RAILWAY ENDOWMENT IN ITALY'S PROVINCES, 1839-1913

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Abstract: This paper presents new annual estimates of railway extension in Italian provinces at 1913 borders for the period 1839-1913. The main operator of the Italian railway network (*Ferrovie dello Stato*) published in 1911 a unique set of homogeneous historical five year maps illustrating the routes of existing railway lines during 1861-1909. These eleven maps were all scanned and georeferenced in an ArcGIS-project. The resulting database was integrated with the information available in historical sources. As a second step, to allocate the various sections of railway lines to Italian provinces, we used a historical digital map (in ArcGIS shapefile format) of Italian provinces freely available on the SISTAT section of the ISTAT (Italian National Institute of Statistics) website. The new estimates were systematically checked against those reported at various geographical scale in the historical sources and in the more recent literature.

Keywords: Italy, railway, provinces, regions, GIS

JEL codes: R12, R4, N73

1. *Introduction*

This paper presents annual estimates of railway extension in Italy's provinces (roughly NUTS 3 level) at 1913 borders for the years 1839-1913.[1] The proposed reconstructions have been obtained with a GIS

(Geographic Information System)[2] approach. The use of GIS technologies to analyze the early diffusion of railway and its impact on socioeconomic developments, regional growth, and urbanization is not new in the international literature. Groote *et al.* (2009) use GIS to analyze the relationship between the biological standard of living and the early development of the transportation network in 90 municipalities of the Netherlands. Atack *et al.* (2010), develop a geographical information system database to investigate the impact of gaining access to rail transportation on 1850-1860 changes in population densities and rate of urbanization in the American Midwest. In 2011 a special edition of the *Journal of Interdisciplinary History* was dedicated to the theme «Railways, population and Geographical Information Systems». Caruana-Galizia and Martí-Henneberg (2013), discuss a project investigating the potential relation between European regions and real income levels between 1870 and 1910. Atack (2013) describes a GIS-based approach to the analysis of the spatiotemporal evolution of the transport system (including railways, steamboat navigable rivers, and canals) for the 19th century US. Hornung (2015) uses GIS techniques to study the effect of railroad access on urban population growth of about 1,000 cities in 19th century Prussia. Donaldson and Hornbeck (2015) also follow a GIS approach to estimates the aggregate impacts of railway development in the US, and in particular on the agricultural sector in 1890.

The availability of a georeferenced database of the Italian railway network allows us in principle to consider any spatial scale of interest (macro-areas, regions, provinces, or municipalities). However, following a rich and expanding literature, in this paper we use the georeferenced database to quantify the development of railways in Italian provinces from 1839, when the first Italian line connecting Naples to Portici was opened, to 1913. The recent years registered an increasing interest among Italy's regional economists and economic historians for the quantitative analysis of economic growth and development and the provincial level. This branch of the literature developed rapidly after the early contributions from A'Hearn *et. al.* (2009), with new evidence on the heights of Italian conscripts, Ciccarelli

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[2] The full GIS-database will be soon available at the website of the *University of Groningen – GeoServices*.

and Fenoaltea (2010), with new evidence on industrial value added, disaggregated for 15 sectors, and Vecchi (2011), presenting a long-term analysis of a wide set of socioeconomic indicators.[3]

The quantification of the Italian endowment of railways at the local, sub-national level is not new in the literature. Ferrovie dello Stato (1911), presents estimates of railway endowment in Italian provinces (NUTS 3 level) for the years 1861, 1886, and 1909. Ciccarelli and Fenoaltea (2009) present annual estimates for the Italian regions (roughly NUTS 2 level) for the years 1861-1913, separating out major and minor lines, and railway and tramway lines. Our contribution to the literature is thus twofold. On the one hand, we extend the reference period to include the pre-unification years. On the other hand, we present *annual* estimates of railway extension at a finer level of geographical disaggregation. The remaining of this paper is structured as follows. Section 2 provides a concise review of the literature. Section 3 discusses the sources and methods. Section 4 illustrates patterns of railway development in Italian provinces, while section 5 concludes.

2. *Background and Review of the Literature*

The first Italian railway line, a short trunk connecting Naples to Portici, was opened in 1839. The lines connecting Milan and Venice, then under Austrian dominance, were built in the years between 1842 and 1857. During the years

[3] The more recent quantitative contributions focusing on socio-economic developments at the provincial level include, among others, A'Hearn *et. al.* (2016), Cappelli (2016; 2017), Ciccarelli and Elhorst (2016), Ciccarelli and De Fraja (2014), Ciccarelli and Fachin (2016), Ciccarelli and Fenoaltea (2013), Ciccarelli and Missiaia (2013), Ciccarelli and Proietti (2013), Ciccarelli and Weisdorf (2016), Daniele *et al.* (2016), Nuvolari and Vasta (2016), and Vecchi (2017) providing a considerable update of the data and methodologies presented in Vecchi (2011). The range of topics covered is rather vast and includes statistical reconstructions on present population, industrial value added, sectoral composition of the labor force, sectoral specialization within manufacturing, literacy and public expenditure on the educational system, measures of political participation, heights of the Italian conscripts, public revenues from indirect taxes, the territorial diffusion of cigarettes, age-heaping and numeracy, market potential. The above contributions refer typically to the post-unification period, even with a long-run perspective. An exception is Ciccarelli and Weisdorf (2016) reporting decennial benchmark estimates of provincial literacy rates by gender for the period 1821-1911. The reported list of contributions and topics is necessarily not exhaustive. We apologize in advance for eventual omissions.

from 1845 to 1853 the line connecting Genoa, and its important port on the Mediterranean Sea, and Turin, the capital city of the Kingdom of Savoy, was built. Turin and Milan were connected by railways between 1855 and 1859. Several influential essayists and politicians of the nineteenth century made railways a central theme of their writings. They wrote about Italian railways as a means to promote the physical and ultimately the political unification of the country. In this respect, Petitti di Roreto (1845) and Cavour (1846) represent the most famous contributions of the pre-unification period.[4] The economic side of the matter was of course also important. High quality coal, an input of growing importance with the diffusion of factory-based industry, was largely imported in Italy from the UK, especially from Cardiff and Newcastle. It was delivered to the main Italian ports, and distributed across the country by railway.[5] From this perspective, the early railway connections of the North-West area probably contributed in a substantial manner to its early industrial development (see Fenoaltea, 2011, p. 190). After the political unification of the country, the subsequent development of the Italian railways was particularly fast. Already in the mid-1880s, the bulk of the national network was completed.[6] Over the next decades, from about the mid-1880s to WWI, the national network was then filled in completely (see, among others, Guadagno, 1996; Kalla-Bishop, 1971; Schram, 1997; Maggi, 2003).

The early development of the Italian network, as it is well known, has been analyzed by influential scholars of the past. Gerschenkron (1955) proposed a new index of industrial production for the years 1881-1913 and noticed that the Italian industrial production, with an annual rate of growth well above 6 percent, accelerated considerably during the years 1896-1908. However, this sizeable rate was

[4] Berkeley (1932), Crispo (1940), and De Biase (1940) constitutes standard references on the relation between the Italian Risorgimento and early railway developments.

[5] Mario Abrate, among the leading experts of industrialization in Piedmont, presents interesting calculations on the matter. In the early 1870s the coal delivered to Turin from St. Etienne (central eastern France) by railways had a price of 35 lire per tons (of which about 15 lire for the coal itself, and 20 lire as transport cost) while the coal shipped from Cardiff to the port of Genoa, and then to Turin by railways had a total cost of about 55 lire per ton (Abrate, 1970, pp. 28-29).

[6] It is however important to recall that even after the introduction of railways traditional costal shipping played an important role within the Italian transport system, and that the Italian rail fares of the time were probably excessively expensive (Fenoaltea, 2011, pp. 183-186).

relatively reduced when compared to those prevailing in the same period in other economically backward countries such as Sweden, Japan, and Russia. According to Gerschenkron, one of the reasons for this relatively reduced rate of growth, was that the Italian railway network was already completed in the 1880s failing to provide an adequate stimulus to the metalmaking and engineering industry after the turn of the century. Romeo (1959) also considered the role of railways during the early steps of the Italian industrialization. He attributed particular importance to the main coastal trunks build soon after the political unification of the country in 1861. These were considered «essential infrastructures» that, in the Rostowian logic of the stages of growth approach to economic development, necessarily predate the growth of a proper industrial sector. Fenoaltea (2011) contains a critical analysis of both Gerschenkron's and Romeo's points of view. On the one hand, and contrary to Gerschenkron's thesis, Fenoaltea shows that given the rising importance of maintenance over time, the stimulus to the metalmaking and engineering industries was relatively high during the first decade of the 20th century. On the other hand, and contrary to Romeo's thesis, calculations referring to the year 1910 show that the social rate of returns of the main costal lines (built during the 1860s) was, given the competition of traditional coastal navigation, probably much lower than the one of the minor internal lines (built during the 1880s). In our view, this last consideration by Fenoaltea (2011) is particularly important because it highlights the point that the rate of return of railway investments, and more generally their contributions to economic development, can greatly benefit from a disaggregated regional analysis.

3. Sources and Methods

In this section we document the sources and methods behind the annual estimates of railway extension in Italian provinces at 1913 borders for the years 1839-1913 that are reported in the Appendices A1-A2.[7] As it will emerge clearly

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[7] For reason of space, Appendix A1 reports the estimates for the years 1839-1876, while Appendix A2 those for the years 1877-1913. A further breakdown of the estimates into main and secondary lines, and standard and narrow gauge lines is available on request.

from the remaining of this section, the historical source Ministero delle Comunicazioni (1927), henceforth *Ministero*, was particularly useful. The source reports the name, the exact date of opening, and the extension in kilometers of each single line opened during the period 4 October 1839-22 December 1926. The list includes hundreds of items. The source further distinguishes among major and minor lines (labelled respectively «Ferrovie dello Stato» and «Ferrovie Secondarie»). Both major and minor lines are further disaggregated into standard and reduced gauge lines.

3.1. *A Digital GIS-database of the Italian Railway Network, 1839-1913*

We digitized the railway lines in ESRI ArcGIS 10.3 as line features.[8] All segments were digitized as detailed as possible, and attributes were added giving an identification code, year of opening, from-to name, gauge (standard or narrow), main/secondary classification, and length as reported in the main source. Digitizing automatically created a shape-length attribute as well, indicating the length of the segment in the GIS-software according to the coordinate system used.

In order to be as accurate as possible, we used a number of auxiliary data. As stated, historical five year maps from Ferrovie dello Stato (1911), and discussed in the online supplementary material of Ciccarelli and Nuvolari (2015) supplied sketches of the routes of all (then) existing railway lines in black, and the lines built in the preceding 5 year time frame in red for the years 1861, 1866, 1871, 1876, 1881, 1886, 1891, 1896, 1901, 1906, and 1909. The eleven maps were all scanned, georeferenced and added to the ArcGIS project (cf. Atack and Margo, 2011, p. 8). The fact that the maps are reported in the same historical publication greatly helped us to retrieve temporally homogenous information.

If a railway line was still in existence in 2016, the route could be traced in ArcGIS («create features» tool) using a streaming ArcGIS online service of current Italian railway lines.[9] Another ArcGIS online service that proved very useful was Open Street Map (OSM). It allowed us to check,

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[8] This section is largely based on section 2 of Ciccarelli and Groote (2016).

[9] Feature service class Ferrovie_Italiane (and FerrovieItaliane for a less detailed version), made available in ArcGIS online by Pierluigi Centomini, whom we thank for this.

and if necessary correct, the routing of the lines as traced and digitized before.

When dealing with railway lines that have been abandoned since 1913, and consequently are not included in the ArcGIS online streaming service of current railway lines, we had to manually draw the lines. In order to figure out the exact routes of these lines, we used the website *Ferrovie Abbandonate* that gives details, including a zoomable map, of virtually every dismantled railroad in Italy.[10] With the OSM layer enabled in ArcGIS this allowed us to draw these lines with a relatively high degree of accuracy. While tracing and drawing, snapping options were on, in order to make sure that newly digitized lines were linked to already existing ones. The total number of lines or segments of lines digitized as such is 843. The shortest segment measures just 172 meters, the longest 154 kilometers (the Ortona-Foggia line opened in 1864).

After the initial phase of digitizing railway lines by tracing and drawing we proceeded with several phases of error checking and resolving. We started with a visual inspection to check whether tracing had gone correctly. In routes with a lot of twists, turns, or corkscrews, tracing may have skipped some corners or may have jumped from one part of the line to another. In particular in mountainous stretches this happened. We corrected or fine-tuned manually if necessary, with the use of the OSM layer. We then made a comparison of the length of the drawn line in ArcGIS (the automatically created attribute shape-length) with the length of the line as given in the underlying *Ministero* database. To do so we joint the original data reported in *Ministero* to the ArcGIS attribute table of the digitized railway lines, and added a calculated field that measured the difference between the shape-length and the length as reported in the source. This revealed a number of issues. Some were related to still existing tracing errors or to incorrect starting or ending points of lines. We further investigated these with the OSM layer enabled. As these also gave the exact locations of (current) railway stations, we could often correct such errors by splitting drawn lines and then merging the split parts with the next section. A next category of errors resulted from unclear track names in urban areas. In particular railway yards and intra-urban

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[10] http://www.ferrovieabbandonate.it/index.php last accessed, August 2016; we are grateful to all people that have participated in creating this website.

linkages between railway stations were often unclear in the *Ministero* source. As these play hardly any role in the analysis of interurban connectivity, we decided to leave most of these issues, as the costs of adding them or correcting errors would not outweigh the benefits for the analysis.

A fundamental issue that came to light was that in the *Ministero* source the to-from labelling was linked to the railway stations of departure and arrival of the trains that used such tracks. The length of new trunks as reported followed this. Often, however, newly built tracks split from or rejoined already existing tracks at some distance from these stations. We decided to follow the *Ministero* source to the letter and digitize from station to station. It is clear that this may sometimes result in double counting of those parts of the track that were now in shared use. However, this double counting will also be present in the original source.

After error correction the differences between all trunks in our geodatabase and the original data in the *Ministero* database were, as we will document, marginal. The final average difference in length between the shape-length in our geodatabase and the length as given in the source was –50.8 meters (N = 843 lines).

After drawing and error correction was finished, a correct topology was added in ArcGIS. This means that all lines that link to each other in reality also do so in the digitized network. This will allow using network tools such as routing, accessibility, closest facility analysis, and the creation of origin-destination cost matrices.

Figure 1 illustrates the maps of the railway network in selected years (1851, 1871, 1891, 1911). Of course, equivalent maps can be easily produced for each year between 1839 and 1913. These kinds of maps are not unusual in the literature, especially for the post-unification period. See, for instance, the chapter devoted to railways in Fenoaltea (2011), and the online supplementary material of Ciccarelli and Nuvolari (2015). For this reason we move on to illustrate the subsequent step in obtaining annual provincial estimates of the railway extension.

3.2. *From Digitized Maps to Provincial Estimates of Railway Extension*

The paper focuses on providing reliable estimates of the length of tracks by year and by province (at 1913 borders).

1851   1871

1891   1911
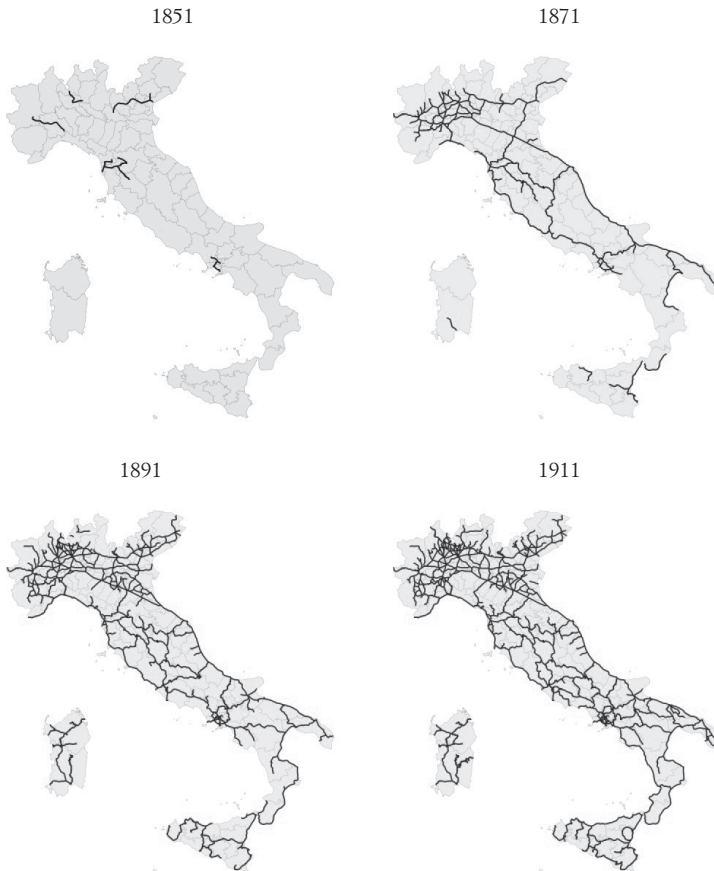
FIGURE 1. Maps of railway extension, selected years.

Source: See text.

In order to arrive at the annual provincial estimates, we applied the «tabulate intersection» tool in ArcGIS. This tool aggregates the length of those parts of our railway lines that are present in each *zone* of a polygon feature (in our case a province). To do so we needed a polygon feature representing the 1913 areas of Italian provinces. The Italian National Institute of Statistics (ISTAT) provides digital maps (ArcGIS shapefile format) of Italian Provinces on the SISTAT section of its website.[11] These are available for several years starting

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[11] http://sistat.istat.it, last accessed August 2016. SISTAT, created in 2011, stands for *Sistema Informativo Storico delle Amministrazioni Territoriali* (Historical Informative System on Territorial Administrative Units).

in 1861. We used the 1881-shapefile in that of the available ones it best represents the borders of the Italian provinces in 1913, and uses the post-Unification names for the Italian provinces, in contrast to the 1871 version which indicates the Southern provinces with the old pre-unification name so that, for example, the province of *Chieti* is reported as *Abruzzo Citeriore*, and the province of *Salerno* as *Principato Citeriore*. We manually changed any international and provincial borders that were not correct according to the 1913 borders. The later provinces of Alto Adige, Gorizia, and Trieste were included in the 1881 shapefile, but labelled as *Territori Stati Esteri.* They could easily be removed. More complicated was that the borders of Udine and Cuneo did not reflect partial territorial border changes with, respectively, Austria-Hungary and France. We manually edited these international borders. We also noticed that a small number of provincial border changes that had occurred between 1868 and 1880 and should have been incorporated in the ISTAT shapefile in fact were not. We corrected these manually. The only corrected area that involved railways was the move of the Presenzano area from Campobasso to Caserta (12 kilometers of railway). An example of a provincial border change that did not involve railway lines is the one that occurred between Pavia and Alessandria in 1877.[12] Finally, we had to correct a large part of the coastline that turned out to have been digitized on a higher spatial scale than our railway lines. Again, the Open Street Map layer provided the spatial information to do so.

For the sake of illustration of the proposed estimates, Figure 2 shows the territorial distribution of the of the railway network in Italian provinces in 1913, subdivided in standard gauge and narrow gauge. The annual estimates of railway endowment in Italy's provinces at 1913 borders for the years 1839-1913 (see Appendices A1-A2) were systematically compared with those reported in historical sources and the more recent literature, as documented in the next section.

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[12] In 1877 the municipality of Isola Sant'Antonio, formerly belonging to the province of Pavia, was absorbed by the province of Alessandria. According to the population census of 1881, the present population of Isola Sant'Antonio amounted to 1,375 inhabitants while the present population of the province of Alessandria amounted to 729,710 inhabitants. See Ciccarelli and Groote (2016) for an exhaustive list of the changes in provincial borders that occurred during 1866-1884. In any case, the few cases of changing provincial borders are mostly of reduced importance.

——— Narrow gauge   ——— Standard gauge

FIGURE 2. The Italian railway network in 1913.

Source: See text.

3.3. *Comparisons with Existing Estimates*

This section documents the result of a comparison between the provincial figures reported in Appendices A1-A2 and two alternative sets of data. The first refers to the railways extension in Italian provinces level (NUTS 3 level) for the years 1861, 1886 and 1909. The second set of data refers instead to the extension of the railways in Italian regions (NUTS 2 level) for the years 1861-1913.[13]

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[13] Data on the railways extension are of course abundant in the historical sources (as documented, for instance, in Fenoaltea, 2015, pp. 67-81, and Ferrovie

The source Ferrovie dello Stato (1911), which contains the eleven maps considered in a previous section, also reports estimates of the railway extension at the provincial level for the years 1861, 1886 and 1909, and could thus be used to double check our estimates. Figure 3 refers to the differences in kilometers between the provincial estimates for 1861, 1886, and 1909 reported for in Ferrovie dello Stato (1911) and those (for the same years) reported in Appendices A1-A2 of this paper.

Figure 3, Panel A shows the distribution of the 207 observations we are considering (69 provinces, 3 observations each, corresponding to the benchmark years 1861, 1886 ad 1909). Differences are centered around zero and the bulk of distribution is within a difference of about 10 kms. Figure 3 Panel B illustrates the magnitude of the same 207 observations. The observations on the x-axis follow a North to South gradient. The first 12 observations refer, for instance, to the difference in kilometers between the two alternative set of estimates (Ferrovie dello Stato, 1911, and Appendices A1-A2 of this paper) for the four provinces forming the Piedmont region.[14] In particular, observations 1-3 refer to the province of Alessandria in the years 1861, 1886, 1909; observations 4-6 refers to the province of Cuneo, and so on and so forth up to the last six observations referring to the provinces of Cagliari and Sassari (forming the region of Sardinia). With very few exceptions, the differences are within a narrow [–10 kms; 10 kms] interval, supporting the reliability of the figures reported in Appendices A1-A2.

We also compared our estimates against the regional estimates for the years 1861-1913 reported in Tables B.009 of Ciccarelli and Fenoaltea (2009). Figure 4 presents a summary of the comparison by means of 16 box plots, one for each region. The y axis reports the difference (measured in kilometers) between the two set of estimates.[15] The regions

dello Stato, 1996). However, the data are rarely grouped at the regional or provincial level, which often constitutes the spatial scale used in empirical analysis.

[14] The 69 provinces are grouped into 16 regions in the Appendices A1-A2.

[15] Box plots are well known statistical tools. They are constructed by drawing a box between the 75th and 25th percentile (corresponding of course to the third and first quartile, usually denoted with Q3 and Q1) of the distribution. The solid line drawn across the box denotes the 50th percentile (corresponding to the median) and represents a measure of the location of the distribution. The difference Q3-Q1 is called the interquartile range and represents a measure of dispersion. Outliers, that is extreme values far away in the tail of the distribution, are represented by means of dots.

A) Histogram of the differences (kms)

B) Geographically ordered differences (kms)

69 provinces, 3 observations each
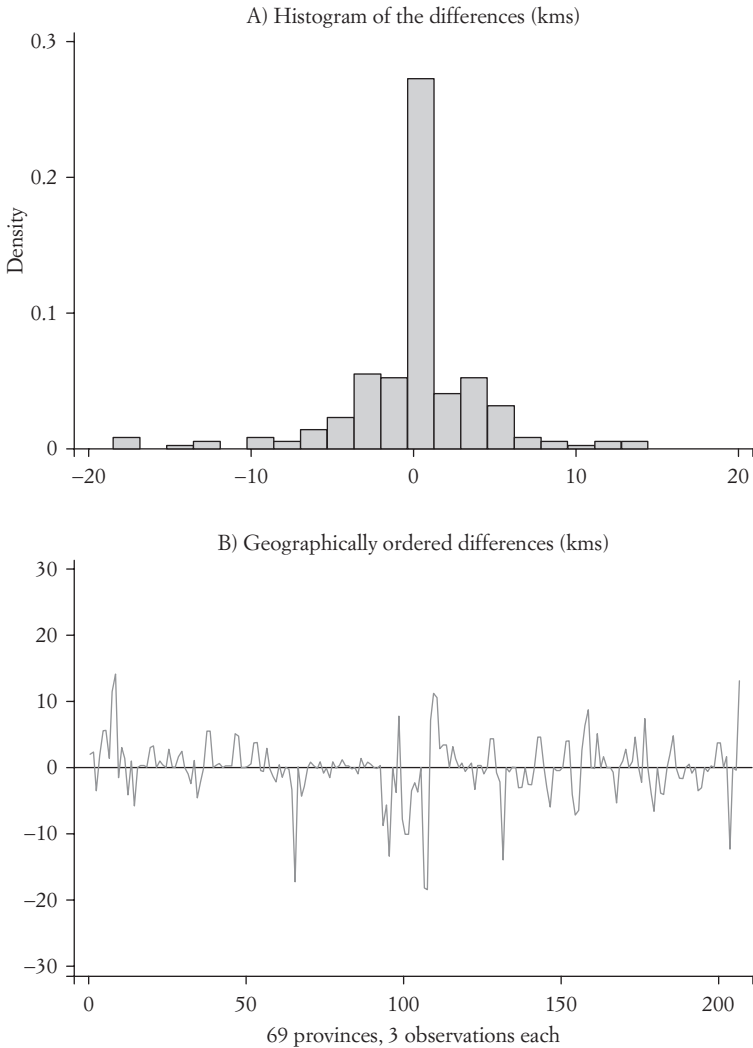
FIGURE 3. Railway extension (kms) in Italian provinces in 1861, 1886, and 1909: a comparison of the data reported in Ferrovie dello Stato (1911) and in the Appendices A1-A2 to this paper.

Source: See text.

are ordered with a North-South gradient. The regions of the North-West (Piedmont, Liguria and Lombardy) are followed by those of the Center/North-East (Venetia, Emilia, Tuscany, Marche, Umbria, and Latium), and then Southern regions
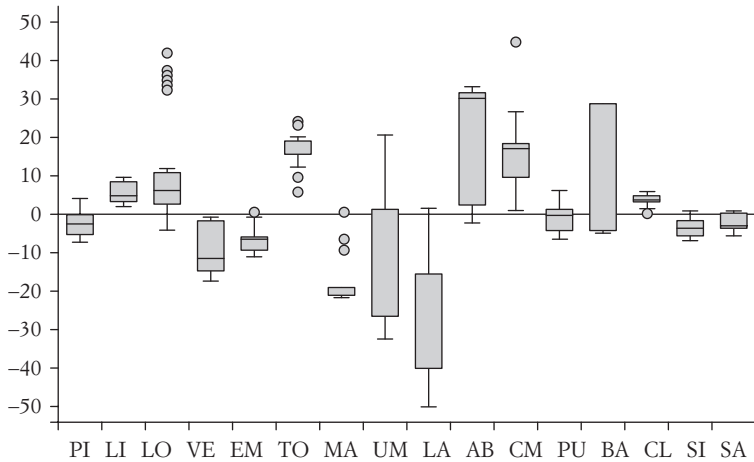
FIGURE 4. Railway extension (kms) in Italian regions 1861-1913: a comparison of the data reported in Ciccarelli and Fenoaltea (2009) and in the Appendices A1-A2 to this paper.

PI = Piedmont; LI = Liguria; LO = Lombardy; VE = Venetia; EM = Emilia, TO = Tuscany, MA = Marche; UM = Umbria; LA = Latium; AB = Abruzzi; CM = Campania; PU = Apulia; BA = Basilicata; CL = Calabria; SI = Sicily; SA = Sardinia.

Source: The figure illustrates the differences between the regional estimates reported in Ciccarelli and Fenoaltea (2009), Table B.009 and those obtained by regional aggregation of the provincial figures reported in Appendices A1-A2.

(Abruzzi, Campania, Apulia, Basilicata, Calabria, Sicily, and Sardinia). The first boxplot refers to the 53 annual observations (from 1861 to 1913) concerning the region of Piedmont. The resulting differences are small. Differences are also small for the regions of Liguria, Venetia, Emilia, Apulia, Calabria, Sicily, and Sardinia. There are other regions, however, such as for instance Latium, for which the box plot reveals larger differences, up to 50 kilometers.

To put things in a proper perspective, Figure 5 focuses on the two regions of Piedmont and Latium, representing in a sense two extreme cases. No difference between our new series and the one from Ciccarelli and Fenoaltea (2009) is visible for the case of Piedmont (Figure 5, Panel A). The two time series referring to the Latium region, however, are not exactly coincident, even though the differences seem not particularly pronounced (Figure 5, Panel B).

After all, it is not surprising that the differences between the two set of data are relatively small, given that both the
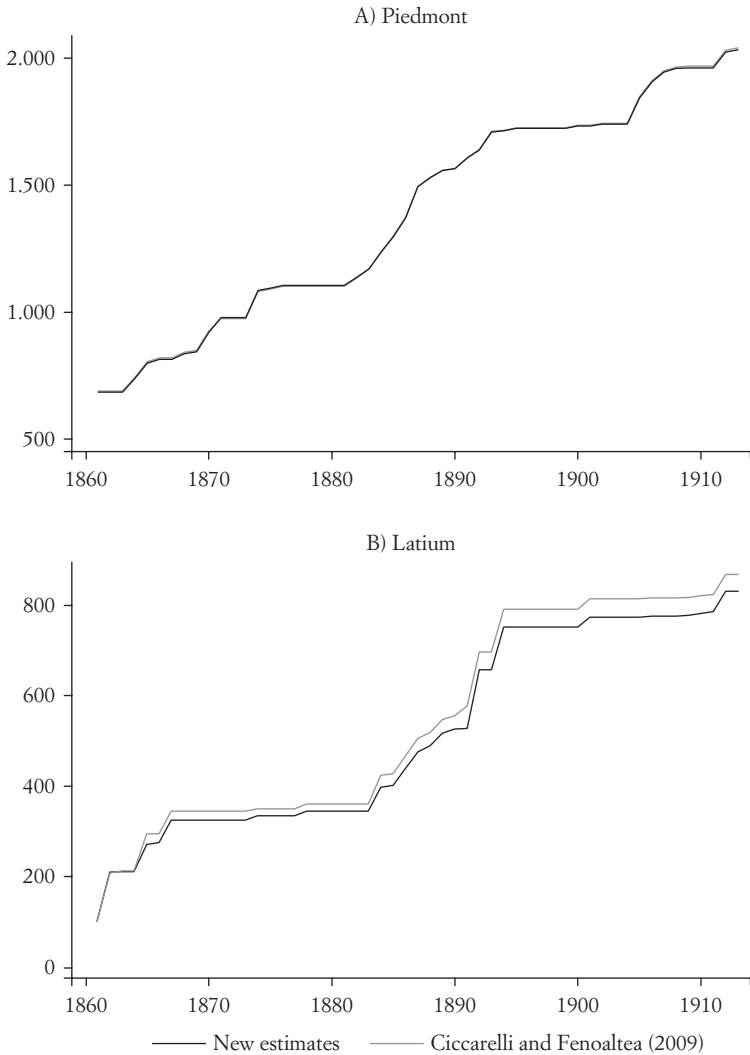
FIGURE 5. Comparison of regional estimates of railways extension: selected regions, 1861-1913 (kms).

Source: Ciccarelli and Fenoaltea (2009), Table B.009, and regional estimates («new estimates») obtained by aggregation of the provincial figures reported in Appendices A1-A2.

data by Ciccarelli and Fenoaltea (2009) and those reported in Appendices A1-A2 to this paper are largely based on the source *Ministero*. Effectively, when trunks belong entirely to a given province, the allocation to provinces of

the data (on the length of the various lines) reported in
Ministero is tedious yet trivial. If instead a line crosses the
border of one or more provinces, then it is necessary to
split or allocate the kilometers of railway line to the various
provinces. To obtain annual estimates of railway extension
at the regional level, Ciccarelli and Fenoaltea (2009)
followed an ad hoc, although fully documented, splitting
procedure.[16] In this paper, as detailed before in this section,
we followed a more systematic approach based on GIS
technologies.[17]

4. *The Provincial Estimates of Railway Extension, 1839-1913*

Figure 6 presents national trends implicit in the new
provincial estimates. These are well known, especially for
the post-unification period. Panel A shows that the national
network developed rather rapidly during the periods 1839-
1865 and 1880-1895, and at a slower pace in the years
surrounding the turn of the century. It reached an extension
of about 18 thousands kms in the pre WWI years. Panel B
shows more explicitly the local maxima of the mid-1860s
and mid-1880s, when more than 600 kms of new lines were
opened.
To account for the different size of the provincial
territory, Figure 7 illustrates the temporal evolution of the
railway density, by macro-areas and for the whole country.
The density is clearly higher than the national average for
the provinces of the North-West and lower for Southern
ones. However, the average density of the Center/North-
East and the South is essentially the same at the end of the
sample period.
Figure 8, Panel A, illustrates the percentage of provinces
with at least one operating line. The first lines were opened
in 1839 and 1840 in, respectively, the provinces of Naples
and Milan. At the time of the political unification of the
country (1861) one province out of two had at least one
railway line operating in its territory, and already in the

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[16] Ciccarelli and Fenoaltea (2009), pp. 124-126.
[17] As a further term of comparison we also considered the provincial estimates
for the year 1915 reported in Collegio degli Ingegneri Ferroviari Italiani (1916),
and the national estimates of the railway extension presented in ISTAT (1958, pp.
136-137). The results of these comparisons are not reported for reason of space,
but are available on request.

A) Railways extension (thousand kms)

B) kms of lines opened
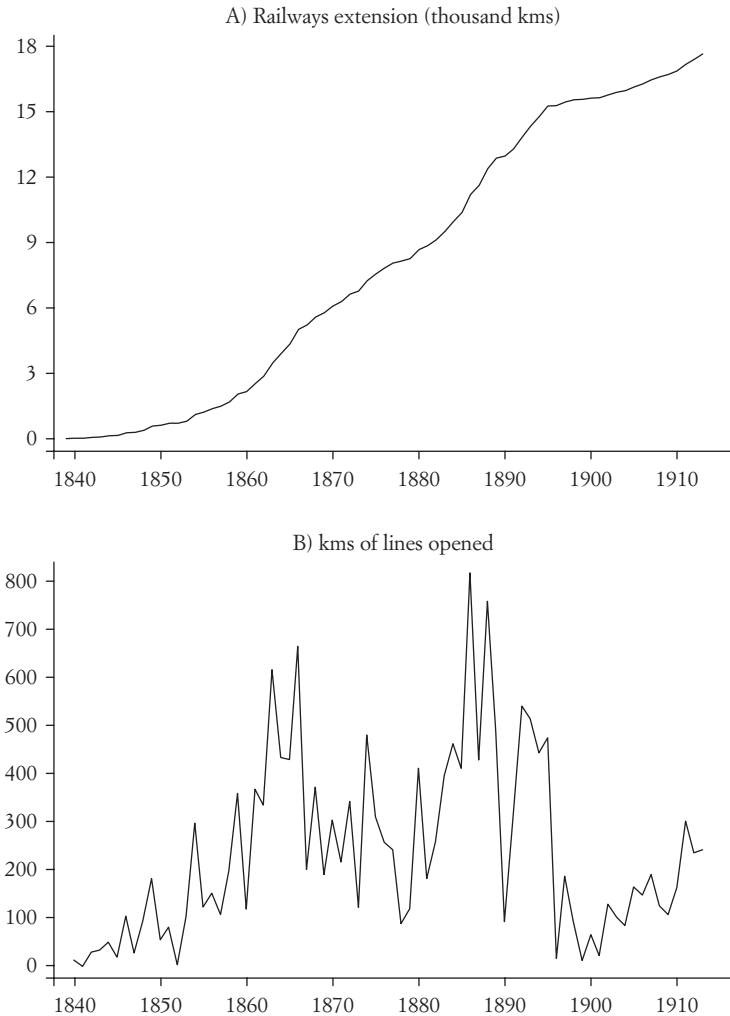
FIGURE 6. The spread of railway in Italy, 1839-1913.

Source: Authors' elaborations on the data reported in Appendices A1-A2.

early 1870s railways reached more than 90 percent of the Italian provinces. Railways eventually reached the provinces of Cagliari in 1871, Porto Maurizio and Sassari in 1872, L'Aquila in 1873, Catanzaro and Girgenti in 1874, Trapani in 1880, Sondrio in 1885, and Belluno in 1886. Figure 8, Panel B illustrates the geographical distribution of the year of first opening of railways, by selected sub-periods (1839-1847, 1848-
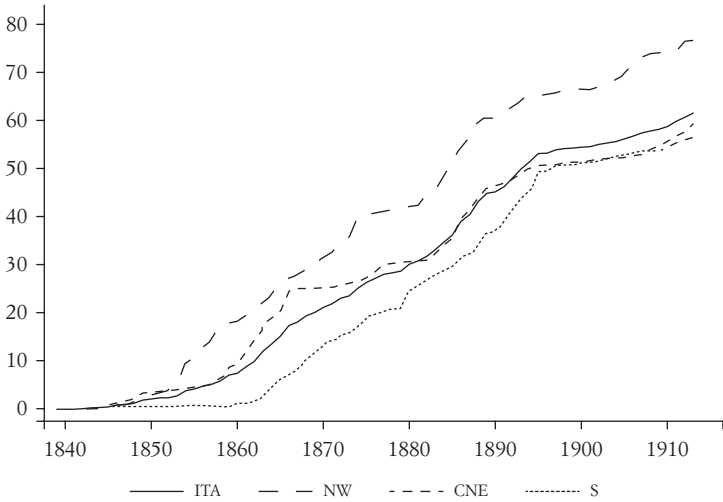
FIGURE 7. Density of the railway network, by macro-area 1839-1913 (kms of rail per 1,000 squared kms of territory).

ITA = Italy; NW = North-West, CNE = Center/North-East; S = South.

Source: Authors' elaborations on the data reported in Appendices A1-A2.

1856, 1857-1865, 1866-1874, and 1875-1886). Dark colors refer to provinces with early opening of railway lines (such as Naples and Milan), while light colors refer to provinces (such as Sondrio and Belluno in the extreme north of Lombardy and Venetia) where railways started to operate later.

Figure 9 illustrates the temporal evolution of railway density in the full set of 69 Italian provinces during the period 1839-1913. For the sake of exposition, the provincial data are grouped into 16 regional frames, ordered with a North to South gradient. Cleary, railway development followed a typical step function with jumps occurring at the time of opening of new lines. The size of the jumps is in turn proportional to the length (km) of the new lines. The regions of Umbria, Latium and Basilicata, including just one province each, highlight these patterns clearly. In Umbria, the opening of new lines was concentrated in the early-1860s to late-1880s. In Basilicata, it was concentrated in the late-1860s to the early-1890s. It was instead more continuous in the region of Latium, with new lines opened since the late 1850s to the end of our investigation period. At the eve of WWI, railway density is typically higher in Northern regions, especially those of the North-West

A) Percentage of provinces with railway lines
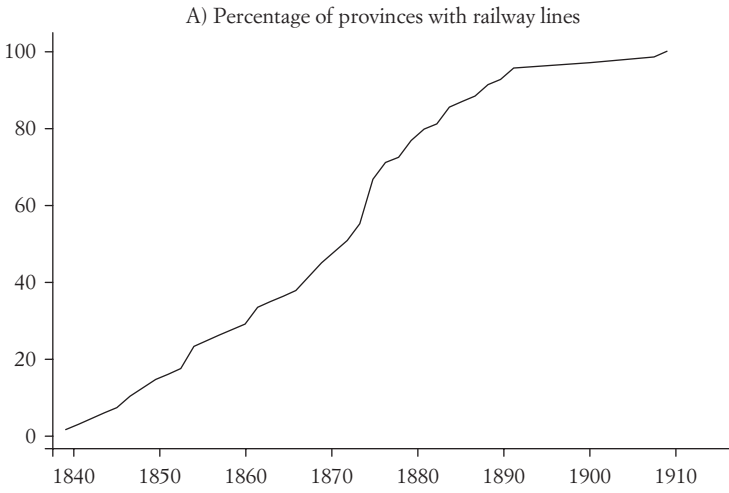
B) First arrival of railways, by period

■ 1839-1847	■ 1848-1856	■ 1857-1865
■ 1866-1874	■ 1875-1886	

FIGURE 8. The spread of railways in Italian provinces, 1839-1886.

Source: Authors' elaborations on the data reported in Appendices A1-A2.
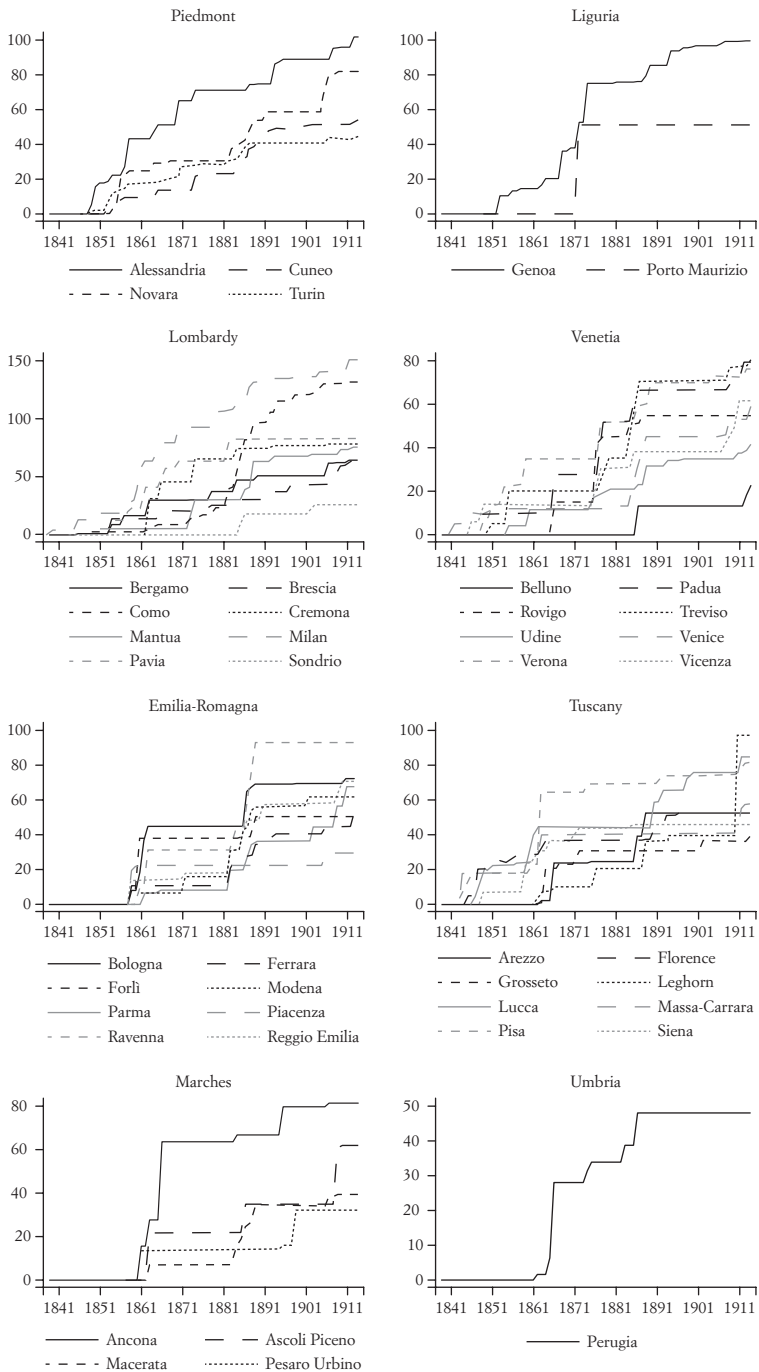
FIGURE 9. The density of railways in Italian provinces, 1839-1913 (kms of rail per 1,000 squared kms of territory).

Source: Authors' elaborations on data reported in Appendices A1-A2.

Latium

Rome

Abruzzi

Aquila · Campobasso
Chieti · Teramo

Campania

Avellino · Benevento
Caserta · Naples
Salerno

Apulia

Bari · Foggia
Lecce

Basilicata

Potenza

Calabria

Catanzaro · Cosenza
Reggio Calabria

Sicily

Caltanissetta · Catania
Girgenti · Messina
Palermo · Syracuse
Trapani

Sardinia

Cagliari · Sassari
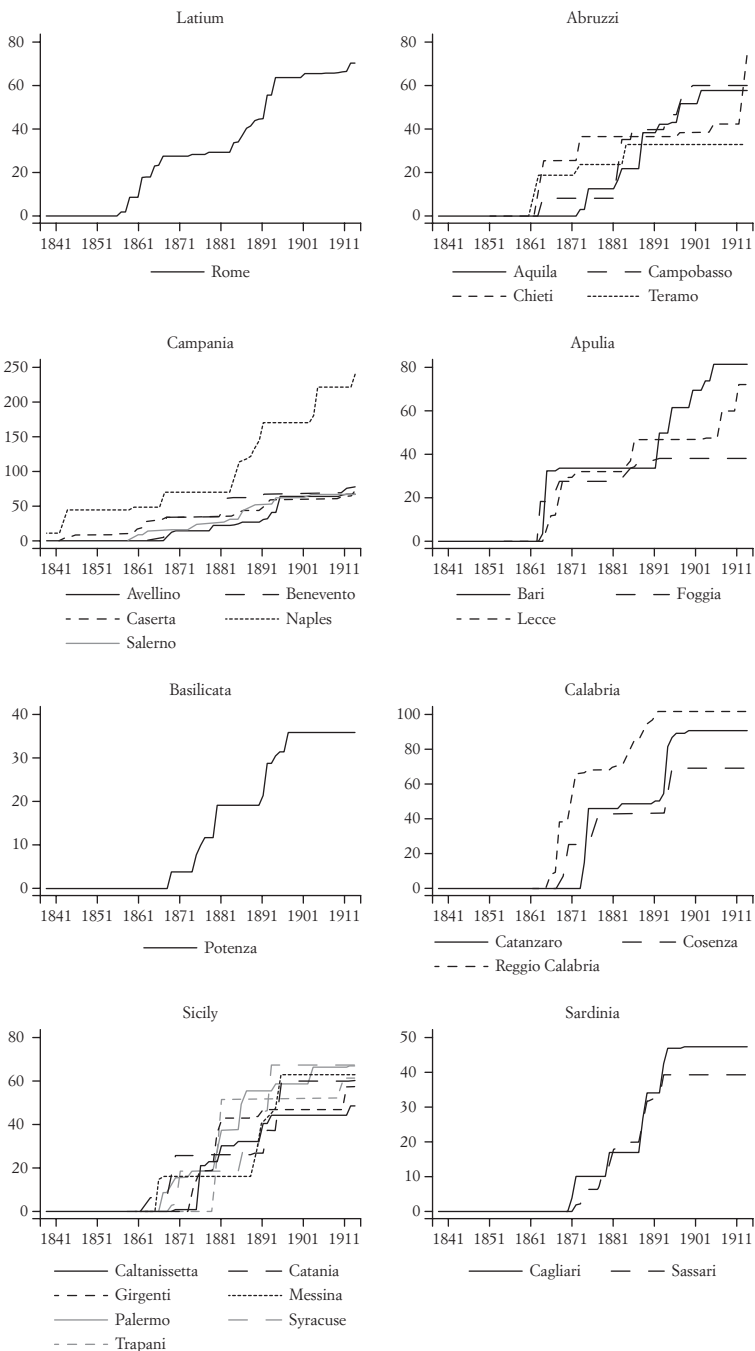
FIGURE 9. (continues)

TABLE 1. *Average regional density of railway, selected years 1841-1911 (kms of rail per 1,000 squared kms of territory)*[a]

	1841	1851	1861	1871	1881	1891	1901	1911
PI	0.00	5.41	25.52	36.45	41.03	57.87	63.26	72.00
LI	0.00	0.00	7.11	18.56	62.00	66.73	72.23	73.50
LO	0.51	3.64	15.35	32.96	44.23	69.46	74.88	84.53
VE	0.00	7.50	14.04	18.52	34.23	53.71	54.16	61.94
EM	0.00	0.00	15.19	22.20	23.88	53.21	54.11	62.11
TO	0.00	10.64	17.38	35.04	38.55	46.88	51.59	62.63
MA	0.00	0.00	7.71	27.61	27.61	38.86	46.86	55.51
UM	0.00	0.00	0.00	27.36	33.15	46.96	46.96	46.96
LA	0.00	0.00	8.37	26.86	28.57	43.70	64.08	65.02
AB	0.00	0.00	0.00	12.89	19.95	36.30	45.15	47.36
CM	1.96	10.51	15.26	33.28	37.81	72.48	83.43	97.48
PU	0.00	0.00	0.00	31.42	32.32	41.08	53.50	66.33
BA	0.00	0.00	0.00	3.71	18.70	20.93	35.09	35.09
CL	0.00	0.00	0.00	17.10	33.44	40.84	54.72	54.78
SI	0.00	0.00	0.00	10.88	31.59	42.84	55.52	59.51
SA	0.00	0.00	0.00	1.87	16.98	32.62	42.35	42.35

[a] The standard deviations are not reported for reason of space. PI = Piedmont; LI = Liguria; LO = Lombardy; VE = Venetia; EM = Emilia, TO = Tuscany; MA = Marche; UM = Umbria; LA = Latium; AB = Abruzzi; CM = Campania; PU = Apulia; BA = Basilicata; CL = Calabria; SI = Sicily; SA = Sardinia.

Source: Regional averages of the provincial figures reported in Appendices A1-A2.

(Piedmont, Liguria, and Lombardy). One notes further that a great amount of within regions heterogeneity is present, and that the national leader is the southern region of Campania, with the province of Naples (with a density well above 200 kms, per 1,000 squared kms of provincial territory) representing a clear outlier.

Table 1 complements the information illustrated in Figure 9 by reporting the regional average of railway density in selected decennial benchmark years.

In 1861, at the time of the country's unification, there was no national network, and Piedmont was the national leader in terms of density, while, with the noticeable exception of Campania, Southern regions were characterized by a complete lack of railways, suggesting probably the predominance of alternative multimodal transport systems based on roads and sea transport.[18] It is also interesting to

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[18] We are aware of no complete historical georeferenced database of the Italian transport system (including items such as roads, railways and related train and postal stations, sea transport and related ports and harbors, waterways, steamboat navigable rivers, and canals).

note that after the turn of the century there was essentially little or no expansion of railways in many regions including Liguria in the North, Latium and Umbria in the Center, and Basilicata, Calabria, Sardinia in the South.

5. *Conclusions*

The new railway estimates presented in this paper further enrich the set of quantitative information available to researchers interested in the economic analysis of the early regional growth and development in Italy. In accord with the growing quantitative literature making of provinces the spatial scale of analysis, the present article proposes annual estimates of railway endowment during 1839-1913 at the provincial level. However, the availability of a fully georeferenced database of railway extension will allow scholars to investigate a wide set of research questions that do not necessarily refer to a given spatial scale. Ongoing research is, for instance, investigating the impact of gaining access to rail transportation on changes in population densities and rate of urbanization in 19th century Italy.

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Appendices

APPENDIX A1. *Railway extension in Italian provinces (kms), 1839-1876*

| | Piedmont | | | | | Liguria | |
	Alessandria	Cuneo	Novara	Turin		Genoa	Porto Maurizio
1839	0.0	0.0	0.0	0.0		0.0	0.0
1840	0.0	0.0	0.0	0.0		0.0	0.0
1841	0.0	0.0	0.0	0.0		0.0	0.0
1842	0.0	0.0	0.0	0.0		0.0	0.0
1843	0.0	0.0	0.0	0.0		0.0	0.0
1844	0.0	0.0	0.0	0.0		0.0	0.0
1845	0.0	0.0	0.0	0.0		0.0	0.0
1846	0.0	0.0	0.0	0.0		0.0	0.0
1847	0.0	0.0	0.0	0.0		0.0	0.0
1848	0.0	0.0	0.0	16.1		0.0	0.0
1849	28.4	0.0	0.0	29.7		0.0	0.0
1850	83.8	0.0	0.0	29.7		0.0	0.0
1851	95.4	0.0	0.0	29.7		0.0	0.0
1852	95.4	0.0	0.0	29.7		0.0	0.0
1853	100.0	31.5	0.0	48.6		41.7	0.0
1854	119.0	51.1	18.9	133.8		41.7	0.0
1855	119.0	67.6	54.2	133.8		41.7	0.0
1856	119.0	67.6	145.6	165.6		52.7	0.0
1857	145.4	81.1	160.3	165.6		52.7	0.0
1858	230.9	81.1	174.4	197.6		58.3	0.0
1859	230.9	81.1	175.3	197.6		58.3	0.0
1860	230.9	81.1	175.3	197.6		58.3	0.0
1861	230.9	81.1	175.3	197.6		58.3	0.0
1862	230.9	81.1	175.3	197.6		58.3	0.0
1863	230.9	81.1	175.3	197.6		66.4	0.0
1864	252.3	81.1	207.4	197.6		81.1	0.0
1865	273.8	114.1	207.5	204.5		81.1	0.0
1866	273.8	114.1	207.5	219.6		81.1	0.0
1867	273.8	114.1	207.5	219.6		81.1	0.0
1868	273.8	114.1	216.0	232.4		144.7	0.0
1869	273.8	114.1	216.0	240.0		144.7	0.0
1870	348.2	114.1	216.3	240.0		152.1	0.0
1871	348.2	114.1	216.3	299.8		152.1	0.0
1872	348.2	114.1	216.3	299.8		210.6	58.9
1873	348.2	114.1	216.3	299.8		210.6	58.9
1874	380.6	179.6	216.3	308.2		300.5	58.9
1875	380.6	188.9	216.3	308.2		300.5	58.9
1876	380.6	188.9	216.3	319.1		300.5	58.9

APPENDIX A1. *(continues)*

	Lombardy							
	Bergamo	Brescia	Como	Cremona	Mantua	Milan	Pavia	Sondrio
1839	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1840	0.0	0.0	0.0	0.0	0.0	12.8	0.0	0.0
1841	0.0	0.0	0.0	0.0	0.0	12.8	0.0	0.0
1842	0.0	0.0	0.0	0.0	0.0	12.8	0.0	0.0
1843	0.0	0.0	0.0	0.0	0.0	12.8	0.0	0.0
1844	0.0	0.0	0.0	0.0	0.0	12.8	0.0	0.0
1845	0.0	0.0	0.0	0.0	0.0	12.8	0.0	0.0
1846	3.2	0.0	0.0	0.0	0.0	41.2	0.0	0.0
1847	3.2	0.0	0.0	0.0	0.0	41.2	0.0	0.0
1848	3.2	0.0	0.0	0.0	0.0	41.2	0.0	0.0
1849	3.2	0.0	11.0	0.0	0.0	59.6	0.0	0.0
1850	3.2	0.0	11.0	0.0	0.0	59.6	0.0	0.0
1851	3.2	0.0	11.0	0.0	12.3	59.6	0.0	0.0
1852	3.2	0.0	11.0	0.0	12.3	59.6	0.0	0.0
1853	3.2	0.0	11.0	0.0	12.3	59.6	0.0	0.0
1854	24.3	65.7	11.0	0.0	12.3	59.6	41.5	0.0
1855	24.3	65.7	11.0	0.0	12.3	59.6	41.5	0.0
1856	24.3	65.7	11.0	0.0	12.3	59.6	41.5	0.0
1857	45.9	65.7	11.0	0.0	12.3	59.6	41.5	0.0
1858	45.9	65.7	11.0	0.0	12.3	87.3	70.6	0.0
1859	45.9	65.7	11.0	0.0	12.3	93.6	79.7	0.0
1860	45.9	65.7	11.0	0.0	12.3	119.8	79.7	0.0
1861	45.9	65.7	11.0	0.0	12.3	187.0	79.7	0.0
1862	45.9	65.7	11.0	0.0	12.3	202.3	135.5	0.0
1863	82.4	65.7	16.1	55.3	12.3	202.3	135.5	0.0
1864	82.4	65.7	16.1	55.3	12.3	202.3	135.5	0.0
1865	82.4	65.7	25.1	55.3	12.3	229.1	135.5	0.0
1866	82.4	98.1	25.1	80.6	12.3	247.0	166.9	0.0
1867	82.4	98.1	25.1	80.6	12.3	247.0	192.1	0.0
1868	82.4	98.1	25.1	80.6	12.3	247.0	192.1	0.0
1869	82.4	98.1	25.1	80.6	12.3	247.0	192.1	0.0
1870	82.4	98.1	25.1	80.6	12.3	281.9	212.7	0.0
1871	82.4	98.1	25.1	80.6	12.3	281.9	212.7	0.0
1872	82.4	98.1	25.1	80.6	12.9	281.9	212.7	0.0
1873	83.2	98.1	40.8	80.6	40.3	294.6	212.7	0.0
1874	83.2	98.1	40.8	115.5	69.8	294.6	212.7	0.0
1875	83.2	98.1	45.9	115.5	69.8	294.6	212.7	0.0
1876	83.2	108.5	49.8	115.5	69.8	294.6	212.7	0.0

APPENDIX A1. *(continues)*

	Venetia							
	Belluno	Padua	Rovigo	Treviso	Udine	Venice	Verona	Vicenza
1839	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1840	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1841	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1842	0.0	12.0	0.0	0.0	0.0	17.0	0.0	0.0
1843	0.0	12.0	0.0	0.0	0.0	17.0	0.0	0.0
1844	0.0	12.0	0.0	0.0	0.0	17.0	0.0	0.0
1845	0.0	12.0	0.0	0.0	0.0	17.0	0.0	0.0
1846	0.0	24.1	0.0	0.0	0.0	25.1	0.0	18.3
1847	0.0	24.1	0.0	0.0	0.0	25.1	0.0	18.3
1848	0.0	24.1	0.0	0.0	0.0	25.1	0.0	18.3
1849	0.0	24.1	0.0	0.0	0.0	25.1	26.0	40.0
1850	0.0	24.1	0.0	0.0	0.0	25.1	26.0	40.0
1851	0.0	24.1	0.0	14.1	0.0	32.2	46.4	40.0
1852	0.0	24.1	0.0	14.1	0.0	32.2	50.0	40.0
1853	0.0	24.1	0.0	14.1	0.0	32.2	50.0	40.0
1854	0.0	24.1	0.0	14.1	0.0	32.2	77.0	40.0
1855	0.0	24.1	0.0	54.9	30.7	32.2	77.0	40.0
1856	0.0	24.1	0.0	54.9	30.7	32.2	77.0	40.0
1857	0.0	24.1	0.0	54.9	30.7	32.2	77.0	40.0
1858	0.0	24.1	0.0	54.9	30.7	32.2	77.0	40.0
1859	0.0	24.1	0.0	54.9	30.7	32.2	117.4	40.0
1860	0.0	24.1	0.0	54.9	83.7	32.2	117.4	40.0
1861	0.0	24.1	0.0	54.9	83.7	32.2	117.4	40.0
1862	0.0	24.1	0.0	54.9	83.7	32.2	117.4	40.0
1863	0.0	24.1	0.0	54.9	83.7	32.2	117.4	40.0
1864	0.0	24.1	0.0	54.9	83.7	32.2	117.4	40.0
1865	0.0	24.1	0.0	54.9	83.7	32.2	117.4	40.0
1866	0.0	65.2	29.5	54.9	83.7	32.2	117.4	40.0
1867	0.0	65.2	29.5	54.9	83.7	32.2	117.4	40.0
1868	0.0	65.2	29.5	54.9	83.7	32.2	117.4	40.0
1869	0.0	65.2	29.5	54.9	83.7	32.2	117.4	40.0
1870	0.0	65.2	29.5	54.9	83.7	32.2	117.4	40.0
1871	0.0	65.2	29.5	54.9	83.7	32.2	117.4	40.0
1872	0.0	65.2	29.5	54.9	83.7	32.2	117.4	40.0
1873	0.0	65.2	29.5	54.9	83.7	32.2	117.4	40.0
1874	0.0	65.2	29.5	54.9	83.7	32.2	117.4	40.0
1875	0.0	65.2	29.5	54.9	111.6	32.2	117.4	40.0
1876	0.0	65.2	82.4	54.9	123.2	32.2	117.4	71.3

APPENDIX A1. *(continues)*

	Emilia							
	Bologna	Ferrara	Forlì	Modena	Parma	Piacenza	Ravenna	Reggio Emilia
1839	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1840	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1841	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1842	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1843	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1844	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1845	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1846	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1847	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1848	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1849	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1850	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1851	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1852	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1853	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1854	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1855	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1856	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1857	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1858	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1859	30.3	0.0	0.0	17.0	35.4	49.0	0.0	32.6
1860	30.3	0.0	0.0	17.0	35.4	54.9	0.0	32.6
1861	70.4	0.0	72.3	17.0	35.4	55.9	18.4	32.6
1862	140.0	18.5	72.3	17.0	35.4	55.9	18.4	32.6
1863	170.7	18.5	72.3	17.0	35.4	55.9	58.8	32.6
1864	170.7	18.5	72.3	17.0	35.4	55.9	58.8	32.6
1865	170.7	18.5	72.3	17.0	35.4	55.9	58.8	32.6
1866	170.7	19.7	72.3	17.0	35.4	55.9	58.8	32.6
1867	170.7	19.7	72.3	17.0	35.4	55.9	58.8	32.6
1868	170.7	19.7	72.3	17.0	35.4	55.9	58.8	32.6
1869	170.7	19.7	72.3	17.0	35.4	55.9	58.8	32.6
1870	170.7	19.7	72.3	17.0	35.4	55.9	58.8	32.6
1871	170.7	19.7	72.3	17.0	35.4	55.9	58.8	32.6
1872	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1873	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1874	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1875	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1876	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5

APPENDIX A1. *(continues)*

	Tuscany							
	Arezzo	Florence	Grosseto	Leghorn	Lucca	Massa Carrara	Pisa	Siena
1839	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1840	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1841	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1842	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1843	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1844	0.0	0.0	0.0	6.1	0.0	0.0	14.2	0.0
1845	0.0	0.0	0.0	6.1	0.0	0.0	33.6	0.0
1846	0.0	0.0	0.0	6.1	7.2	0.0	48.0	0.0
1847	0.0	21.5	0.0	6.1	7.2	0.0	54.3	0.0
1848	0.0	77.3	0.0	6.1	29.6	0.0	54.3	0.0
1849	0.0	114.3	0.0	6.1	29.6	0.0	54.3	26.5
1850	0.0	114.3	0.0	6.1	29.6	0.0	54.3	26.5
1851	0.0	130.2	0.0	6.1	29.6	0.0	54.3	26.5
1852	0.0	130.2	0.0	6.1	29.6	0.0	54.3	26.5
1853	0.0	130.2	0.0	6.1	36.2	0.0	54.3	26.5
1854	0.0	130.2	0.0	6.1	36.2	0.0	54.3	26.5
1855	0.0	130.2	0.0	6.1	36.2	0.0	54.3	26.5
1856	0.0	130.2	0.0	6.1	37.8	0.0	54.3	26.5
1857	0.0	138.0	0.0	6.1	40.6	0.0	54.3	26.5
1858	0.0	138.0	0.0	9.7	40.6	0.0	54.3	26.5
1859	0.0	139.8	0.0	9.7	40.6	0.0	54.3	82.8
1860	0.0	139.8	0.0	9.7	40.6	0.0	54.3	88.9
1861	0.0	139.8	0.0	9.7	56.9	0.0	70.1	94.8
1862	0.0	160.1	0.0	9.7	63.1	4.1	70.1	117.0
1863	7.2	189.7	4.3	13.7	63.1	13.6	195.6	117.0
1864	7.2	215.1	93.1	13.7	63.1	13.6	195.6	117.0
1865	7.2	215.1	93.1	13.7	63.1	13.6	195.6	137.7
1866	78.2	215.1	93.1	13.7	63.1	18.0	195.6	137.7
1867	78.2	215.1	103.7	13.7	63.1	18.0	195.6	137.7
1868	78.2	215.1	103.7	13.7	63.1	18.0	195.6	137.7
1869	78.2	215.1	103.7	13.7	63.1	18.0	195.6	137.7
1870	78.2	215.1	103.7	13.7	63.1	18.0	195.6	137.7
1871	78.2	215.1	103.7	13.7	63.1	18.0	195.6	150.4
1872	78.2	215.1	138.2	13.7	63.1	18.0	195.6	166.2
1873	78.2	215.1	138.2	13.7	63.1	18.0	195.6	166.2
1874	78.2	215.1	138.2	13.7	63.1	18.0	210.5	166.2
1875	80.9	215.1	138.2	13.7	63.1	18.0	210.5	166.8
1876	80.9	215.1	138.2	13.7	63.1	36.5	210.5	166.8

APPENDIX A1. *(continues)*

	Marche				Umbria	Latium
	Ancona	Ascoli	Macerata	Pesaro	Perugia	Rome
1839	0.0	0.0	0.0	0.0	0.0	0.0
1840	0.0	0.0	0.0	0.0	0.0	0.0
1841	0.0	0.0	0.0	0.0	0.0	0.0
1842	0.0	0.0	0.0	0.0	0.0	0.0
1843	0.0	0.0	0.0	0.0	0.0	0.0
1844	0.0	0.0	0.0	0.0	0.0	0.0
1845	0.0	0.0	0.0	0.0	0.0	0.0
1846	0.0	0.0	0.0	0.0	0.0	0.0
1847	0.0	0.0	0.0	0.0	0.0	0.0
1848	0.0	0.0	0.0	0.0	0.0	0.0
1849	0.0	0.0	0.0	0.0	0.0	0.0
1850	0.0	0.0	0.0	0.0	0.0	0.0
1851	0.0	0.0	0.0	0.0	0.0	0.0
1852	0.0	0.0	0.0	0.0	0.0	0.0
1853	0.0	0.0	0.0	0.0	0.0	0.0
1854	0.0	0.0	0.0	0.0	0.0	0.0
1855	0.0	0.0	0.0	0.0	0.0	0.0
1856	0.0	0.0	0.0	0.0	0.0	0.0
1857	0.0	0.0	0.0	0.0	0.0	20.9
1858	0.0	0.0	0.0	0.0	0.0	20.9
1859	0.0	0.0	0.0	0.0	0.0	101.1
1860	0.0	0.0	0.0	0.0	0.0	101.1
1861	31.3	0.0	0.0	42.5	0.0	101.1
1862	31.3	0.0	0.0	42.5	14.8	209.4
1863	55.4	46.6	20.9	42.5	14.8	210.9
1864	55.4	46.6	20.9	42.5	14.8	210.9
1865	55.4	46.6	20.9	42.5	60.3	271.0
1866	127.4	46.6	20.9	42.5	265.7	274.5
1867	127.4	46.6	20.9	42.5	265.7	324.5
1868	127.4	46.6	20.9	42.5	265.7	324.5
1869	127.4	46.6	20.9	42.5	265.7	324.5
1870	127.4	46.6	20.9	42.5	265.7	324.5
1871	127.4	46.6	20.9	42.5	265.7	324.5
1872	127.4	46.6	20.9	42.5	265.7	324.5
1873	127.4	46.6	20.9	42.5	265.7	324.5
1874	127.4	46.6	20.9	42.5	297.8	334.5
1875	127.4	46.6	20.9	42.5	321.9	334.5
1876	127.4	46.6	20.9	42.5	321.9	334.5

APPENDIX A1. *(continues)*

	Abruzzi				Campania				
	Aquila	Campo-basso	Chieti	Teramo	Avellino	Bene-vento	Caserta	Naples	Salerno
1839	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0
1840	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0
1841	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0
1842	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0
1843	0.0	0.0	0.0	0.0	0.0	0.0	21.9	21.0	0.0
1844	0.0	0.0	0.0	0.0	0.0	0.0	33.0	39.9	0.0
1845	0.0	0.0	0.0	0.0	0.0	0.0	33.0	39.9	0.0
1846	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1847	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1848	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1849	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1850	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1851	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1852	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1853	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1854	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1855	0.0	0.0	0.0	0.0	0.0	0.0	45.0	39.9	0.0
1856	0.0	0.0	0.0	0.0	0.0	0.0	55.7	39.9	5.3
1857	0.0	0.0	0.0	0.0	0.0	0.0	55.7	39.9	5.3
1858	0.0	0.0	0.0	0.0	0.0	0.0	55.7	39.9	5.3
1859	0.0	0.0	0.0	0.0	0.0	0.0	55.7	39.9	5.3
1860	0.0	0.0	0.0	0.0	0.0	0.0	55.7	44.5	28.1
1861	0.0	0.0	0.0	0.0	0.0	0.0	97.2	44.5	43.6
1862	0.0	0.0	0.0	0.0	0.0	0.0	97.2	44.5	43.6
1863	0.0	0.0	25.7	51.0	0.0	0.0	148.1	44.5	68.8
1864	0.0	35.4	73.7	51.0	0.0	0.0	148.1	44.5	68.8
1865	0.0	35.4	73.7	51.0	0.0	0.0	148.1	44.5	68.8
1866	0.0	35.4	73.7	51.0	0.0	0.0	148.1	44.5	74.7
1867	0.0	35.4	73.7	51.0	1.3	0.0	165.0	62.5	74.7
1868	0.0	35.4	73.7	51.0	18.9	71.5	179.5	62.5	74.7
1869	0.0	35.4	73.7	51.0	37.3	71.5	179.5	62.5	77.3
1870	0.0	35.4	73.7	51.0	43.0	71.5	179.5	62.5	77.3
1871	0.0	35.4	73.7	51.0	43.0	71.5	179.5	62.5	77.3
1872	0.0	35.4	73.7	51.0	43.0	71.5	179.5	62.5	77.3
1873	19.7	35.4	106.0	64.4	43.0	71.5	179.5	62.5	77.3
1874	19.7	35.4	106.0	64.4	43.0	71.5	179.5	62.5	94.9
1875	80.0	35.4	106.0	64.4	43.0	71.5	179.5	62.5	116.3
1876	80.0	35.4	106.0	64.4	43.0	71.5	179.5	62.5	116.3

APPENDIX A1. *(continues)*

	Apulia			Basilicata	Calabria		
	Bari	Foggia	Lecce	Potenza	Catan-zaro	Cosenza	Reggio Calabria
1839	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1840	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1841	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1842	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1843	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1844	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1845	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1846	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1847	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1848	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1849	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1850	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1851	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1852	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1853	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1854	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1855	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1856	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1857	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1858	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1859	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1860	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1861	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1862	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1863	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1864	19.3	131.3	0.0	0.0	0.0	0.0	0.0
1865	179.7	131.3	45.7	0.0	0.0	0.0	0.0
1866	179.7	131.3	84.4	0.0	0.0	0.0	17.6
1867	179.7	163.7	84.4	0.0	0.0	0.0	17.6
1868	187.1	199.6	166.2	0.0	0.0	0.0	76.2
1869	187.1	199.6	206.4	37.0	0.0	32.8	76.2
1870	187.1	199.6	208.1	37.0	0.0	105.6	76.2
1871	187.1	199.6	208.1	37.0	0.0	105.6	112.1
1872	187.1	199.6	226.4	37.0	0.0	105.6	132.2
1873	187.1	199.6	226.4	37.0	0.0	105.6	132.2
1874	187.1	199.6	226.4	37.0	49.4	111.4	132.2
1875	187.1	199.6	226.4	75.1	151.9	111.4	135.8
1876	187.1	199.6	226.4	96.9	151.9	127.0	135.8

APPENDIX A1. *(continues)*

	Sicily							Sardinia	
	Calta-nissetta	Catania	Gir-genti	Messina	Palermo	Syracuse	Trapani	Cagliari	Sassari
1839	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1840	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1841	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1842	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1843	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1844	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1845	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1846	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1847	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1848	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1849	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1850	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1851	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1852	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1853	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1854	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1855	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1856	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1857	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1858	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1859	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1860	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1861	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1862	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1863	0.0	0.0	0.0	0.0	14.1	0.0	0.0	0.0	0.0
1864	0.0	0.0	0.0	0.0	31.5	0.0	0.0	0.0	0.0
1865	0.0	0.0	0.0	0.0	31.5	0.0	0.0	0.0	0.0
1866	0.0	0.0	0.0	47.3	36.7	0.0	0.0	0.0	0.0
1867	0.0	42.7	0.0	51.6	36.7	0.0	0.0	0.0	0.0
1868	0.0	42.7	0.0	51.6	36.7	0.0	0.0	0.0	0.0
1869	0.0	60.1	0.0	51.6	61.1	10.4	0.0	0.0	0.0
1870	2.7	127.0	0.0	51.6	77.6	10.4	0.0	0.0	0.0
1871	2.7	127.0	0.0	51.6	77.6	68.8	0.0	50.1	0.0
1872	2.7	127.0	0.0	51.6	77.6	68.8	0.0	131.9	20.2
1873	2.7	127.0	0.0	51.6	77.6	68.8	0.0	131.9	20.2
1874	2.7	127.0	27.5	51.6	94.4	68.8	0.0	131.9	66.5
1875	2.7	127.0	42.1	51.6	94.4	68.8	0.0	131.9	66.5
1876	68.4	128.8	55.7	51.6	94.4	68.8	0.0	131.9	66.5

APPENDIX A2. *Railway extension in Italian provinces (kms), 1877-1913*

	Piedmont				Liguria	
	Alessandria	Cuneo	Novara	Turin	Genoa	Porto Maurizio
1877	380.6	188.9	216.3	319.1	300.5	58.9
1878	380.6	188.9	216.3	319.1	300.5	58.9
1879	380.6	188.9	216.3	319.1	300.5	58.9
1880	380.6	188.9	216.3	319.1	300.5	58.9
1881	380.6	188.9	216.3	319.1	303.4	58.9
1882	380.6	188.9	231.1	335.3	303.4	58.9
1883	380.6	188.9	265.3	335.3	303.4	58.9
1884	380.6	227.9	279.3	348.7	303.4	58.9
1885	380.6	250.0	284.9	380.1	303.4	58.9
1886	380.6	264.8	297.4	427.3	305.3	58.9
1887	398.0	302.9	348.4	445.3	305.3	58.9
1888	398.0	308.7	378.4	445.3	317.8	58.9
1889	400.1	333.7	378.4	445.3	342.2	58.9
1890	400.1	340.0	378.4	445.3	342.2	58.9
1891	400.1	351.3	410.4	445.3	342.2	58.9
1892	400.1	383.6	410.4	445.3	342.2	58.9
1893	460.7	391.3	410.4	445.3	342.2	58.9
1894	467.3	391.3	410.4	445.3	375.7	58.9
1895	475.7	391.3	410.4	445.3	375.7	58.9
1896	475.7	391.3	410.4	445.3	375.7	58.9
1897	475.7	391.3	410.4	445.3	382.7	58.9
1898	475.7	391.3	410.4	445.3	382.7	58.9
1899	475.7	391.3	410.4	445.3	384.4	58.9
1900	475.7	401.0	410.4	445.3	387.3	58.9
1901	475.7	401.0	410.4	445.3	387.3	58.9
1902	475.7	408.3	410.4	445.3	387.3	58.9
1903	475.7	408.9	410.4	445.3	387.3	58.9
1904	475.7	408.9	410.4	445.3	387.3	58.9
1905	475.7	408.9	512.4	445.3	387.3	58.9
1906	475.7	408.9	559.5	460.8	391.7	58.9
1907	508.9	408.9	559.5	466.6	397.1	58.9
1908	510.6	408.9	573.1	466.6	397.1	58.9
1909	512.5	408.9	573.1	466.6	397.1	58.9
1910	512.5	408.9	573.1	466.6	397.1	58.9
1911	512.5	408.9	573.1	466.6	397.7	58.9
1912	543.8	421.3	573.1	485.9	399.0	58.9
1913	543.8	430.1	573.1	485.9	399.0	58.9

APPENDIX A2. *(continues)*

	Lombardy							
	Bergamo	Brescia	Como	Cremona	Mantua	Milan	Pavia	Sondrio
1877	83.2	108.5	49.8	115.5	69.8	294.6	212.7	0.0
1878	103.5	120.1	49.8	115.5	69.8	294.6	212.7	0.0
1879	103.5	120.1	68.4	115.5	69.8	336.1	212.7	0.0
1880	103.5	120.1	69.4	115.5	69.8	338.4	212.7	0.0
1881	103.5	120.1	69.4	115.5	69.8	338.4	212.7	0.0
1882	103.5	120.1	114.7	115.5	69.8	342.9	266.1	0.0
1883	103.5	120.1	114.7	115.5	71.5	342.9	276.4	0.0
1884	131.0	120.1	164.0	131.2	71.5	361.6	276.4	0.0
1885	131.0	143.5	208.0	131.2	71.5	361.6	276.4	37.1
1886	131.0	143.5	236.0	131.2	91.8	361.6	276.4	57.7
1887	131.0	143.5	236.0	133.3	91.8	404.3	276.4	57.7
1888	131.0	143.5	273.8	133.3	148.6	417.4	276.4	57.7
1889	141.1	143.5	278.6	133.3	148.6	420.0	276.4	57.7
1890	141.1	143.5	278.6	133.3	148.6	420.0	276.4	57.7
1891	141.1	143.5	278.6	133.3	148.6	430.6	276.4	57.7
1892	141.1	143.5	303.5	133.3	148.6	430.6	276.4	57.7
1893	141.1	174.7	303.5	135.5	160.0	430.6	276.4	57.7
1894	141.1	174.7	331.2	135.5	160.0	430.6	276.4	57.7
1895	141.1	174.7	331.2	135.5	160.0	430.6	276.4	57.7
1896	141.1	174.7	331.2	135.5	160.0	430.6	276.4	57.7
1897	141.1	202.0	331.2	135.5	160.0	430.6	276.4	57.7
1898	141.1	202.0	347.3	135.5	160.0	432.7	276.4	57.7
1899	141.1	202.0	347.3	135.5	160.0	432.7	276.4	57.7
1900	141.1	202.0	347.3	135.5	160.0	432.7	276.4	57.7
1901	141.1	202.0	347.3	135.5	160.0	432.7	276.4	57.7
1902	141.1	202.0	348.1	135.5	163.2	432.7	276.4	83.5
1903	141.1	202.0	353.6	135.5	163.2	432.7	276.4	83.5
1904	141.1	202.0	364.1	135.5	163.2	448.2	276.4	83.5
1905	141.1	202.0	375.5	135.5	163.2	448.2	276.4	83.5
1906	171.3	202.0	375.5	137.9	163.2	448.2	276.4	83.5
1907	171.6	247.8	375.5	137.9	163.2	448.2	276.4	83.5
1908	172.8	247.8	375.5	137.9	163.2	448.2	276.4	83.5
1909	172.8	282.5	375.5	137.9	169.8	448.2	276.4	83.5
1910	172.8	282.5	375.5	137.9	169.8	448.2	278.0	83.5
1911	178.3	302.1	381.4	137.9	173.7	479.1	278.0	83.5
1912	178.3	302.1	381.4	137.9	177.4	479.1	278.0	83.5
1913	178.3	302.1	381.4	137.9	177.4	479.1	278.0	83.5

APPENDIX A2. *(continues)*

	Venetia							
	Belluno	Padua	Rovigo	Treviso	Udine	Venice	Verona	Vicenza
1877	0.0	122.0	87.6	83.0	131.4	32.2	175.5	92.5
1878	0.0	122.0	87.6	83.0	139.6	32.2	175.5	92.5
1879	0.0	122.0	87.6	96.1	152.5	32.2	175.5	92.5
1880	0.0	122.0	87.6	96.1	152.5	32.2	175.5	92.5
1881	0.0	122.0	87.6	96.1	152.5	35.2	175.5	92.5
1882	0.0	122.0	87.6	96.1	152.5	35.2	175.5	92.5
1883	0.0	122.0	87.6	96.1	152.5	35.2	175.5	92.5
1884	0.0	122.0	98.7	122.1	152.5	35.2	175.5	92.5
1885	0.0	146.3	98.7	161.4	152.5	62.6	175.5	114.9
1886	48.6	156.6	98.7	193.8	167.2	87.8	202.3	114.9
1887	48.6	156.6	106.9	193.8	167.2	99.8	202.3	114.9
1888	48.6	156.6	106.9	193.8	229.2	120.4	202.3	114.9
1889	48.6	156.6	106.9	193.8	229.2	120.4	236.2	114.9
1890	48.6	156.6	106.9	193.8	229.2	120.4	236.2	114.9
1891	48.6	156.6	106.9	193.8	229.2	120.4	236.2	114.9
1892	48.6	156.6	106.9	193.8	229.2	120.4	236.2	114.9
1893	48.6	156.6	106.9	193.8	247.4	120.4	236.2	114.9
1894	48.6	156.6	106.9	193.8	247.4	120.4	236.2	114.9
1895	48.6	156.6	106.9	193.8	247.4	120.4	236.2	114.9
1896	48.6	156.6	106.9	193.8	247.4	120.4	236.2	114.9
1897	48.6	156.6	106.9	193.8	253.0	120.4	236.2	114.9
1898	48.6	156.6	106.9	193.8	253.0	120.4	236.2	114.9
1899	48.6	156.6	106.9	193.8	253.0	120.4	236.2	114.9
1900	48.6	156.6	106.9	193.8	253.0	120.4	236.2	114.9
1901	48.6	156.6	106.9	193.8	253.0	120.4	236.2	114.9
1902	48.6	156.6	106.9	193.8	253.0	120.4	236.2	114.9
1903	48.6	156.6	106.9	193.8	253.0	120.4	236.2	114.9
1904	48.6	156.6	106.9	193.8	253.0	120.4	247.0	114.9
1905	48.6	156.6	106.9	193.8	253.0	120.4	247.0	114.9
1906	48.6	156.6	106.9	193.8	253.0	120.4	247.0	114.9
1907	48.6	156.6	106.9	193.8	253.0	122.6	247.0	125.5
1908	48.6	164.6	106.9	211.3	253.0	140.5	247.0	133.7
1909	48.6	164.6	106.9	211.3	253.0	140.5	247.0	148.1
1910	48.6	164.6	106.9	211.3	272.3	140.5	247.0	185.3
1911	48.6	187.0	106.9	211.3	272.3	141.5	247.0	185.3
1912	67.6	187.0	106.9	211.3	281.4	141.5	257.5	185.3
1913	83.4	187.0	106.9	219.1	301.7	157.3	257.5	185.3

APPENDIX A2. *(continues)*

				Emilia				
	Bologna	Ferrara	Forlì	Modena	Parma	Piacenza	Ravenna	Reggio Emilia
1877	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1878	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1879	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1880	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1881	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1882	170.7	19.7	72.3	41.8	35.4	55.9	58.8	41.5
1883	170.7	52.8	72.3	90.2	69.2	55.9	58.8	72.0
1884	170.7	52.8	72.3	111.1	84.5	55.9	80.3	72.0
1885	170.7	52.8	72.3	111.1	84.5	55.9	80.3	72.0
1886	170.7	52.8	74.7	111.1	89.1	55.9	85.6	98.4
1887	246.9	66.5	74.7	117.1	90.9	55.9	105.3	112.7
1888	256.1	91.0	74.7	141.8	90.9	55.9	127.1	112.7
1889	263.5	96.4	96.1	147.2	113.3	55.9	174.8	112.7
1890	263.5	96.4	96.1	147.2	113.3	55.9	174.8	112.7
1891	263.5	96.4	96.1	148.7	113.3	55.9	174.8	133.3
1892	263.5	96.4	96.1	148.9	113.3	55.9	174.8	134.6
1893	263.5	96.4	96.1	148.9	128.8	55.9	174.8	134.6
1894	263.5	96.4	96.1	148.9	133.4	55.9	174.8	134.6
1895	263.5	96.4	96.1	148.9	133.4	55.9	174.8	134.6
1896	263.5	96.4	96.1	148.9	133.4	55.9	174.8	134.6
1897	263.5	96.4	96.1	148.9	133.4	55.9	174.8	134.6
1898	263.5	96.4	96.1	148.9	133.4	55.9	174.8	134.6
1899	264.7	96.4	96.1	148.9	133.4	55.9	174.8	134.6
1900	264.7	96.4	96.1	148.9	133.4	55.9	174.8	134.6
1901	264.7	96.4	96.1	148.9	133.4	55.9	174.8	134.6
1902	264.7	96.4	96.1	162.7	133.4	55.9	174.8	134.6
1903	264.7	118.2	96.1	162.7	133.4	55.9	174.8	134.6
1904	264.7	118.2	96.1	162.7	133.4	55.9	174.8	134.6
1905	264.7	118.2	96.1	162.7	133.4	55.9	174.8	134.6
1906	264.7	118.2	96.1	162.7	146.7	73.3	174.8	134.6
1907	264.7	118.2	96.1	162.7	146.7	73.3	174.8	134.6
1908	264.7	118.2	96.1	162.7	146.7	73.3	174.8	134.6
1909	264.7	149.5	96.1	162.7	146.7	73.3	174.8	149.2
1910	264.7	149.5	96.1	162.7	146.7	73.3	174.8	164.3
1911	275.4	179.7	96.1	162.7	146.7	73.3	174.8	164.3
1912	275.4	179.7	96.1	162.7	146.7	73.3	174.8	164.3
1913	275.4	179.7	96.1	162.7	171.4	73.3	174.8	164.3

APPENDIX A2. *(continues)*

	Tuscany							
	Arezzo	Florence	Grosseto	Leghorn	Lucca	Massa Carrara	Pisa	Siena
1877	80.9	215.1	138.2	13.7	63.1	36.5	210.5	166.8
1878	80.9	215.1	138.2	13.7	63.1	36.5	210.5	166.8
1879	80.9	215.1	138.2	13.7	63.1	36.5	210.5	166.8
1880	80.9	215.1	138.2	13.7	63.1	36.5	210.5	166.8
1881	80.9	215.1	138.2	13.7	63.1	36.5	210.5	166.8
1882	80.9	215.1	138.2	13.7	63.1	36.5	210.5	166.8
1883	80.9	215.1	138.2	13.7	63.1	36.5	210.5	166.8
1884	80.9	215.1	138.2	13.7	63.1	36.5	210.5	166.8
1885	80.9	215.1	138.2	13.7	63.1	36.5	210.5	174.2
1886	128.6	215.1	138.2	13.7	63.1	36.5	210.5	174.2
1887	128.6	215.1	138.2	13.7	63.1	36.5	210.5	174.2
1888	172.4	218.5	138.2	13.7	63.1	64.0	210.5	174.2
1889	172.4	218.5	138.2	13.7	63.1	64.0	210.5	174.2
1890	172.4	253.0	138.2	13.7	84.4	64.0	211.2	174.2
1891	172.4	253.0	138.2	13.7	84.4	64.0	211.2	174.2
1892	172.4	265.9	138.2	13.7	94.6	64.0	224.9	174.2
1893	172.4	298.2	138.2	13.7	94.6	64.0	224.9	174.2
1894	172.4	298.2	138.2	13.7	94.6	77.3	224.9	174.2
1895	172.4	298.2	138.2	13.7	94.6	77.3	224.9	174.2
1896	172.4	305.5	138.2	13.7	94.6	77.3	224.9	174.2
1897	172.4	305.5	138.2	13.7	94.6	77.3	224.9	174.2
1898	172.4	305.5	138.2	13.7	105.0	77.3	224.9	174.2
1899	172.4	305.5	138.2	13.7	108.8	77.3	224.9	174.2
1900	172.4	305.5	138.2	13.7	108.8	77.3	224.9	174.2
1901	172.4	305.5	138.2	13.7	108.8	77.3	224.9	174.2
1902	172.4	305.5	161.7	13.7	108.8	77.3	224.9	174.2
1903	172.4	305.5	161.7	13.7	108.8	77.3	224.9	174.2
1904	172.4	305.5	161.7	13.7	108.8	77.3	224.9	174.2
1905	172.4	305.5	161.7	13.7	108.8	77.3	224.9	174.2
1906	172.4	305.5	161.7	13.7	108.8	77.3	226.0	174.2
1907	172.4	305.5	161.7	13.7	108.8	77.3	226.0	174.2
1908	172.4	305.5	161.7	13.7	108.8	77.3	226.0	174.2
1909	172.4	305.5	161.7	13.7	108.8	77.3	226.0	174.2
1910	172.4	305.5	161.7	33.3	108.8	77.3	239.6	174.2
1911	172.4	306.6	161.7	33.3	121.9	98.9	239.6	174.2
1912	172.4	306.6	161.7	33.3	121.9	102.5	247.6	174.2
1913	172.4	339.1	174.8	33.3	121.9	102.5	247.6	174.2

APPENDIX A2. *(continues)*

	Marche				Umbria	Latium
	Ancona	Ascoli	Macerata	Pesaro	Perugia	Rome
1877	127.4	46.6	20.9	42.5	321.9	334.5
1878	127.4	46.6	20.9	42.5	321.9	345.2
1879	127.4	46.6	20.9	42.5	321.9	345.2
1880	127.4	46.6	20.9	42.5	321.9	345.2
1881	127.4	46.6	20.9	42.5	321.9	345.2
1882	127.4	46.6	20.9	42.5	321.9	345.2
1883	127.4	46.6	20.9	42.5	367.4	345.2
1884	133.6	46.6	48.2	42.5	367.4	397.7
1885	133.6	46.6	55.3	42.5	367.4	401.8
1886	133.6	74.3	72.3	42.5	455.9	437.5
1887	133.6	74.3	72.3	42.5	455.9	476.4
1888	133.6	74.3	100.8	42.5	455.9	488.7
1889	133.6	74.3	100.8	42.5	455.9	517.5
1890	133.6	74.3	100.8	42.5	455.9	526.4
1891	133.6	74.3	100.8	42.5	455.9	527.9
1892	133.6	74.3	100.8	42.5	455.9	657.2
1893	133.6	74.3	100.8	42.5	455.9	657.2
1894	133.6	74.3	100.8	42.5	455.9	751.5
1895	159.7	74.3	100.8	47.9	455.9	751.5
1896	159.7	74.3	100.8	47.9	455.9	751.5
1897	159.7	74.3	100.8	47.9	455.9	751.5
1898	159.7	74.3	100.8	96.3	455.9	751.5
1899	159.7	74.3	100.8	96.3	455.9	751.5
1900	159.7	74.3	100.8	96.3	455.9	751.5
1901	159.7	74.3	100.8	96.3	455.9	774.2
1902	159.7	74.3	100.8	96.3	455.9	774.2
1903	159.7	74.3	100.8	96.3	455.9	774.2
1904	159.7	74.3	100.8	96.3	455.9	774.2
1905	159.7	74.3	100.8	96.3	455.9	774.2
1906	162.9	74.3	112.1	96.3	455.9	776.3
1907	162.9	74.3	112.1	96.3	455.9	776.3
1908	162.9	129.6	114.8	96.3	455.9	776.3
1909	162.9	131.9	114.8	96.3	455.9	778.2
1910	162.9	131.9	114.8	96.3	455.9	782.5
1911	162.9	131.9	114.8	96.3	455.9	785.5
1912	162.9	131.9	114.8	96.3	455.9	830.8
1913	162.9	131.9	114.8	96.3	455.9	830.8

APPENDIX A2. *(continues)*

	Abruzzi			Campania				
	Aquila	Campo-basso	Chieti	Teramo	Avellino	Bene-vento	Caserta	Naples	Salerno
1877	80.0	35.4	106.0	64.4	43.0	71.5	179.5	62.5	119.0
1878	80.0	35.4	106.0	64.4	43.0	71.5	179.5	62.5	119.0
1879	80.0	35.4	106.0	64.4	66.7	71.5	179.5	62.5	119.0
1880	80.0	35.4	106.0	64.4	66.7	71.5	179.5	62.5	119.0
1881	80.0	35.4	106.0	64.4	66.7	85.2	179.5	62.5	119.0
1882	104.3	89.5	106.0	64.4	66.7	127.7	179.5	62.5	122.2
1883	137.9	151.9	106.0	64.4	66.7	129.7	179.5	62.5	152.0
1884	137.9	151.9	106.0	89.5	69.2	129.7	197.7	78.1	152.0
1885	137.9	151.9	106.0	89.5	72.4	129.7	218.2	100.7	152.0
1886	137.9	171.4	106.0	89.5	79.9	129.7	226.4	105.5	192.7
1887	137.9	171.4	106.0	89.5	79.9	129.7	226.4	105.5	217.8
1888	242.7	171.4	106.0	89.5	79.9	129.7	226.4	109.0	236.8
1889	242.7	171.4	106.0	89.5	79.9	129.7	226.4	121.4	254.2
1890	242.7	171.4	106.0	89.5	79.9	129.7	226.4	129.3	254.2
1891	242.7	171.4	106.0	89.5	92.0	140.2	246.9	152.4	254.2
1892	267.3	171.4	106.0	89.5	95.1	140.2	305.4	152.4	259.4
1893	267.3	171.4	106.0	89.5	122.0	140.2	305.4	152.4	259.4
1894	267.3	201.0	106.0	89.5	122.0	140.2	305.4	152.4	301.9
1895	272.3	201.0	106.0	89.5	191.3	140.2	312.4	152.4	301.9
1896	272.3	201.0	106.0	89.5	191.3	140.2	312.4	152.4	301.9
1897	327.2	243.7	111.9	89.5	191.3	140.2	312.4	152.4	301.9
1898	327.2	251.8	111.9	89.5	191.3	140.2	312.4	152.4	301.9
1899	327.2	251.8	111.9	89.5	191.3	140.2	312.4	152.4	301.9
1900	327.2	260.3	111.9	89.5	191.3	140.2	312.4	152.4	301.9
1901	327.2	260.3	111.9	89.5	191.3	140.2	312.4	152.4	301.9
1902	365.1	260.3	111.9	89.5	191.3	140.2	312.4	152.4	319.1
1903	365.1	260.3	111.9	89.5	191.3	140.2	312.4	160.1	319.1
1904	365.1	260.3	111.9	89.5	191.3	140.2	315.4	197.9	326.9
1905	365.1	260.3	120.5	89.5	191.3	140.2	315.4	197.9	326.9
1906	365.1	260.3	120.5	89.5	191.3	140.2	315.4	197.9	326.9
1907	365.1	260.3	120.5	89.5	191.3	140.2	315.4	197.9	326.9
1908	365.1	260.3	120.5	89.5	191.3	140.2	315.4	197.9	326.9
1909	365.1	260.3	120.5	89.5	191.3	140.2	315.4	197.9	326.9
1910	365.1	260.3	120.5	89.5	197.3	146.7	332.2	197.9	326.9
1911	365.1	260.3	120.5	89.5	200.4	157.9	332.2	197.9	326.9
1912	365.1	260.3	174.7	89.5	200.4	157.9	332.2	197.9	326.9
1913	365.1	260.3	214.6	89.5	200.4	162.5	374.8	214.4	326.9

Appendix A2. (*continues*)

	Apulia			Basilicata	Calabria		
	Bari	Foggia	Lecce	Potenza	Catan-zaro	Cosenza	Reggio Calabria
1877	187.1	199.6	226.4	114.0	151.9	171.5	135.8
1878	187.1	199.6	226.4	114.0	151.9	171.5	135.8
1879	187.1	199.6	226.4	114.0	151.9	181.1	135.8
1880	187.1	199.6	226.4	186.2	151.9	181.1	135.8
1881	187.1	199.6	226.4	186.2	151.9	181.1	139.8
1882	187.1	199.6	226.4	186.2	151.9	181.1	139.8
1883	187.1	199.6	226.4	186.2	161.0	181.1	139.8
1884	187.1	212.3	244.1	186.2	161.0	181.1	151.9
1885	187.1	248.1	260.5	186.2	161.0	181.1	161.0
1886	187.1	248.1	330.4	186.2	161.0	181.1	169.6
1887	187.1	267.9	330.4	186.2	161.0	181.1	169.6
1888	187.1	267.9	330.4	186.2	161.0	181.1	179.4
1889	187.1	267.9	330.4	186.2	161.0	181.1	188.6
1890	187.1	267.9	330.4	186.2	161.0	181.1	188.8
1891	187.1	276.1	330.4	208.5	166.0	181.1	201.7
1892	276.7	276.1	330.4	280.6	166.0	181.1	201.7
1893	276.7	276.1	330.4	280.6	180.0	181.1	201.7
1894	276.7	276.1	331.0	297.2	269.2	183.7	201.7
1895	341.6	276.1	331.0	305.9	286.9	288.8	201.7
1896	341.6	276.1	331.0	305.9	294.8	288.8	201.7
1897	341.6	276.1	331.0	349.6	294.8	288.8	201.7
1898	341.6	276.1	331.0	349.6	294.8	288.8	201.7
1899	341.6	276.1	331.0	349.6	299.8	288.8	201.7
1900	385.9	276.1	331.0	349.6	299.8	288.8	201.7
1901	385.9	276.1	331.0	349.6	299.8	288.8	201.7
1902	385.9	276.1	331.0	349.6	299.8	288.8	201.7
1903	409.6	276.1	335.3	349.6	299.8	288.8	201.7
1904	409.6	276.1	335.3	349.6	299.8	288.8	201.7
1905	452.2	276.1	335.3	349.6	299.8	288.8	202.2
1906	452.2	276.1	335.3	349.6	299.8	288.8	202.2
1907	452.2	276.1	423.1	349.6	299.8	288.8	202.2
1908	452.2	276.1	423.1	349.6	299.8	288.8	202.2
1909	452.2	276.1	423.1	349.6	299.8	288.8	202.2
1910	452.2	276.1	423.1	349.6	299.8	288.8	202.2
1911	452.2	276.1	508.6	349.6	299.8	288.8	202.2
1912	452.2	276.1	508.6	349.6	299.8	288.8	202.2
1913	452.2	276.1	508.6	349.6	299.8	288.8	202.2

Appendix A2. (*continues*)

	Sicily						Sardinia	
	Caltanis-setta	Catania	Gir-genti	Messina	Palermo	Syracuse	Trapani	Cagliari	Sassari
1877	68.4	128.8	55.7	51.6	94.4	68.8	0.0	131.9	66.5
1878	74.3	128.8	55.7	51.6	94.4	68.8	0.0	131.9	98.0
1879	74.3	128.8	55.7	51.6	94.4	68.8	0.0	131.9	98.0
1880	74.3	128.8	111.1	51.6	146.5	68.8	74.1	222.1	162.1
1881	98.2	128.8	129.4	51.6	186.9	68.8	125.6	222.1	186.1
1882	98.2	128.8	129.4	51.6	186.9	68.8	125.6	222.1	186.1
1883	98.2	128.8	129.4	51.6	186.9	68.8	125.6	222.1	207.4
1884	98.2	128.8	129.4	51.6	186.9	68.8	125.6	222.1	207.4
1885	104.7	128.8	129.4	51.6	188.0	68.8	125.6	222.1	207.4
1886	104.7	128.8	129.4	51.6	254.8	101.0	125.6	222.1	207.4
1887	104.7	128.8	129.4	51.6	278.2	101.3	125.6	222.1	207.4
1888	104.7	128.8	131.4	51.6	278.2	101.3	125.6	351.2	263.0
1889	104.7	132.0	131.4	83.8	278.2	111.1	125.6	447.3	331.4
1890	104.7	132.0	131.4	96.6	278.2	111.1	125.6	447.3	331.4
1891	131.5	132.0	140.9	112.4	278.2	170.4	125.6	447.3	341.1
1892	131.5	185.6	140.9	119.7	278.2	172.0	125.6	447.3	341.1
1893	143.9	185.6	140.9	145.0	278.2	249.5	125.6	557.4	410.0
1894	143.9	185.6	140.9	151.8	293.8	249.5	125.6	616.7	410.0
1895	143.9	293.0	140.9	201.2	293.8	249.5	125.6	616.7	410.0
1896	143.9	293.9	140.9	201.7	293.8	249.5	125.6	616.7	410.0
1897	143.9	293.9	140.9	201.7	293.8	249.5	125.6	616.7	410.0
1898	143.9	295.7	140.9	201.7	293.8	249.5	125.6	621.9	410.0
1899	143.9	295.7	140.9	201.7	293.8	249.5	125.6	621.9	410.0
1900	143.9	295.7	140.9	201.7	293.8	249.5	125.6	621.9	410.0
1901	143.9	295.7	140.9	201.7	293.8	249.5	125.6	621.9	410.0
1902	143.9	295.7	140.9	201.7	293.8	249.5	125.6	621.9	410.0
1903	143.9	295.7	140.9	201.7	332.2	249.5	125.6	621.9	410.0
1904	143.9	295.7	140.9	201.7	332.2	249.5	125.6	621.9	410.0
1905	143.9	295.7	140.9	201.7	332.2	249.5	125.6	621.9	410.0
1906	143.9	295.7	140.9	201.7	332.2	249.5	125.6	621.9	410.0
1907	143.9	295.7	140.9	201.7	332.2	249.5	125.6	621.9	410.0
1908	143.9	295.7	140.9	201.7	332.2	249.5	125.6	621.9	410.0
1909	143.9	295.7	140.9	201.7	332.2	249.5	125.6	621.9	410.0
1910	143.9	295.7	140.9	201.7	332.2	249.5	149.6	621.9	410.0
1911	143.9	295.7	173.1	201.7	332.2	249.5	149.6	621.9	410.0
1912	157.7	296.8	173.1	201.7	335.8	249.5	149.6	621.9	410.0
1913	157.7	296.8	173.1	201.7	335.8	249.5	149.6	621.9	410.0

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