frac{Mutual}{\sigma_{Mutual}})$$
$$Pol = 0.5(\frac{Local\_vot}{\sigma_{local\_vot}} + \frac{Nat\_vot}{\sigma_{nat\_vot}})$$

The provincial distribution of social participation (Soc) and political participation (Pol) is illustrated in Figure4, panel 2.

Social overhead capital

The data on the local and national roads, measured in kilometers, are from Correnti (1873), pp. 122-125. The data on the number of postal offices are from ZZZ. The extension of the railways network (measured in kilometers) for the year 1861 is taken from Ferrovie dello Stato (1911) were data by province are reported. The extension of the railways network in 1871 has been estimated by allocating to the various provinces the kilometers of new lines opened between 1861 and 1871, as reported in Ministero delle comunicazioni (1927).

The elementary variables used as inputs to the principal component analysis providing as output the social overhead capital indicators used in the convergence models are:

1. Local and national roads, km's normalized by surface of the province in km^2 (*Roads*)

2. Railways, km's normalized by surface of the province in km^2 (*Rail*)

3. Number of post offices per 100.000 residents (*Post*)

The results of applying PCA on the above elementary variables are summarized in Table A3.

Table A3. Social overhead capital: Principal component analysis

	elementary variables		
	Roads	*Rail*	*Post*
first princ. component:			
weights	0.658	0.673	-0.339
variance explained (%):	42.2		

Source: see text.

The first principal component explains about 42% of the variance of the entire set of variables, and it is positively correlated with *Roads* and *Rail* (which have almost equal weights) and negatively with *Post* (which has a smaller weight). In fact, the second PC (not shown here) is very close to the latter variable. We thus decided to split this set of indicators as well, including the post offices variable directly, and the simple mean of the *Roads* and *Rail* variables (*RR*), duly scaled, capturing communication infrastructures.

$$RR = 0.5(\frac{Roads}{\sigma_{Roads}} + \frac{Rail}{\sigma_{Rrail}})$$

The provincial distribution of social overhead capital indicators (*Post* and *RR*) is illustrated in Figure4, panel 3.

Historical sources

Antonielli, E. (1872), *Annuario statistico delle provincie italiane per l'anno 1872*, Florence.

Correnti, C. (1873), *L'Italia economica nel 1873*, Rome.

Ferrovie dello Stato (1911), Ferrovie Italiane 1861-1909, Riproduzione dei lavori grafici presentati all'Esposizione internazionale di Torino del 1911.

Franchetti, L. (1875), *Condizioni economiche ed amministrative delle province napoletane*, Tipografia della Gazzetta d'Italia, Florence.

Ministero delle comunicazioni (1927), Sviluppo delle ferrovie italiane dal 1839 al 31 dicembre 1926, Rome.

Istat (1958), Sommario di statistiche storiche italiane, 1861-1955, Rome.

Ministero di Agricoltura Industria e Commercio (1867), Statistica del Regno d'Italia. Elezioni politiche e amministrative. Anni 1865-66. Florence.

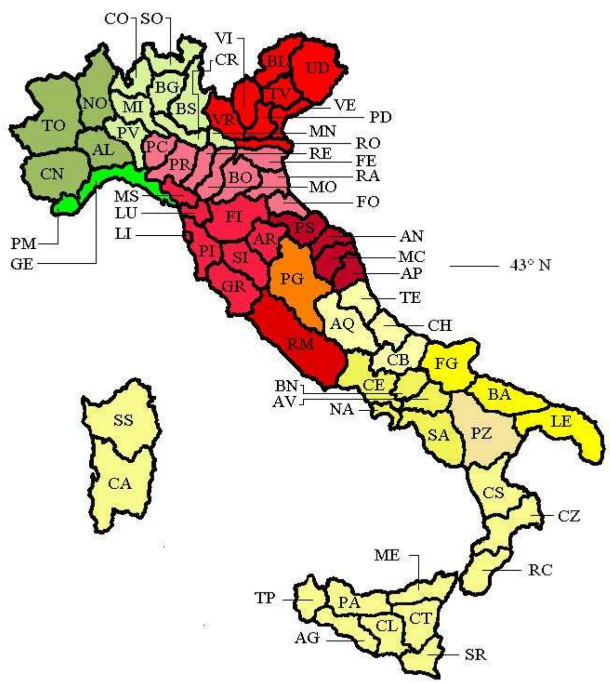
Ministero di Agricoltura, Industria e Commercio (1874–76) *Popolazione. Censimento 31 dicembre 1871. 3 voll.* Direzione Generale della Statistica, Rome, Italy.

Ministero di Agricoltura, Industria e Commercio (1875), *Statistica delle società di mutuo soccorso*, Rome.

Ottino, G. (1875), *La stampa periodica, il commercio dei libri e la tipografia in Italia*, Milan.

The appendix ends by providing a map of Italy's provinces in 1911. The name of each region, in bold, is followed by the name (and tag) of its provinces. Different colors simply highlight regional borders.

PIEDMONT: Alessandria (AL), Cuneo (CN), Novara (NO), Turin (TO)
LIGURIA: Genoa (GE), Porto Maurizio (PM)
LOMBARDY: Bergamo (BG), Brescia (BS), Como (CO), Cremona (CR), Mantua (MN), Milan (MI), Pavia (PV), Sondrio (SO)
VENETIA: Belluno (BL), Padua (PD), Rovigo (RO), Treviso (TV),Udine (UD), Venice (VE), Verona (VR), Vicenza (VI)
EMILIA: Bologna (BO), Ferrara (FE), Forlì (FO), Modena (MO), Parma (PR), Piacenza (PC), Ravenna(RA), Reggio Emilia (RE)
TUSCANY: Arezzo (AR), Florence (FI), Grosseto (GR), Leghorn (LI), Lucca (LU), Massa Carrara (MS), Pisa (PI), Siena (SI)
MARCHES: Ancona (AN), Ascoli Piceno (AP), Macerata (MC), Pesaro (PE)
UMBRIA: Perugia (PG)
LATIUM: Roma (RM)



ABRUZZI: Aquila (AQ), Campobasso (CB), Chieti (CH), Teramo (TE)
CAMPANIA: Avellino (AV), Benevento (BN), Caserta (CE), Naples (NA), Salerno (SA)
APULIA: Bari (BA), Foggia (FG), Lecce (LE)
BASILICATA: Potenza (PZ)
CALABRIA: Catanzaro (CZ), Cosenza (CS), Reggio Calabria (RC)
SICILY: Caltanissetta (CL), Catania (CT), Girgenti (AG), Messina (ME), Palermo (PA), Syracuse (SR), Trapani (TP)
SARDINIA: Cagliari (CA), Sassari (SS)

References

A'Hearn B. (1998),"Institutions, externalities and economic growth in southern Italy. Evidence from the cotton textile industry, 1861/1914," *Economic History Review*, , pp. 734-762.

A'Hearn, B., Delfino, A. and Nuvolari, A. (2013), " 'Uniting Souls' and counting skills: age-heaping in the first Italian national censuses, 1861-1881', paper presented at the Valencia FRESH meeting, 13-14 June, 2013.

Anselin, L. (2008) "Spatial regression," in Fotheringham, A.S, and P.A. Rogerson (eds.) *The SAGE Handbook of Spatial Analysis*, SAGE, Los Angeles and London, pp. 255-276

Anselin, L. and Rey, S. (1991) "Properties of tests for spatial dependence in linear regression models," *Geographical Analysis*, 23, pp. 112-131

Banfield, E. C. (1958), *The moral basis of a backward society*, Free Press, Glencoe.

Bauer, Paul B., Mark E. Schweitzer, and Scott A. Shane. (2012), "Knowledge Matters: The Long-Run Determinants of State Income Growth," *Journal of Regional Science*, 52, 240-255.

Boltho, A., W. Carlin and P. Scaramozzino (1997) "Will East Germany become a new Mezzogiorno¿' *Journal of Comparative Economics*, Vol. 24, 241-264.

Brunetti A., Felice E. and G. Vecchi (2011), "Reddito," in G. Vecchi (ed.), *In ricchezza e in povertà. Il benessere degli italiani dall'Unità a oggi*, Bologna: Mulino.

Cafagna, L. (1998), "Contro tre pregiudizi sulla storia dello sviluppo economico italiano," in P. Ciocca and G. Toniolo (eds.), *Storia economica d'Italia, 1: Interpretazioni*, Laterza, Rome-Bari, pp. 297-325.

Cafagna, L. (1989), *Dualismo e sviluppo nella storia d'Italia*, Marsilio, Padova.

Capello, R. (2009) "Spatial spillovers and regional growth: a cognitive approach" *European Planning Studies*, 17, pp. 639-658.

Ciccarelli C., S. Fenoaltea (2013) "Through the magnifying glass: Provincial aspects of industrial growth in post-Unification Italy," *Economic History Review*, 66, pp. 57-85.

Ciccarelli C., Missiaia A. (2013), "The industrial labor force of Italy's provinces: Estimates from the population censuses, 1871-1911," *Rivista di Storia Economica*, 29, 2, pp. 141-192.

Ciccarelli C., Proietti T. (2013), "Patterns of industrial specialisation in post-unification Italy," *Scandinavian Economic History Review*, 61, 3, pp. 259-286.

Ciocca P. (2007), *Ricchi per sempre ?*, Bollati Boringhieri, Turin.

Clough, S. B, and Livi, C. (1956), "Economic growth in Italy: An analysis of the uneven development of North and South," *Journal of Economic History*, 16, 3, pp. 334-349.

Daniele V., Malanima P. (2007), "Il prodotto delle regioni e il divario Nord-Sud in Italia (1861-2004)," *Rivista di politica economica*, 97, no. 3-4, pp. 267-340.

Daniele V., Malanima P. (2011), *Il divario nord-sud in Italia, 1861-2011*, Rubbettino, Soveria Mannelli.

Di Liberto, A. (2008) "Education and Italian regional development," *Economics of Education Review*, 27, pp. 94-107.

Eckaus, R. S. (1961), "The North-South Differential In Italian Economic Development," *Journal of Economic History*, 21, 3, pp. 285-317.

Farneti, P. (1971), *Sistema politico e società civile*, Giappichelli, Turin.

Felice E. (2012), "Regional convergence in Italy, 1891-2001: testing human and social capital," *Cliometrica*, 6, pp. 267-306.

Felice E. (2014), *Perché il Sud è rimasto indietro*, Il Mulino, Bologna.

Fenoaltea, S. (2011), "Peeking backward: Regional aspects of industrial growth in post-unification Italy," *Journal of Economic History*, 63, 4, pp. 1059-1102.

Gennaioli, N., R. La Porta, F. Lopez-De-Silanes (2013), "Human capital and regional development," *Quarterly Journal of Economics*, 128, pp. 105-164.

Giersch, H. (1949) "Economic union between nations and the location of industries," *Review of Economic Studies*, 17, pp. 87-97.

Isard, W. (1954) "Location theory and trade theory: A short run analysis," *Quarterly Journal of Economics*, 68, pp. 305-320.

Magrini, S. (2004) "Regional (di)convergence," in J. V. Henderson and J.-F. Thisse, (eds.) *Handbook of Regional and Urban Economics*, Elsevier, Vol. 4, pp. 2741-2796.

Paci, R. and A. Saba (1998) "The empirics of regional economic growth in Italy: 1951-1993," *Rivista Internazionale di Scienze Economiche e Commerciali*, 5, pp. 513-542.

Putnam, R. D. (1993), *Making democracy work: civic traditions in modern Italy*, Princeton University Press, Princeton (with Leonardi R. and Nanetti R.Y.)

Rey, J. S. and Montouri, B. D. (1999), "US regional income convergence: a spatial econometric perspective," *Regional Studies*, 33, 2, pp. 143-156.

Rodrik, D. (2013), "Unconditional convergence in manufacturing," *Quarterly Journal of Economics*, 128, 1, pp. 165-204.

Silverman, B. W. (1986), *Density Estimation for Statistics and Data Analysis*, Chapman & Hall, London.

Sinn, H.-W. and F. Westermann (2001) "Two Mezzogiornos," NBER Working Paper No. 8125.

Tabellini, G. (2010)"Culture and institutions: Economic development in the regions of Europe," *Journal of the European Economic Association*, 8, pp. 677-716.

Zamagni, V. (1990), *Dalla periferia al centro. La seconda rinascita economica dell'Italia, (1861-1990)*, Il Mulino, Bologna.