Railways and Travel Time in Italy, 1921-1937*

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Abstract

During the interwar period, Italian railways benefitted from technological and organisational improvements that changed the structure of the network. During the same years, the industrial structure adapted to new macroeconomic conditions and suffered from a prolonged crisis. Using the official timetables (*Orari Generali*) of the railways, I provide the first reconstruction of travel time and train speed for a sample of about 2,000 passenger trains on 102 principal railway lines in 1921, 1927, 1931 and 1937. I integrate this original dataset with information from other statistical sources to determine the evolution of the railway transport during the interwar period. Hence, I use population and industrial censuses to evaluate the relationship with economic variables, and present some preliminary results. The paper introduces the research project, provides a review of the literature, and discusses some findings.

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1 Introduction

This paper is part of a research project on transport innovation and economic development in Italy between 1921 and 1971, when the Italian economy was transformed by structural changes which sustained the industrialisation of the country. The years 1921-1944 roughly coincided with the fascist dictatorship, and they witnessed the economic crisis of the 1930s, the policies implemented by the regime to tackle it, and finally the destructions of the Second World War. The second phase (1945-1971) began with the foundation of the Republic and covered the post-war reconstruction and the subsequent 'economic miracle.'

The two phases also showed two contrasting trends in regional divides, as the gap between the South and the rest of the country widened during the interwar period and then narrowed from the late 1950s to the early 1970s.[1] Behind the general catching-up there was high regional variation, partly due to selective developmental projects.

Although considerable research on the period has been devoted to the national and international economic dynamics, and to the role of public policies, rather less attention has been paid to the evolution of transport. Yet, this was revolutionised by the electrification of the railway network, the construction of the motorways, and by the launch of a new merchant navy. These innovations modified not only the cost of moving goods and people, but also the geography of the country, as they reduced travel times and increased connections. However, the impact was unequally spread, since investments selected areas and networks in non-random fashion. Moreover, innovations combined in different ways over time and space.

I propose that a comprehensive and integrated analysis of the impact of transport at the local level can allow for a more precise identification of the economic impact of transport infrastructures on industrialisation. Thus, the main focus of my research investigates the extent to which transport innovations explain the geographical distribution of industrial activities at the city, provincial (NUTS 3), and regional (NUTS 2) level, and how this

[1] A. Brunetti, E. Felice, and G. Vecchi, 'Income,' in G. Vecchi (ed.), *Measuring Wellbeing. A History of Italian Living Standards* (Oxford, 2017).

affected the evolution of regional divides. I make use of primary sources such as train and ferry timetables, transport access and length of the railway and road networks, in order to produce an original dataset of transport at the local level. I then gather data from industrial and population censuses to individuate local patterns of industrialisation for eight benchmark years: 1921, 1927, 1931, 1938, 1944, 1951, 1961, 1971.

I finally apply factor endowment and New Economic Geography approaches to provide a quantitative assessment of the impact of transport innovation on the location of industrial activities throughout the period, in order to contribute to the study of their relationship in the peculiar context of XXth century Italy.

In this paper, I focus on the interwar period (1921-1939), when a massive program of electrification transformed the structure of the railway network, and travel time decreased considerably. During the same years, the first motorways were built. After a review of the relative literature, the paper describes the data collected so far and the preliminary results of my investigation.

2 Literature Review

2.1 Transport and Industrial Activities and Urbanisation

Economic theory has acknowledged the importance of transport since its onset. Adam Smith (1776) argued that reductions in transport costs extend markets, which increases the division of labour. Joan H. von Thünen (1826) was the first to account for transport costs in a spatial model of agricultural output and land rents.[2] For a rather different analysis, Launhardt (1882) and Weber (1909) modelled the firm's optimal location as a problem of minimising the total transport cost;[3] later, Hotelling (1929) introduced travel costs into a

[2] M.Fujita, P. Krugman, and A.J. Venables, *The Spatial Economy* (London, 1999), pp. 15-17.

[3] M.J. Beckman and J.F. Thisse, 'The Location of Production Activities,' in P. Nijkamp (ed.), Handbook of Regional and Urban Economics, Volume I, (Elsevier, 1987), pp. 49-55.

model of spatial competition which laid the foundation of classical location theory.[4]

More recently, the New Economic Geography (NEG) has merged[5] the location theory's approach with insights from the international trade theory to propose a unified model of the geographic distribution of economic activities.[6] Previous studies — dating back to Marshall (1920) — had already considered transport costs among the determinants of industrial concentration, but NEG theories leave room for more complex interactions.[7] Since such models can be expanded to account for further elements, several studies have integrated NEG arguments with models à la Heckscher–Ohlin: partly neglected by NEG theories, these justify localisation as a function of local endowments, which have been found to be highly explicative for key production factors, such as coal and water.[8] Economic historians have applied this more comprehensive framework to explain historical concentration of industries in certain locations,[9] or more generally spatial inequalities.[10]

In the Italian case, the regional divides, the fragmentation of pre-unitary polities, and the morphological characters of the territory often inspired geographically-minded studies. Giustino Fortunato was probably the first observer to point at geographical endowments to explain the backwardness of the Mezzogiorno.[11] Economic historians started investigating regional development in Italy with a quantitative approach from the 1980s, following in

[4] J.F. Thisse, 'Location Theory,' in S.N. Durlauf and L.E. Blume, *The New Palgrave Dictionary of Economics*, 2nd edn (2008).

[5] S. Brakman, H. Garretsen and C. van Marrewijk, *An Introduction to Geographical Economics* (Cambridge, 2001), pp. 22-57.

[6] P.R. Krugman, 'On the Relationship between Trade Theory and Location Theory,' *Review of International Economics*, 1/2 (1993), pp. 110-122.

[7] P. Krugman and A.J. Venables, 'Globalization and the Inequality of Nations,' *The Quarterly Journal of Economics*, Vol. 110, No. 4 (Nov., 1995), pp. 857-880

[8] P. Epifani, 'Heckscher–Ohlin and agglomeration,' Regional Science and Urban Economics, 35 (2005) 645-657. Cf. T. Gutberlet, 'Mechanization and the spatial distribution of industries in the German Empire, 1875 to 1907', Economic History Review, 67, 2 (2014), pp. 463-491 and A. Fernihough, and K. O'Rourke, 'Coal and the European Industrial Revolution', CEPR Discussion Papers, no. 9819 (2014).

[9] Cf. N. Crafts and A. Mulatu, 'What explains the location of industry in Britain, 1871–931?', *Journal of Economic Geography*, 5 (2005), pp. 499-518; and A. Klein and N. Crafts, 'Making sense of the manufacturing belt: determinants of U.S. industrial location, 1880– 1920,' *Journal of Economic Geography*, 12 (2012), pp. 775-807.

[10] P. Combes, M. Lafourcade, J.F. Thisse, and J.C. Toutain 'The rise and fall of spatial inequalities in France: A long-run perspective,' *Explorations in Economic History*, 48 (2011) 243-271.

[11] Cf. M. Griffo, 'Il meridionalismo nazionale di Giustino Fortunato,' in S. Cassese (ed.), *Lezioni sul meridionalismo* (Bologna, 2016).

particular a seminal work by Vera Zamagni.[12] Since then, a long series of studies has developed, proposing different explanations based on evidentiary bases.[13]

Among geographically-minded studies, the NEG theory has been recently applied to the Italian case by Brian A'Hearn and Antony Venables, who have analysed the role of three key factors for industrial development — natural advantages, domestic market access, and foreign market access.[14] Other studies, although not always referring explicitly to NEG models, have also proposed analytical interpretations of industrial concentration and economic development for the Italian case.[15]

However, few researches have focused specifically on the 21st century, as most of the existing literature examines the liberal period, between the unification of the country in 1861, and the First World War. My aim is to link such literature with current studies on the interwar period and the 'economic miracle.'

2.2 Railways and Cliometrics

For long time, railways were seen as a fundamental driver of industrial development. In the 1950s, these traditional views received support from contemporary theories of economic development, such as Rostow's stages of growth, which stressed the importance of railways as 'the most powerful initiator of take-offs.'[16] However, Rostow's theory was criticised by early practitioners of cliometrics, notably Robert Fogel, Albert Fishlow, and Gary Hawke.

[12] V. Zamagni, *Industrializzazione e squilibri regionali in Italia*, (Bologna, 1978).

[13] For a general overviews see L. Cafagna, *Dualismo e sviluppo nella storia d'Italia* (Venezia, 1989); E. Felice, *Divari regionali e intervento pubblico* (Bologna, 2007); V. Daniele and P. Malanima, *Il Divario Nord-Sud in Italia 1861-2011* (Soveria Mannelli, 2011).

[14] B. A'Hearn and A.J. Venables, 'Internal Geography and External Trade: regional disparities in Italy, 1861-2011,' *Quaderni di Storia Economica*, n. 12, Banca d'Italia, October 2011.

[15] Ciccarelli and S. Fachin, 'Regional Growth with Spatial Dependence: a Case Study on Early Italian Industrialization,' Quaderni di Storia Economica, n. 35, Banca d'Italia, January 2016; G. Iuzzolino, G. Pellegrini, and G. Viesti, 'Convergence among Italian Regions, 1861-2011,' Quaderni di Storia Economica, n. 22, Banca d'Italia, October 2011; P. Martinelli, 'Von Thünen south of the Alps: access to markets and interwar Italian agriculture,' European Review of Economic History, 18 (2014), 107–143, A. Missiaia, 'Where Do We Go From Here? Market Access and Regional Development in Italy (1871-1911),' European Review of Economic History, 20 (2016), pp. 215-241.

[16] W.W. Rostow, *The Stages of Economic Growth* (Cambridge, 1960), p. 55 and pp. 60-62.

Although with some differences,[17] these authors identified four key channels of the railways' impact on economic growth: Social savings, social rates of return, backward linkages, and forward linkages. Although they can all have implications on the geographical distribution of economic activities, the most relevant for my project is the last one. Forward linkages identify all the benefits procured by the railways to the economy which are not caught by the other channels: namely, efficiency gains stemming from market integration and rising external and internal economies.

Cliometricians argued that railways played little or no role for the location of industries, because inter-regional trade would have exploited alternative means of transport, but they also recognised their importance for factor endowments, stating that railways 'allowed farmers to move the margin of cultivation further west' in the case of the U.S. and that they had an impact 'upon the production of coal and other minerals' for Britain.[18]Moreover, they recognised that the problem was not settled, as 'lower transport charges [could cause] geographical shifts by enterprises [...] that might result in external economies for society as a whole [...].'[19]

Railways are virtually the most studied mode of transport in the Italian economic history, although the major attention has been dedicated to the liberal period. Contrasting views were proposed by Rosario Romeo, Emilio Sereni, Alexander Gerschenkron, and Gino Luzzatto, but they all followed the traditional approach.[20] The New Economic History approach was instead introduced in Italy by Stefano Fenoaltea, who has given many contributions to the topic. In his early works, Fenoaltea investigated both the backward and forward linkages. Among the former, he focused on the impact of the railways on the economic cycle, stressing the importance of maintenance over construction as a stimulus to national industries. On forward linkages, Fenoaltea evaluated the impact of railway investment with a general equi-

[17]See G.R. Hawke, *Railways and Economic Growth in England and Wales 1840-1870* (Oxford, 1970), pp. 1-32; and P. O'Brien, *The New Economic History of the Railways* (London, 1977), pp. 22-39.

[18]O'Brien, *The New Economic History of the Railways*, pp. 77-78.

[19]*Ibid.*, p. 81; cf. G.R. Hawke, *Railways and Economic Growth*, pp. 394-5.

[20]S. Fenoaltea, *The Reinterpretation of Italian Economic History. From Unification to the Great War* (Cambridge, 2011), p. 169.

librium model, and the social savings produced by the railway transport. He concluded that the stimulus to market integration was small, and that railways principally mattered for the development of the Industrial Triangle (Milan, Turin, Genoa), while they had a small effect on the other regions.[21]

In more recent studies Fenoaltea has confirmed the previous considerations, and computation of return on investment has shown that only the major trunks in the North and the minor ones were effective in reducing transport costs. Major trunks in the South, instead, did little both for market integration and the reduction of transport costs.[22] However, Fenoaltea does not address the issue of the impact on the local level, although he states that 'it [...] paid to locate activity where it did not minimize production costs, but saved transportation costs.'[23]

Similar conclusions were reached by Albert Schram, who integrated the quantitative approach with the study of the institutional setting. Schram used data on traffic to explicitly evaluate the effect on local development, and agreed with Fenoalta on the importance of the network for the industrialisation of the Industrial Triangle. He nonetheless stated that 'hardly any serious attention has been given to the relationship between railway construction and operation on the one hand, and regional differences in economic development on the other.'[24]

In the last decades, economic historians have actually offered estimates of numerous quantitative dimensions of socio-economic development at the regional and provincial level, but the role of transport infrastructure has received less attention. Moreover, most of the studies on transport have focused on the analysis of market integration.[25] My research

[21]S. Fenoaltea, 'Italy' in P. O'Brien (ed), *Railways and Economic Development, 1830-1914* (Oxford, 1983).

[22]But cf. G. Federico, 'Market integration and market efficiency: The case of 19th century Italy,' *Explorations in Economic History*, 44 (2007), pp. 293-316

[23]S. Fenoaltea, *The Reinterpretation*, p. 177.

[24]A. Schram, *Railways and the Formation of the Italian State in the Nineteenth Century* (Cambridge, 1997).

[25]See Federico, G., 'Market Integration and Market Efficiency?; and A. Missiaia, 'Regional Market Integration in Italy During the Unification (1832-1882),' LSE Economic History Working Papers No.48325 (2009).

proposes instead to focus on the effect on industrial location as a forward linkage of transport investment. In so doing, it aims at answering to Schram's call to arms that 'the only truly comprehensive way of analysing traffic in Italy would be to construct a complete matrix of all traffic flows, whether by rail, river, canal, land or sea. [...] Unfortunately, so far this has proved impossible to do.'[26]

2.3 Travel Time

Travel time were not a focus of the first cliometric analyses of the railways. Fogel's study concerned mainly agricultural freight, and Fishlow — who incorporated passenger service in the analysis — downplayed the role of time in computing social savings. Such decision was criticised by Boyd and Walton, who proposed a reassessment of social savings from the US rail passenger services in the nineteenth century.[27] They argued that 'time cost savings are a sufficient explanation of travellers' overwhelming willingness to pay premium fares for railroad services when faced with water alternatives.'[28] Their estimates — performed taking into account different demand elasticities and costs of alternative modes of transport — found that 'the efficiency gains from the movement of people were larger than those from moving foodstuffs,' and remarkably around 2.6% of US 1890 GNP.[29].

For the British case, Hawke had already included passenger traffic in his analysis of social savings, but his methodology had been criticised by contemporaries, and yet he did not include time savings in his computations.[30] Timothy Leunig performed a reassessment of passenger social savings from Victorian British Railways explicitly taking into account savings in time costs.[31] Following modern transport economics assumptions and methodologies,

[26] Schram, *Railways*, p. 116.

[27] Boyd, J. H., and Walton, G. M. (1971). 'The Social Savings from Nineteenth-Century Rail Passenger Services,' *Explorations in Economic History*, 9, 233-254. https://doi.org/10.1016/0014-4983(71)90059-3.

[28] *Ibid.*, p. 239.

[29] *Ibid.*, p. 249

[30] See W. J. Baker, 'Railways and Economic Growth in England and Wales, 1840–1870 by G.R. Hawke' (Book Review), *The Journal of Economic History*, Vol. 31, No. 3 (Sep., 1971), pp. 718-719, and A. Fishlow, 'Railways and Economic Growth in England and Wales, 1840–1870 by G.R. Hawke' (Book Review), *Journal of Economic Literature*, 10, No. 1 (1972), pp. 75-76.

[31] Leunig, T. (2017). 'Time is Money: A Re-Assessment of the Passenger Social Savings from Victorian

Leunig train speed and time saved thanks to the railways in comparison with competing modes of transport. Integrating estimates of value of the time saved with monetary costs, Leunig revises Hawke's estimates for 1865 and extends them for a longer time period, finding that 'passenger railways alone [accounted] for 15% of total TFP growth in the pre-1913 railway era.'[32]

Even if my primary aim is to investigate the impact of transport improvements on economic geography, the computation of travel time and improvements associated with new technologies and organisation plays a fundamental role in my analysis. In a context of apparently obsolete technology, in fact, travel time and average speed improvements appear to be the variables of choice to replace for the traditional 'first adoption' approach.

To the best of my knowledge, similar estimates have not been attempted for the Italian case yet, especially for the twenty-first century. The research project aims at including a similar exercise in the analysis. Hence, the present paper provides the first estimates of railways travel time and train speed in the interwar period for a sample of principal rail routes.

3 Historical Background

3.1 Railways

Since 1906, the Italian railways were almost completely owned and managed by the state, through *Ferrovie dello Stato* (FS), a state-owned enterprise. During the interwar period, the railway network was transformed by a program of investments. New direct lines (*direttissime*) were opened, and the railway network reached its maximum length in 1942 (23.227 km). New stations were built and others expanded. Faster trains were introduced: the Elettrotreni

British Railways,' *The Journal of Economic History*, 66(3). https://doi.org/10.1017/S0022050706000283

[32] *Ibid.*, p. 669.

(171-201 km/h), the *rapidi*, and the *leggeri*. Double tracks increased by 25%.[33]

The most important innovation was, however, the electrification of the network. The first electrified lines had already been experimented at the beginning of the century, they slightly expanded before the First World War, and by 1915 they had reached 377 km in length.[34] During the 1920s, the electrified tracks increased by 243% (+ 1104 km), and in the 1930s by 230% (+ 3608 km), reaching 32% of the total network in 1940 (5173 km; see Fig. 1).[35]

However, the electrification of the network was not evenly spread on the existing lines. It concentrated at first in the North-West of the country (in the early 1920s), then it was brought to the North-East (late 1920s, early 1930s), and later to the Centre (mainly late 1930s). The lines in the South would be electrified mainly after the Second World War, and the Islands would receive the innovation even in a later period (Figs. 2–5).

The innovation process was mirrored by the locomotive fleet, which shifted from steam centred in the early 1920s, to a mixed system of steam (around 60%), electric, and diesel engines at the end of the period (Fig. 6).

Such innovations contributed to a substantial reduction of travel times over the network, which is described in detail in Section 5.

3.2 Motorways and Road Transport

The fascist regime was favourable to motor vehicles, and it patronised investments in the first motorways. However, policies often lacked coordination and coherence,[36] so only a minor share of the projects was realised. First came the Milano-Laghi, in 1925; later followed the Milano-Bergamo (1927), the Rome-Ostia (1928), the Naples-Pompeii (1929), the Bergamo-Brescia (1931), the Milan-Turin (1932), the Florence-to-the-sea (1933), the Padua-Mestre, and finally the Genoa-Po Valley (1935), originally the only one to be entirely financed and

[33] Data elaborated from F. Aglianò and S. Spataro, 'Tavole Statistiche' in P. Spirito et al., *Le Ferrovie Italiane tra Stato e Mercato* (Rome, 1996)

[34] Maggi, *Storia dei trasporti in Italia*, p. 53.

[35] Calculations based on F. Aglianò and S. Spataro, 'Tavole Statistiche'.

[36] M. Moraglio, 'Real Ambition or just Coincidence? The Italian fascist motorway projects in inter-war Europe,' *The Journal of Transport History*, 30/2 (2009), pp. 168-82.

operated by the *Azienda Stratale Autonoma della Strada* (Aass), a public company.[37] The Aass had been established in 1928 and entrusted with the maintenance of 137 km of main roads (strade statali), but the quality of the network was low, especially in the South, and even worse at the local level.

Road and rail competition started during the interwar period. Technological improvements lowered the cost of motor vehicles, so their number increased dramatically, from 49,433 in 1920 to 358,208 in 1940, although Italy lagged behind the other industrialised countries.[38] Only from the 1950s the number of motor vehicles boomed, first thanks to cheap motorcycles and later to the car.[39]

Competition on freight began during the interwar period as well. To contrast it, FS introduced the *Littorine* (diesel locomotives), and started operating as road haulier through the *Istituto Nazionale Trasporti*, a sub-holding of FS.[40] However, only from the Second World War trucks started increasing exponentially, in line with private motor vehicles.[41]

Hence, in the rest of the paper I focus on innovations in the railway network, leaving road transport aside for further research.

4 Travel Time Data

Historians agree that innovations in the railway network promoted a reduction of travel time, but its extent and evolution has — to the best of my knowledge — never received a quantitative scrutiny. I provide here a novel dataset on travel time by train between Rome and sixty-nine cities[42] for four benchmark years: 1921, 1927, 1931, and 1937. These coincide with years for which industrial and population data are available from national censuses, hence they allow for further investigation on forward linkages.

[37]Maggi, *Storia dei trasporti*, pp. 110-113.

[38]Ibid., p. 106.

[39]Istat, *Sommario di Statistiche Storiche, 1926-1985* (Roma, 1986), p. 276.

[40]See S. Maggi, *Storia dei trasporti in Italia* (Bologna, 2013), pp. 53-59 and Id., Le ferrovie (Bologna, 2013), pp. 207-233.

[41]Istat, *Sommario di Statistiche Storiche, 1926-1985*, p. 276.

[42]See Appendix for the list of cities included.

The dataset is built using the original official timetables (*Orari Generali*) published by the *Ministero delle Comunicazioni* on behalf of *Ferrovie dello Stato*. Each issue details all railway lines operated on the national territory, integrated with information on tramways, lake, sea, and road passenger services, as well as national and international airlines.

Timetables were published monthly, but in order to process the vast amount of data contained in each issue, one issue from each year has been selected, depending on source availability and taking care of potential biases.[43] Attention has been restricted to connections between Rome and the principal city in each Italian province outside the Lazio region, but the research project aims to reconstruct a matrix of all railway connections. Lines to cities which do not belong anymore to the Italian territory have been dropped to ensure compatibility with data on the post-war period.

Data processed so far concern more than 2,000 outbound and inbound trains travelling on around 102 lines, between Rome and sixty-nine cities. Since cities in the sample are all main destinations, the dataset concerns 'important' journeys, i.e. primary lines connecting big population centres.[44]

The dataset at the current state presents several drawbacks, which will be addressed in the next versions. First, as it concerns only primary cities, it does not catch changes affecting transport at the local level. Since innovation was usually first introduced on main lines (e.g. trains connecting main cities), the dataset can produce upward biased estimates of travel time reduction over the period. For the British case, Leunig found that routes to main cities enjoyed higher average speeds than those to secondary destinations.[45] The same is probably to be expected for the Italian case (see above).

Second, data on the electrification of the network shows that this innovation was widely introduced in the North, whilst in the South it was applied only to the main trunks (par-

[43] Issues used for writing this working paper are: Ministero delle Comunicazioni, *Orario Generale*, anno XXIII – n. 3, Marzo 1921 (Torino, 1921); anno XXIX – n. 5, 15 Maggio 1927 (Torino, 1927); Anno XXX – n. 11, Novembre 1931 (Torino, 1931); anno 39 – n. 3, Marzo 1937 (Torino, 1937)

[44] Cf. T. Leunig, 'Time is Money: A Re-Assessment of the Passenger Social Savings from Victorian British Railways,' *The Journal of Economic History*, Vol. 66, No. 3 (September 2006), pp. 643-646.

[45] Leunig, 'Time is Money,' p. 649.

ticularly, the new railway line from Rome to Naples). Since the dataset does not take into account secondary lines, it probably underestimates the North-South divide in terms of average travel time.

Third, the dataset focuses on lines connecting the main cities to Rome, hence it does not directly capture improvements that affected other parts of the network. This can lead again to a biased estimates in case innovations are clustered in railway lines which are orthogonal to those leading to Rome.[46]

The first two issues will be automatically solved when secondary lines are integrated in the dataset. The third issue will require more advanced techniques and refined data which will be presented in a following paper.

5 Results

5.1 Travel Time and Train Speed in Interwar Italy

Between 1921 and 1937, travel time in the sample decreased, on average, by 29% (– 4h 27m), with a coefficient of variation of 0.55 (Fig, 7. Dropping cities in the islands (for which travel time is affected at the same time by innovation in rail and naval transport) the gain is reduced to 4h 6m. Improvements favoured the North (– 34.4% of average travel time between Rome and the main cities of the North between 1921 and 1937), whereas the Centre and the South fared similarly (– 24.5% and – 24.3%). In absolute terms, however, passengers could now save, on average, 3h 28m when travelling from Rome to the main cities in the South, more than when travelling to the much closer cities in the Centre (on average, -2h 21m). The Islands appear to have narrowed considerably the distance from the capital

[46] As a general example, given three nodes A, B and C, an improvement on the line connecting B and C would benefit A only if A is connected to either node through the third one, or A is sitting in the middle, or the relative cost of using a line falls below a certain threshold. In fact, if the three nodes are connected in triangular fashion (as in the case of Rome, Genoa and Venice), any improvement between two (Genoa and Venice) would not benefit the third one (Rome) unless specific cases apply (e.g. the improvement makes cheaper to go from Rome to Venice through Genoa rather than directly).

(average travel time decreased by 29.2%).

Looking at the compartment level,[47] it appears that the situation in the North was varied, with a clear divide between the North West and the North East. The former benefitted from reductions slightly above the national average, whereas the latter enjoyed a reduction of average travel time to and from Rome by 38.96% over the interwar period. Such reduction was even higher for the compartments of Venice and Trieste (43% and 40%, respectively).

In general, it appears that the improvements of the interwar years favoured the connection between the western and the eastern coast of the country, which had been missed in the previous infrastructural pushes and that had been lamented during parliamentary debates (Fig. 7).[48]

I also compute average speed using rail distance between Rome and the sixty-nine destinations. Train speed increased, on average, by 15.97 km/h, over the period 1921-1937. Variation is high though, and comparisons between compartments are difficult to make because of different starting points and geographical conditions. (Fig. 9). It is however possible to compare in which periods compartments gained most from improvements.

On average 41% of the speed increase in the whole sample was accrued between 1921 and 1927, whilst 42% dated between 1931 and 1937 (Fig. 8). However, the figure varies at the compartment level: compartments in the North East show the most similar dynamics, since there more than 50% of the increase in average speed was gained over the period 1931-1937 (74% Bologna compartment, 57% Venice, 56% Trieste). The Turin and Genoa compartment show figures similar to each other, as the variation in average speed was almost half accrued in 1921-27, and the remaining half was spread over the next ten years, concentrating earlier for Genoa (32% in 1927-31) and later for Turin (31% in 1931-1937). Average speed increase in Milan concentrated instead in the period 1927-1937 (60% of the increase). Compartments

[47] 'Compartments' (*Compartimenti*) were railways organisational division of the territory. Before 1946 there were thirteen compartments, their size generally larger than current regions (NUTS 2).

[48] Camera dei Deputati. Assemblea, (154 seduta, 29 Maggio 1926). Resoconto Stenografico. XXVII Legislatura, p. 6069; but see also Camera dei Fasci e delle Corporazioni, (23 seduta, 24 Aprile 1940). Assemblea plenaria. Resoconto Stenografico. XXX Legislatura.1940, pp. 533-534.

on the Adriatic (East) coast received increments later than those facing the Tyrrhenian sea, except for the Naples compartment, whose improvement in average speed was mainly realised in 1931-1937 (83% of the total increase since 1921).

This latter finding is potentially due to the opening of the *direttissima* Rome-Naples, which happened in October 1927, five months later than the data used here for computing speed in 1927. However, the correlation between increments of average speed and variation of electrified tracks is low and not statistically significant throughout the whole period, even if it increases over time. This may imply that the electrification was not the main or only driver of the reduction in travel time. However, the estimate may be biased by the fact that is uses average travel time to and from Rome with the total electrified tracks in each compartment. A more precise estimate will be provided after having coded lines according to the status of electrification of the tracks. This will be done by both using primary sources and geo-referencing original maps of the network.

5.2 Railways, Population and Industrialisation

In this paragraph, I provide very preliminary results on a tentative evaluation of the relationship between railway improvements and macro-economic variables. To perform this analysis, I have digitised provincial data from the industrial censuses of 1927 and 1937-1940.[49] Since these data are aggregated at a higher level (NUTS 3) than railways' almost micro data, results must be taken with careful reserves. I am currently digitising data at the city level, and next versions of this working paper will integrate them in the dataset.

Nonetheless, provincial data can still provide interesting information, because railway data concern the main urban centre in each province. It is arguable that a large share of the economic activity of each province is concentrated in or related to its main city. Hence, improvements affecting railways connections to main cities can directly or indirectly affect the rest of the province.

[49] Istat, *Censimento Industriale e Commerciale* (Rome, 1927), and *Id.*, *Censimento Industriale e Commerciale* (Rome, 1937-40).

The first test concerns the relationship between the railways and population in 1927. We could test, for instance, whether the pre-existing conditions and the improvements of the railway network in the previous years show any relationship with the population in 1927, or whether the population in 1927 shaped the decisions on railway improvements in the following years. Both computing correlations and performing OLS regressions with the available variables, however, finds little significant relationship between the two phenomena. The only exception is the relationship between provincial population in 1927 and railways improvements in the period 1927-1931. There is in fact a positive (0.37) and significant (p-value 0.0017) correlation between population in 1927 and the variation in speed between 1927 and 1931, even after controlling for railway variables in previous years. Correlations between population in 1927 and railway variables in 1921 and 1927 are instead not statistically significant. This may suggest that the second 'push' for improving the network was driven by considerations of the population needs. This is even more significant since the period 1927-1931 accounted for a relatively small improvements in railway performance (see above). However, the result may be biased if both population dynamics and railway improvements were driven by other factors at the provincial level. Further tests on the relationship between railway and economic variables seem to confirm the picture. Both the number of industrial establishments and horse power of industrial engines in 1927 are found to be correlated with railway improvements in 1927-1931.

We could speculate that the missing link between railway variables and industrial activities in 1937 is due to the disruptive economic crisis that had been suffered in the country since the beginning of the decade. In fact, railway improvements may had been planned before this period, and when they were implemented, they did not respond anymore to the necessities of a changed industrial structure. To check the plausibility of this interpretation, careful study of the chronology of investment decisions and of the impact of the economic crisis on the geographical distribution of industrial activities is needed.

6 Conclusion

This paper has presented a novel dataset which for the first time allows the computation of travel time and train speed on the main railway lines in Italy during the interwar period. The analysis has shown the substantial improvements which were gained throughout the period on the total network (−29% of travel time, +41% of train speed, in 1921-1937).

In this sense, it provides a quantitative check to the anecdotical evidence proposed by the pre-existing literature. Moreover, it adds a new dimension to the analysis, as it allows to map improvements at the local level. Aggregating by compartments — which provides a figure close to the regional level — shows that the biggest improvements were enjoyed by the North-East (−39% average travel time to and from Rome, +62% average speed). In general, the Adriatic (East) coast seems to have gained in terms of connection to Rome (+33% travel time, +50% speed). The North-West, instead, already showed high speeds in 1921, and improvements were not as large.

Looking at the chronology, it appears that improvements in the North clustered in the first ten years, whilst the South mainly received them in the second decade, a pattern which is in line with the electrification of the network. However, correlation between the electrification and service improvement is low, hence improvements may depend also on other causes, such as innovation in the locomotive fleet, or organisational changes. Further research will allow to disentangle such effects.

Comparing railway improvements with data from the industrial censuses, we do not find strong relationship at the provincial level. This may imply that railways were ineffective, both at stimulating industrial activities and at adapting to its present needs. However, estimates may be biased if changes happened within provinces. Hence, a more refined dataset will be constructed to perform more precise tests which would take into account the geographical dimension. The only exception is the year 1927, for which provincial population and main industrial variables appear significantly correlated with railways improvements in the following period (1927-1931). This may imply that railway investments during that period were directed to the transport needs of the industries. Further analysis will allow to test these hypotheses.

Bibliography

- A. Brunetti, E. Felice, and G. Vecchi, 'Income,' in G. Vecchi (ed.), *Measuring Wellbeing. A History of Italian Living Standards* (Oxford, 2017)
- M. Fujita, P. Krugman, and A.J. Venables, *The Spatial Economy* (London, 1999)
- M.J. Beckman and J.F. Thisse, 'The Location of Production Activities,' in P. Nijkamp (ed.), Handbook of Regional and Urban Economics, Volume I, (Elsevier, 1987)
- J.F. Thisse, 'Location Theory,' in S.N. Durlauf and L.E. Blume, *The New Palgrave Dictionary of Economics*, 2nd edn (2008)
- S. Brakman, H. Garretsen and C. van Marrewijk, *An Introduction to Geographical Economics* (Cambridge, 2001)
- P.R. Krugman, 'On the Relationship between Trade Theory and Location Theory,' *Review of International Economics*, 1/2 (1993)
- P. Krugman and A.J. Venables, 'Globalization and the Inequality of Nations,' *The Quarterly Journal of Economics*, Vol. 110, No. 4 (Nov., 1995)
- P. Epifani, 'Heckscher–Ohlin and agglomeration,' Regional Science and Urban Economics, 35 (2005)
- T. Gutberlet, 'Mechanization and the spatial distribution of industries in the German Empire, 1875 to 1907', Economic History Review, 67, 2 (2014), pp. 463-491
- A. Fernihough, and K. O'Rourke, 'Coal and the European Industrial Revolution', CEPR Discussion Papers, no. 9819 (2014)
- N. Crafts and A. Mulatu, 'What explains the location of industry in Britain, 1871–1931?', *Journal of Economic Geography*, 5 (2005), pp. 499-518
- A. Klein and N. Crafts, 'Making sense of the manufacturing belt: determinants of U.S. industrial location, 1880–1920,' *Journal of Economic Geography*, 12 (2012), pp. 775-807
- P. Combes, M. Lafourcade, J.F. Thisse, and J.C. Toutain 'The rise and fall of spatial inequalities in France: A long-run perspective,' *Explorations in Economic History*, 48 (2011) 243-271

- M. Griffo, ‘Il meridionalismo nazionale di Giustino Fortunato,’ in S. Cassese (ed.), *Lezioni sul meridionalismo* (Bologna, 2016)
- V. Zamagni, *Industrializzazione e squilibri regionali in Italia*, (Bologna, 1978)
- L. Cafagna, *Dualismo e sviluppo nella storia d’Italia* (Venezia, 1989)
- E. Felice, *Divari regionali e intervento pubblico* (Bologna, 2007)
- V. Daniele and P. Malanima, *Il Divario Nord-Sud in Italia 1861-2011* (Soveria Mannelli, 2011)
- B. A’Hearn and A.J. Venables, ‘Internal Geography and External Trade: regional disparities in Italy, 1861-2011,’ *Quaderni di Storia Economica*, n. 12, Banca d’Italia, October 2011
- Ciccarelli and S. Fachin, ‘Regional Growth with Spatial Dependence: a Case Study on Early Italian Industrialization,’ Quaderni di Storia Economica, n. 35, Banca d’Italia, January 2016
- G. Iuzzolino, G. Pellegrini, and G. Viesti, ‘Convergence among Italian Regions, 1861-2011,’ Quaderni di Storia Economica, n. 22, Banca d’Italia, October 2011
- P. Martinelli, ‘Von Thünen south of the Alps: access to markets and interwar Italian agriculture,’ European Review of Economic History, 18 (2014), 107–143
- A. Missiaia, ‘Where Do We Go From Here? Market Access and Regional Development in Italy (1871-1911),’ European Review of Economic History, 20 (2016), pp. 215-241
- W.W. Rostow, *The Stages of Economic Growth* (Cambridge, 1960), p. 55 and pp. 60-62
- G.R. Hawke, *Railways and Economic Growth in England and Wales 1840-1870* (Oxford, 1970)
- P. O’Brien, *The New Economic History of the Railways* (London, 1977)
- S. Fenoaltea, *The Reinterpretation of Italian Economic History. From Unification to the Great War* (Cambridge, 2011)
- S. Fenoaltea, ‘Italy’ in P. O’Brien (ed), *Railways and Economic Development, 1830-1914* (Oxford, 1983)
- G. Federico, ‘Market integration and market efficiency: The case of 19th century Italy,’ *Explorations in Economic History*, 44 (2007), pp. 293-316
- A. Schram, *Railways and the Formation of the Italian State in the Nineteenth Century* (Cambridge, 1997)
- A. Missiaia, ‘Regional Market Integration in Italy During the Unification (1832-1882),’ LSE Economic History Working Papers No.48325 (2009)

- Boyd, J. H., and Walton, G. M. (1971). 'The Social Savings from Nineteenth-Century Rail Passenger Services,' *Explorations in Economic History*, 9, 233-254. https://doi.org/10.1016/0014 4983(71)90059-3

- W. J. Baker, 'Railways and Economic Growth in England and Wales, 1840–1870 by G.R. Hawke' (Book Review), *The Journal of Economic History*, Vol. 31, No. 3 (Sep., 1971), pp. 718-719

- A. Fishlow, 'Railways and Economic Growth in England and Wales, 1840–1870 by G.R. Hawke' (Book Review), *Journal of Economic Literature*, 10, No. 1 (1972), pp. 75-76

- Leunig, T. (2017). 'Time is Money: A Re-Assessment of the Passenger Social Savings from Victorian British Railways,' *The Journal of Economic History*, 66(3). https://doi.org/10.1017/S

- [50]

- Camera dei Fasci e delle Corporazioni, (23 seduta, 24 Aprile 1940). Assemblea plenaria. Resoconto Stenografico. XXX Legislatura.1940, pp. 533-534

- F. Aglianò and S. Spataro, 'Tavole Statistiche' in P. Spirito et al., *Le Ferrovie Italiane tra Stato e Mercato* (Rome, 1996)

- Maggi, *Storia dei trasporti in Italia* (Bologna, 2009)

- M. Moraglio, 'Real Ambition or just Coincidence? The Italian fascist motorway projects in inter-war Europe,' *The Journal of Transport History*, 30/2 (2009), pp. 168-82

- Istat, *Sommario di Statistiche Storiche, 1926-1985* (Roma, 1986)

- Maggi, *Storia dei trasporti in Italia* (Bologna, 2013)

[50] Camera dei Deputati. Assemblea, (154 seduta, 29 Maggio 1926). Resoconto Stenografico. XXVII Legislatura, p. 6069

Figures

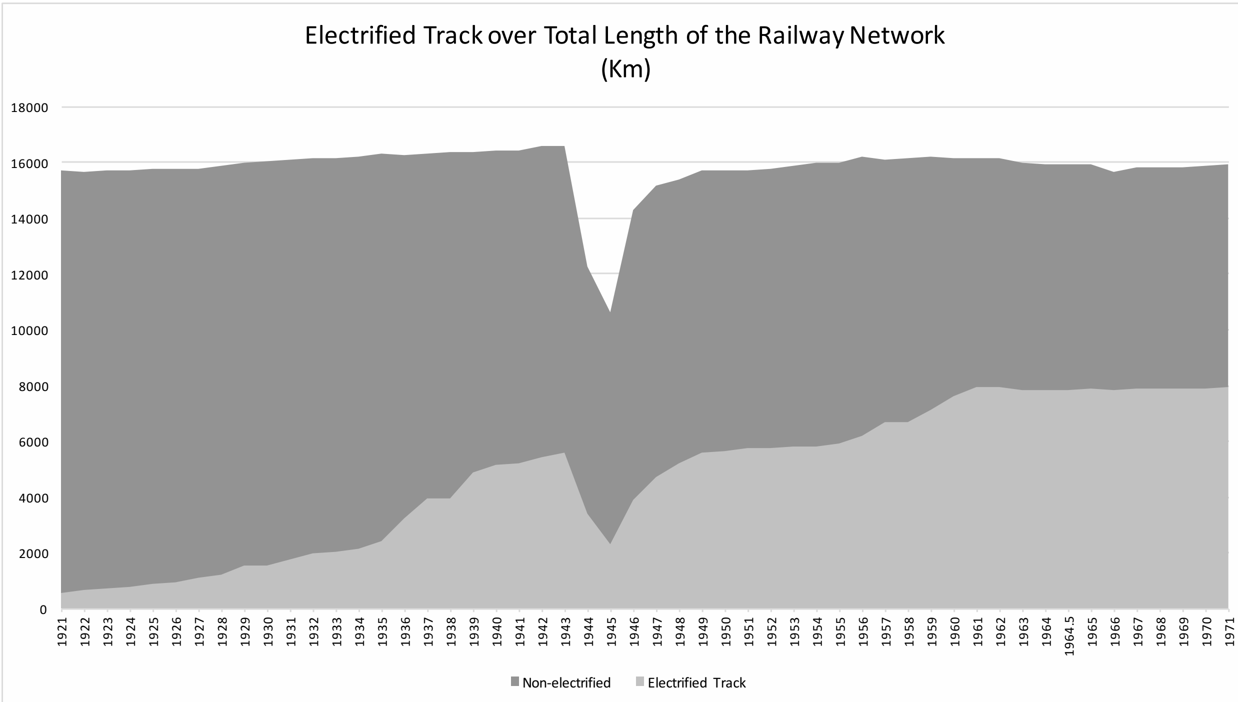


Figure 1: Electrification of the Network

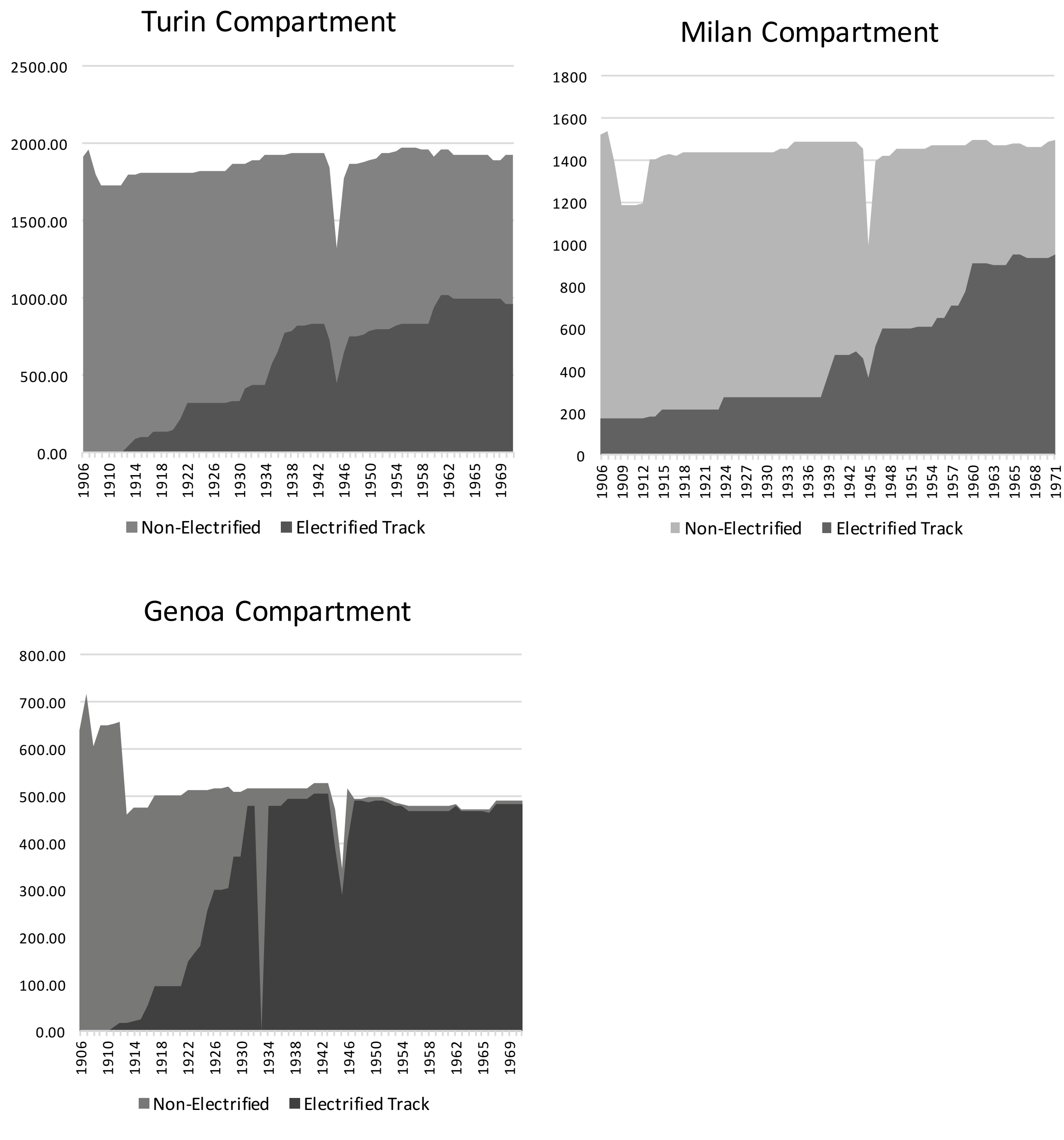


Figure 2: Electrification by Compartment

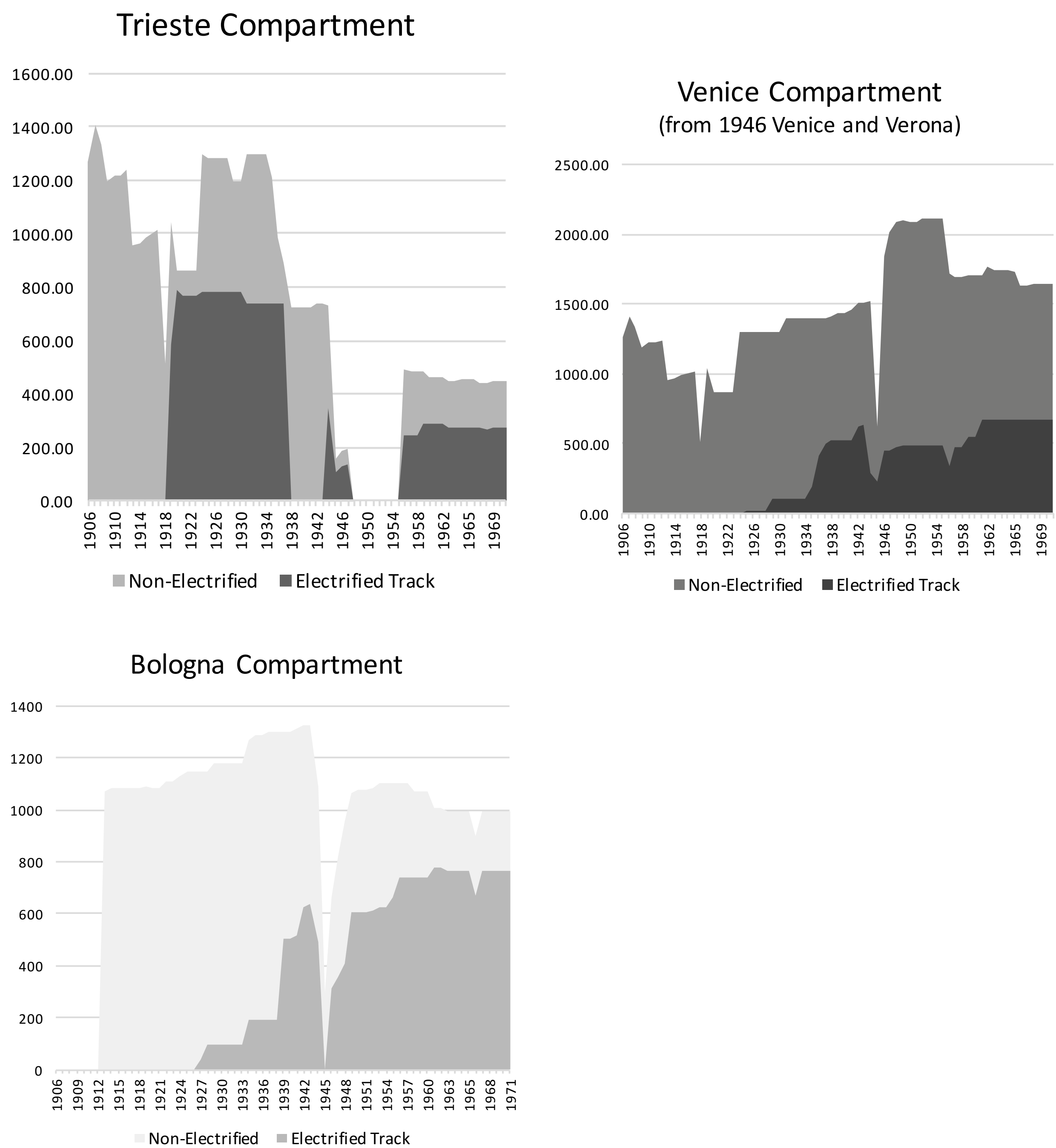
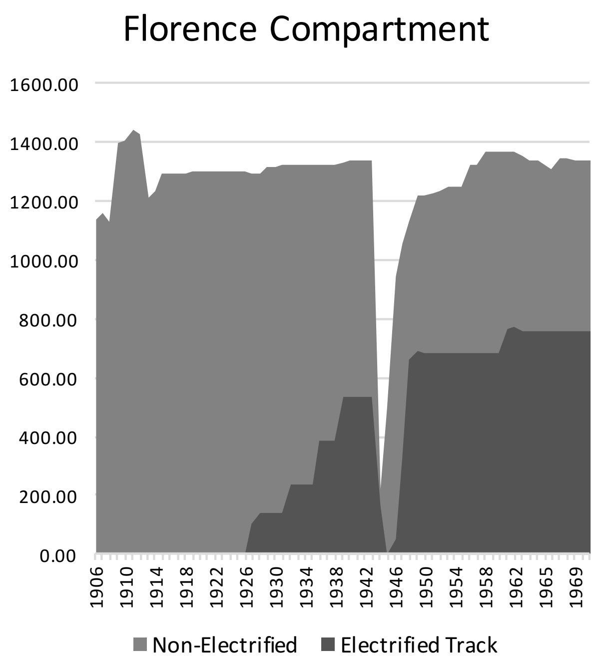


Figure 3: Electrification by Compartment (follows)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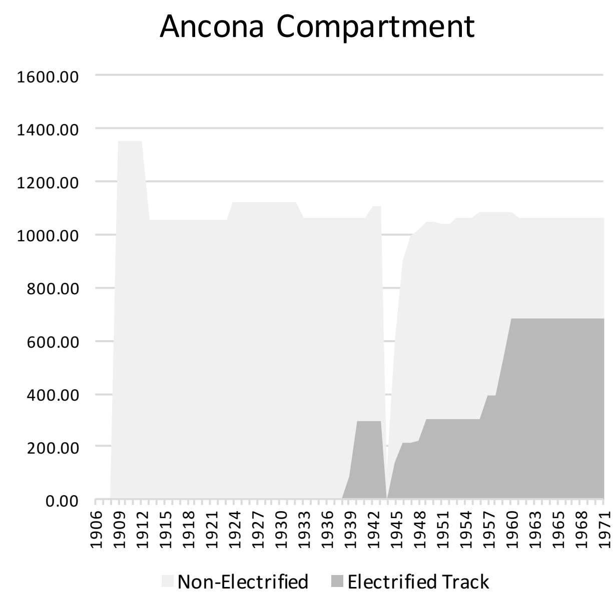
Non-Electrified
Electrified Track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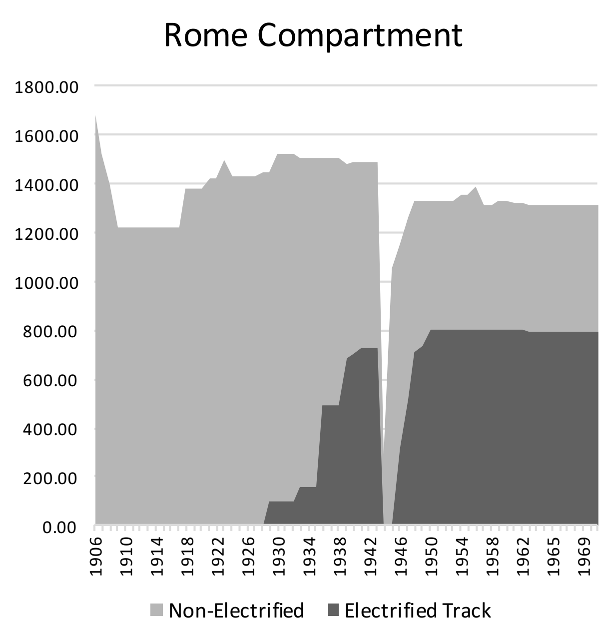
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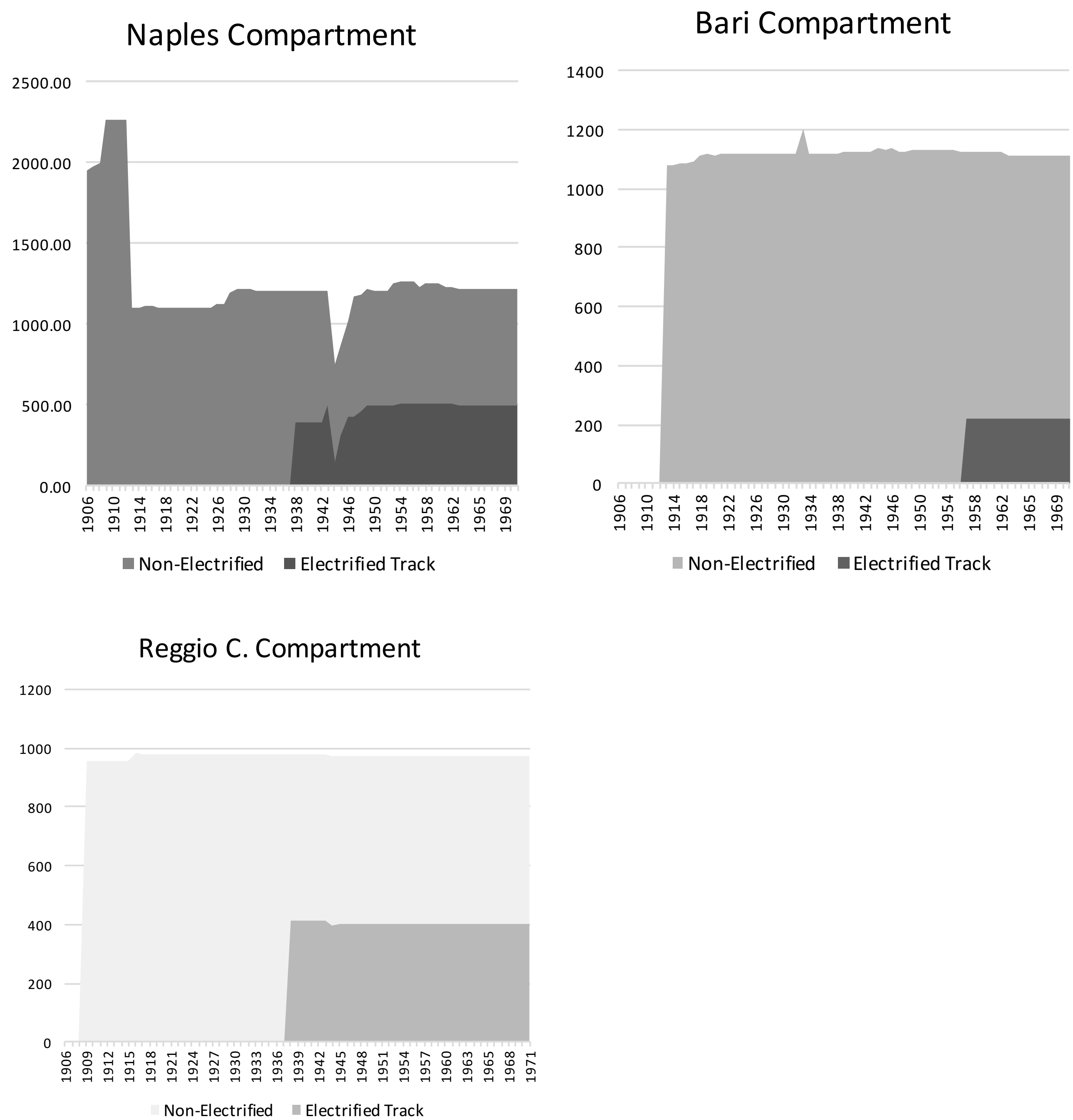

Figure 4: Electrification by Compartment (follows)

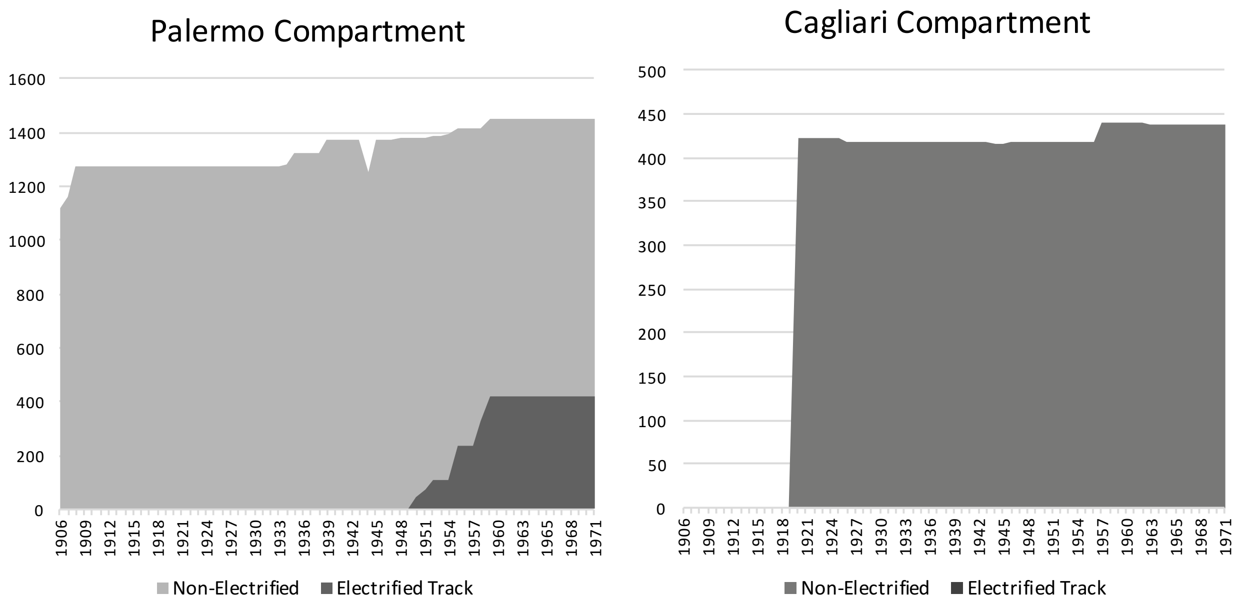

Figure 5: Electrification by Compartment (follows)

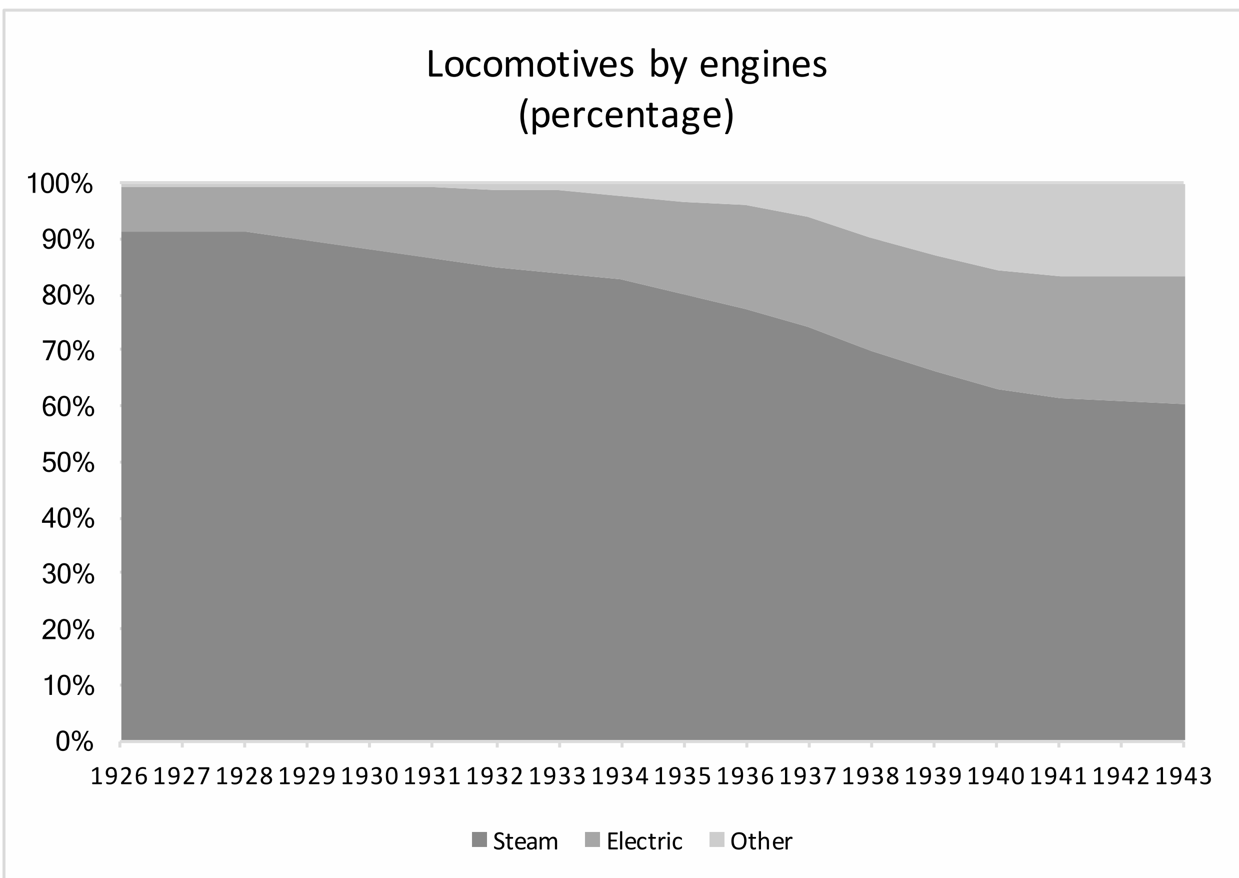

Figure 6: Evolution of Locomotives

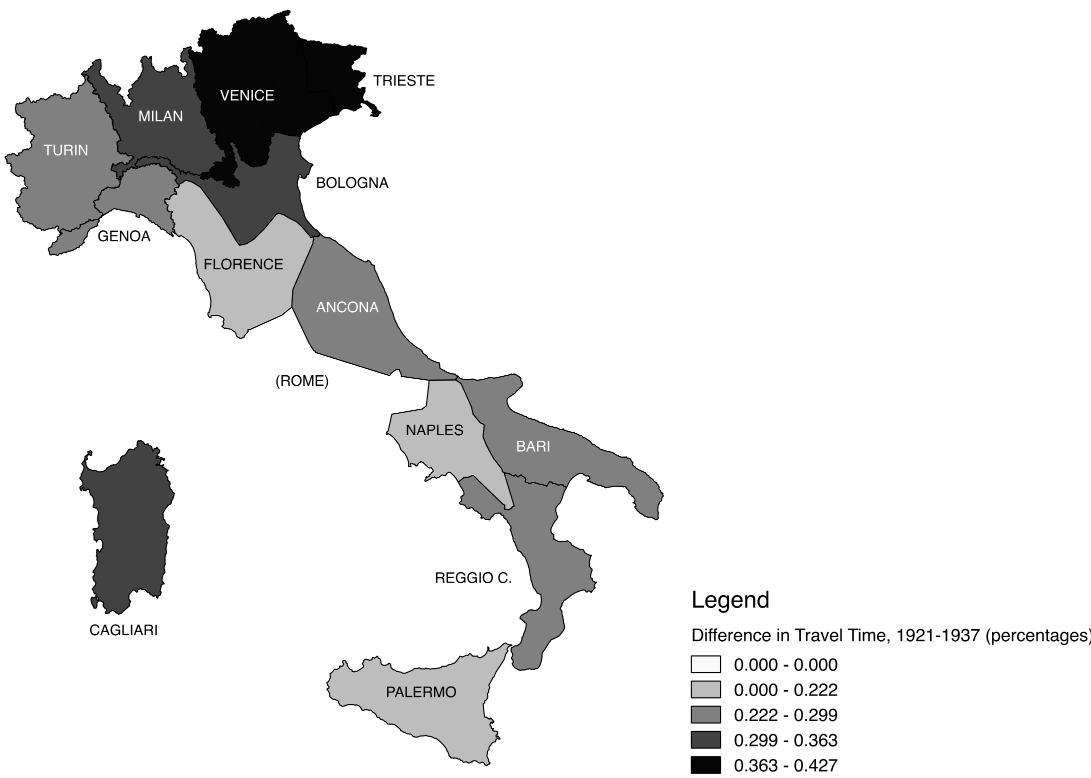

Figure 7: Average Reduction of Travel Time by Compartment. Compartments are named after their main city.

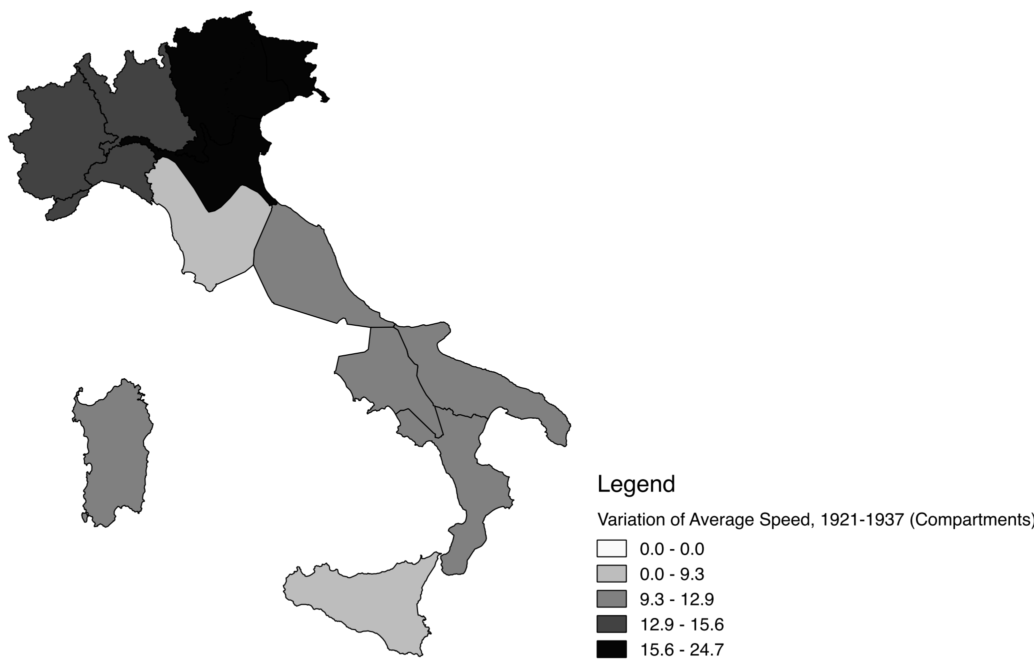

Figure 8: Average Increase of Train Speed by Compartment (km/h).

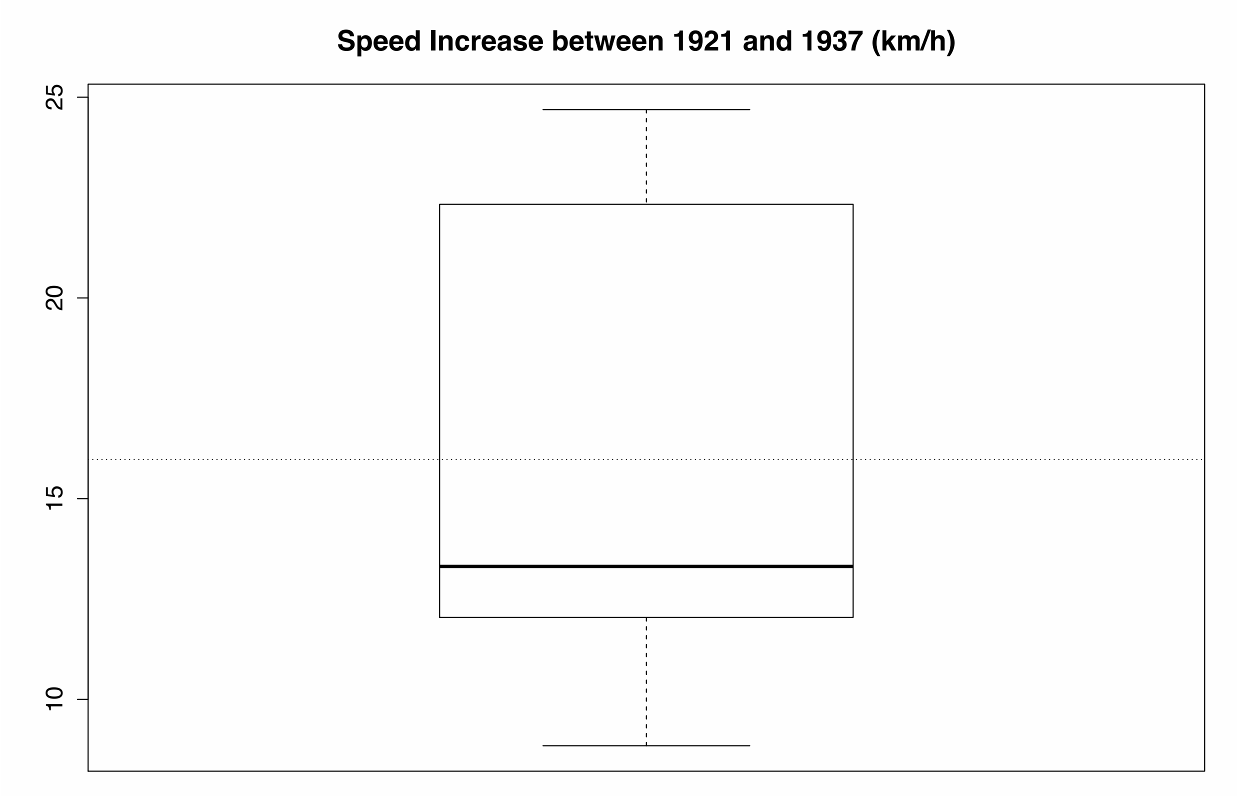

Figure 9: Average Speed Increase at the Compartment Level in 1937-1921. The dotted line indicates the mean.

Appendix

Destinations included in the dataset

Ancona	Ascoli Piceno	Chieti	L'Aquila
Macerata	Perugia	Pesaro	Teramo
Bari	Foggia	Lecce	Potenza
Bologna	Ferrara	Modena	Padova
Parma	Piacenza	Ravenna	Reggio nell'Emilia
Rovigo	Cagliari	Sassari	Arezzo
Firenze	Forli	Grosseto	Livorno
Lucca	Massa	Pisa	Siena
Genova	Porto Maurizio	Bergamo	Brescia
Como	Cremona	Mantova	Milano
Pavia	Sondrio	Avellino	Benevento
Campobasso	Napoli Centrale	Salerno	Agrigento
Caltanissetta	Catania	Messina	Palermo
Siracusa	Trapani	Catanzaro	Cosenza
Reggio di Calabria	Alessandria	Cuneo	Novara
Torino	Trieste	Udine	Belluno
Trento	Treviso	Venezia	Verona
Vicenza			