A TAXONOMY OF INFRASTRUCTURE FINANCING IN EUROPE ON THE LONG RUN (12TH-18TH CC.)

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Working Paper n. 2013-03
Gennaio 2013
A taxonomy of infrastructure financing in Europe on the long run  
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Abstract

This paper intends to trace the evolution of the financing solutions devised by some European countries to create their infrastructure framework. Starting from some indications on the Roman Age, when the first main public work was constructed, the analysis focuses on the Middle Ages and on the Early Modern Age. The primary goal is to elaborate a taxonomy pointing out the varied and different instruments developed over time to finance consistent works, targeted to provide services and facilities to the highest number of citizens. We concentrate specifically on ‘economic’ infrastructures such as roads, canals, bridges, water and sewer lines. Most of the current historiography has unduly projected the successful financing of today’s leading countries onto the past, measuring only the distance of the previous specific financing means from an ideal current pattern. This stance led mostly to fictitious narratives. Highlighting the context-dependent specificities, this research conversely aims to draw a picture of how manifold and interrelated infrastructure financing were in the pre-industrial Europe and how they were highly performative related to their institutional, social and political background. Our preliminary result is that the effectiveness of infrastructure financing ways is strictly correlated to a set of variables that dynamically encompass institutions, political regimes, supply-side and demand-side factors, whose interplay determines a path-dependence.

Keywords:
Financial History, History of Infrastructure, Pre-industrial Europe.

JEL codes:
N 23, N 13, N43, N73.

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1 An earlier version of this paper was presented at the XI Milan European Economy Workshop, June 22-23 2012. The MEEW was supported by the Jean Monnet Chair of EU Industrial Policy and the EIBURS program. The usual disclaimer applies. We are thankful to Massimo Florio and Hugh Goldsmith for their helpful comments. The support of EIBURS is gratefully acknowledged.  
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Introduction

Infrastructure is a wide and tangled matter and the specific literature abounds of studies which have usually focused on its technological aspects, or its economic outcomes, or again considering one single sector or one limited historical period. Nowadays infrastructure represents, with no doubt, one of the key factors fostering economic development and social modernization; its provision shows alluring benefits. However, it is still hard to state whether infrastructure has been a driving force leading to development and growth or conversely the upshot of an economically advanced society. Studies that looked at the past in order to investigate into the cause-effect relationship, turned out to make an attempt to understand the historical period not on its own terms but strictly in terms of its distance from the contemporary practice, commonly in order to validate it.

Hence, the analysis of how infrastructure had been financed in the long run may allow us to better delve and grasp the inner dynamics of infrastructure provision, concentrating on one of the most determinant, as well as bias-reconstructed, elements of its success or failure. A long-run overview implies several warnings. First, the definition of the term. Infrastructure in the past civilization refers to something different from what we intend nowadays, nevertheless, a common meaning can be found. Moreover, many of the clear-cut categories used to be adopted in the debate on infrastructure do not match with the distinctions employed today: overlapping is very frequent. Second, the public/private dichotomy which traditional historiography has been concentrating on for long has been overcome by a more nuanced and articulated approach; according to it, public and private present moving borders. Over time the concept and the boundaries of the State’s action and commitments are radically changing both on a theoretical and a concrete level. Its forms of intervention have been transforming together with the evolution of the settlement of its jurisdiction: from direct intervention to concessions, from exploitation of common goods to the use of fiscal revenues.

We focus on the financial means acted out to realize infrastructure and we aim to create a taxonomy defining the financial solutions adopted over time and by different societies, like for instance the compulsory labour (corvées), the deliberate support by the aristocracy, local and central taxes and indebtedness, other financial instruments and private/public partnerships. Infrastructure, as above mentioned, can be an all-embracing term; in this study have limited our analysis to ‘economic’ infrastructures, such as roads, canals, bridges, water and sewer lines.

We try to avoid a very common teleological bias according to which most of the current historiography has projected onto the past the successful solutions of the leader country’s present time, stating that all the other financing systems used in the past were inefficient and that the price-making market, populated by maximizing actors, appears as the only natural allocation system to which the humankind tended. We regard history as a field for research and analysis rather than the simple
aggregate of facts to pillage in order to corroborate a theory, as in cliometrics and new institutionalism.

The research intends to draw a picture of how manifold and interrelated infrastructure provisioning and financing are in past societies in terms of social preferences, economic structures, technological advance and political regimes. Thus the importance of context-dependent specificities has been stressed. Our hypothesis is that the effectiveness of an infrastructure financing system is correlated to a set of variables that embraces both supply-side and demand-side factors, whose interplay is path-dependent. Such a historical narrative, deeply involved with the institutional and social factors, may afford an appropriate method for understanding issues affecting specific financing choices, over centuries and over Europe.

Obviously, the paper does not presume to be exhaustive nor to cover the entire range of typologies of infrastructure financing. However, in order to avoid cherry-picking representative case studies from Italy, England, France and Germany have been selected.

Before spanning this general overview, a remark on the term ‘finance’ and ‘infrastructure’ is required in order to define the research field. With finance we refer to all financial instruments, both public and private, used to fund the realization of this kind of public works. With the term infrastructure we intend works made either by governments or private individuals or groups, to be benefited by citizens and that allowed social and economic development of societies. The etymology of the term ‘infrastructure’ has Latin roots and is composed by two words: *infra* which comes from *infera* (below) and *structura* which derives from *structo*, the supine form of the Latin verb *struere* that literally means to put layers, one above the other or one near another. The widespread use of this word in English is rather recent and comes from France where such expression has entered the common vocabulary since the second half of the 19th century. In the English speech the term infrastructure was applied for the first time in 1927 in a military context and referred to the stable military installations needed to the defence of a country. Despite its recent diffusion, the underlying meaning - namely the physical components of interrelated systems providing commodities and services essential to enhance societal living - was present already in the antiquity such as the Greek and the Roman societies.

Evidence of public works built to provide services and facilities for the community are present even earlier, almost 15,000 years ago, among the Aegeans. These people coming from the Aegean area were forced, by the new geo-topographical developments and conditions to develop the skills required for communication and commerce, becoming great navigators and merchants; “thus by necessity, advanced infrastructural societies were developed and predominated the whole Mediterranean area” ². Later, in 1450 BC the Minyers developed a precocious technology for irrigation which was used to drain out the plain of Copais because this area was flooded by the waters of the nearby rivers of Melana and Kifisos. For this purpose they constructed a huge canal, 43 km long, 40 mt high, and 5 mt deep,

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known as the Mynyer Canal to support the water flow, and an advanced sewer system 2.500 mt long, 1.5 mt wide, and 1.8 mt high.

Yet, it is only during the Greek and Roman civilizations that an outstanding and systematic framework of infrastructure was realized. Under the democratic reign of Pericles in 5th-century BC Greece, infrastructure was financed by the State, whose expenditure was equivalent to about 1/5 of the Gross National Income, much higher than the Rome of Augustus, where the government’s expenses were 5% of the total amount of the revenues. The Greek total expenses have been estimated around 1,000 talents and the alleys’ tributes about 600 talents per year. The main source of the incomes were constituted by the silver mines of Laurio which provided from 50 to 100 talents per year. Other three relevant sources created the State’s wealth: custom rights, namely the rate on 1% on import, export, etc. (around 20 talents per year), taxes on the Metecs (48 talents per year) and on the slaves’ import and sale (38 talents per year). Much less was the amount of Roman Empire’s expenses during the reign of Augustus (30-23 BC), which amounted at 5% of the total revenues.

1. The Roman Age: Aerarium, Fiscus and Compulsory Labour.

With the Roman civilization, we chart the first attempts to realize a wide net of infrastructure, serving for many different uses, from military goals – such as roads and bridges – to more common and social purposes, such as aqueducts, public fountains, supplied to the population as a benefit, in order to enhance the citizens’ living standards. Public and ambitious works were not built with merely economic or strategic and military aims, but also with the goal of civilizing their peopole and transmitting such civilization and magnificence to the future generations. The road network, as well as the aqueducts system, constituted an emblematic example of infrastructure built in a systematic way and in a European dimension. According to the specific historical period significant changes occurred in the infrastructure financing system, which shaped some patterns that would persist in the following eras.

5. Ibid.
6 In the Republic Age, and especially during the Empire.
7. Evidence of infrastructure such as sewage were present also in the Greek society, yet there lacked that systematic plan, which conversely characterized the Roman society. Roads were not paved, in the Greek society and the drainage system unknown, before the Roman age. See Goodchild, Forbes, Strade e comunicazioni sulla terraferma. Con un paragrafo sui porti, sulle darsene e sui fari, p. 536. See also E.M. Steinby, Edilizia pubblica e potere politico nella Roma Repubblicana, Milano 2012; A.D. Bianco, Aqua ducta, aqua distributa. La gestione delle risorse idriche in età romana, Torino 2007.
8. See Erdkamp, in Rosenstein & Morstein – Marx, 2006, p. 284. The first issues of silver coins by Rome, during the Republic age (509-32 BC) were minted in Campania around 310 BC. They were
To build their infrastructure, in particular aqueducts, fountains, roads and bridges, the Romans mainly used:

- **Aerarium** (Republican age: 509-31 BC); namely public money raised by the administration of the Roman State. In the Republican Age the biggest part of the revenues were constituted of taxes levied on the provinces and the incomes of the Ager Publicus
- **Fiscus** (Empire Age: 31 BC-476 AD); this included the State’s and the Provinces’ money (res publica) as well as the Emperor’s own money (res privata). In this period res publica and res privata often coincided.
- War booties⁹ (for instance, the bridge-viaduct on the Flaminia road).
- Fines
- Compulsory (unfree and unpaid) labour
- Evergetism (the Agrippa bridge, Neroniano and Elio bridges, placed in Rome, were firstly built for private use and subsequently for public utilization); indeed, some public works were directly financed by private citizens either for charity or for spontaneous evergetism¹⁰. Evergetism is the use, widely spread in the Hellenist world and in the Roman Empire, to deliver gifts to the community, apparently in a selfless way but in order to win favour. The reasons which underlay such actions are at least twofold: on the one hand, by constructing public works they aimed at increasing their personal prestige, on the other hand, however, the citizens interwove a special relation with his/her city, the Urbis, which was felt as the heimat, an ethic and social element, a fundamental reference point for human existential goals. Charity actions in the Roman age were devoted firstly to the city in order to increase personal prestige, as above mentioned, but also because it was felt as a sort of social obligation. The city was perceived as an extension of the familia and of the gens.

According to the Codex of Giustinianus (534), every inhabitant of the Roman empire was obliged to contribute in the maintenance and repair of roads as well as bridges: “ad instructiones reparationesque itinerum pontiumque genus hominum […] cessare oportet”¹¹. The minor communication system, routes and tracks in the rural communities would create the basis on which the Medieval communication system probably issued to pay for the construction of the road, the so called Via Appia, but might also have been minted to pay the aqueduct Aqua Appia.


¹⁰. The term come from Greek εὐεργετέω, which means: “I do good things”. It was an expression created by the French historian A. Boulanger in 1923 and referred to the Classical world, specifically the practice of giving gifts to the community by wealthy people or members of the aristocracy; see P. Gauthier, *Les cités grecques et leurs bienfaiteurs*, Athens-Paris, 1985.

would develop\textsuperscript{12}. In the latter case, the maintenance was committed to the ‘pagans’ or pagi, that were the inhabitants of the rural districts\textsuperscript{13}.

3. Roads, Bridges and Canals in the Middle Ages: Corvées and Tolls

As the Roman Empire fell in 476 AD, a central authority lacked and along with it the issue of building a large network of infrastructure. Hence, infrastructure underwent a process of gradual deterioration loosing at the same time the overriding role they played during the imperial age. Landowners often claimed for the permission to raise tolls of nearby stretches of roads useful to finance their maintenance. Sometimes small communities or private citizens collected sums of money to repair or improve roads, bridges, canals and ditches. But, without a central government such interventions were episodic and asystematic\textsuperscript{14}. Besides a general economic and demographic decline, the barbarian raids heavily damaged the facilities system, first of all roads and bridges. Some invaders adopted the same administrative instruments of their predecessors, drawing upon the so called antiqua consuetudo. The responsibility of repairing infrastructure was distributed among different institutions as, for instance, the case of the monastery of Bobbio, which in the second half of the 9th century was committed by Lodovico II to repair 18 metres, or more precisely the eleventh part, of the Ticino bridge in Pavia\textsuperscript{15}. There is evidence that in Istria the Francs compelled the inhabitants to repair stretches of roads, while in the Italian Peninsula decrees obliging the subjects to regularly maintain public works (included streets and bridges) were issued. Nonetheless these were extraordinary events, normally linked to the military campaigns or to the times sovereigns came to Rome to be crowned (i.e. Charlemagne); they constituted the only occurrence in which governments cared about roads. It was firstly an imperial practice, which was subsequently renewed in 1183 with the Peace of Constance, with which the Lombard Communes promised Frederick Barbarossa that they would repair – through financial funds and human force – roads and bridges on his army’s return route\textsuperscript{16}. Yet, this practice was also widespread in the furthest areas, like

\textsuperscript{12} If it is true on the one hand that the Roman road system persisted for centuries, on the other hand it is also true that this was possible thanks to the hard work of the following societies that maintained and improved those main roads, see J-F. Bergier, \textit{Conclusioni}, in Bergier, Coppola (eds), \textit{Vie di terra e d’acqua. Infrastrutture viarie e sistemi di relazioni in area alpina (secoli XIII-XVI)}, p. 253.

\textsuperscript{13} Building a long road implied stops along the path for water provision. The Roman roads had water wells and tanks every 50 kilometers, see Goodchild, Forbes, \textit{Strade e comunicazioni sulla terraferma. Con un paragrafo sui porti, sulle darsene e sui fari}, p. 505. They were also marked by milestones which were useful not only for measuring the distance, but also for managing their maintenance. Ibidem, p. 516. Along the roads there were also “poste di cambio dei cavalli e stazioni più grandi e ostelli”, the so called mansiones. Such mansiones will serve in the future too as central offices that collected taxes, ivi, p. 521.

\textsuperscript{14} Ivì, p. 531.


England where Edward I, during the wars in Wales, ordered to the communities to directly care and finance the maintenance of roads to facilitate the passing of his army.\(^\text{17}\) He gave the cities like Northampton the permission to raise a tax in order to pave the roads. Such a tax was estimated and based on the type of transported goods and of vehicles. Sometimes private citizens, imbued with a high public spirit, lavished money on building city roads or other public works. In London and in the nearby area, about 36 roads were financed by members of the urban elite\(^\text{18}\).

At the beginning of the 12th century a new age opened up, and the communication system became a central issue in the political agenda of governments. A new social and economic scenario was shaping: on the one hand, the medieval commercial revolution took place with the rapid increase of commercial exchange, on the other hand, a new local administrative institution, the Commune, was born (which was independent from central power and self managed its territory); finally the first embryonic forms of national monarchy were developing. In 1170, the Commune of Vimodrone, near Milan, had to fulfil the commitment of the so called vicinanza, that is the obligation of participating in the repair of churches, water sources, as well as roads and bridges. Such duties recalled the Roman law according to which all the inhabitants of the pagus (village) had to contribute to the maintenance and building of public works\(^\text{19}\). The same applied for the ditches built for irrigation and benefiting agriculture and manufacture of different communities. The Roggia\(^\text{20}\) Serio, near Bergamo, was built at the beginning of 1200\(^\text{21}\). The Commune of Bergamo that built the ditch divided the work into the rural communities living on the boundaries of the watercourse. Many private pieces of land were expropriated, justified by the higher ideal, namely the irrigation of many rural areas. The works involved several Communes, specifically Treviglio, Antegnate and Calvenzano, and also ecclesiastical institutions, the urban elite and other municipal organizations. Ditches and canal building were managed by specific individuals and institutions. At the top there were the podestà, the console and the Consiglio di anziani, who appointed specific people to control and maintain both canals and bridges\(^\text{22}\). Beside the initiatives spurred by local authorities, there is also evidence of enterprises undertaken by groups of private citizens or corporations of communities, especially in unfriendly territories, as is the case of Ru Curtot in the Aosta Valley, in the North-West of Italy\(^\text{23}\).

In the areas at the East of Rhein, where isolated regions started being inhabited, new roads were set up but only where they were needed; in the more populated Western areas, conversely, continuity and innovation dynamically interacted and increased. The array of promoters enlarged and, if at the beginning of the century

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20 Roggia means the irrigation ditch.
22. Ivi, p. 102.
23 This specific case study has been investigated by Massimo Florio, *Corvée versus money: Microhistory of a water infrastructure in the Alps, the Rû Courtaud*, 1393-2013.
works on roads were mainly provided by local ecclesiastical institutions, such as monasteries\textsuperscript{24}, or by lay organizations and also by wealthy citizens\textsuperscript{25}. From the second half on, the local authorities took interest in the ways of communication, making it a central issue of the government activity.

In England, between 1114 and 1118, the Laws of Henry I (\textit{leges Henrici I}) were issued; they constituted the most ancient legislative document including laws concerning roads and obliged all subjects to participate in maintaining and repairing bridges and road structures. Such obligations were not a burden on individuals, albeit on the real estate, namely on the properties embodying the infrastructure\textsuperscript{26}.

At the beginning of the 13th century England adopted and extended the financing tool of toll collection – that appeared in a subsidiary area of the late Roman Empire – that characterized its way of infrastructure financial provision. The first one to be created was the \textit{pavage}, namely a toll for the maintenance of roads. The king gave concessions to collect the pavegge either to a private citizen, normally an entrepreneur, or to a corporation of the city, or to the ‘good men’ of a community. Grants given to the city were related to the possibility of paving streets, while grants given to the rural villages referred only to the possibility of repairing some stretches of roads – normally those connecting the countryside to the city of London. In 1249 the first grant of pavegge was issued to the town of Beverley in Yorkshire; born with the cult of St John of Beverely, it gradually remained permanent. In 1266 another oldest grant was given to Shrewsbury in order to pave the new market place\textsuperscript{27}. The second type of toll was the \textit{pontage}, which was levied specifically to repair bridges. Similar to the pavegge, the pontage was a grant given by the king for a limited period of time. If by that term works were not completed, such grants could be extended. The first pontage for bridges were Ferrybridge, Yorkshire and Staines, on the river Thames; 370 grants were issued to build the three bridges\textsuperscript{28}.

Between 1185 and 1283, in Northern France and in the German territories several legal documents faced in detail the issues concerning building and imposing a set of \textit{corveés} (compulsory unpaid works). They also obliged nobles, clergymen and

\textsuperscript{24} After having funded the monastery of Saint-Sauveur in the Cevannes, St. William had a new road opened in order to make the community easier to reach, see T. Szabó, \textit{Comuni e politica stradale in Toscana e in Italia nel Medioevo}, Bologna 1992, p. 47. In 1292 the bishop of Verona Pietro della Scala improved the road leading to the new monastery recently settled by the Dominicans, by pulling down the nearby house (that he himself donated to the friars) so that the believers could easily reach the religious house”; see G.B. Biancolini, \textit{Notizie storiche sulle chiese di Verona}, Verona 1749, Libro II, p. 555.


\textsuperscript{28} \textit{Ibid.}
citizens to cover the costs for the maintenance of roads, on the basis of a proportional apportioning settled by a specific commission\textsuperscript{29}. In 1235, in the Alps region for the first time a new law was issued stating that the landowners who received tolls through main roads and bridges, were also obliged to maintain and repair them\textsuperscript{30}. Indeed, along with the ruin of the Roman Empire, a legal dualism came to characterize Europe: in Italy and the Mediterranean areas Roman law continued to be observed, while in the central and northern regions it declined and the customary law became absolutely prevalent\textsuperscript{31}.

In the Italian Peninsula cities were economically expanding and growing thanks also to a good transportation system. Cities here were in charge to keep the road infrastructures in good conditions. With the emergence of the Communes, public administrative structures able to take on new and more complex tasks stemmed out. Furthermore, under the relevant influence of Roman law (Bartolo da Sassoferrato, Ubaldo degli Ubaldi) roads and bridges were again regarded public good.

With the rise of the Communes, in northern Italy, the building of roads and bridges is again a State’s goal under specific administrations, constituted by their own offices and officers (see i.e. \textit{boni homines}, \textit{suprastans}, \textit{viarius} in Pisa, Siena, Spoleto and Como)\textsuperscript{32}. The cities’ infrastructure policy can be divided into two distinct phases: in the first one, the rural areas were embodied in the municipality jurisdiction; in the second one, roads and bridges outside their own boundaries were maintained or newly constructed according to inter-territorial agreements. In the latter phase a crucial and propelling role was played by the merchants, as they knew most of the routes, hence the local administrations relied on their expertise.

Between 1100 and 1350 this new attitude of public powers towards road infrastructure led to the creation of a road network in Europe, maybe less sound than the Roman one, yet much more flexible and diversified. Cities and big rural communities were linked to each other not by highways, but by many different minor roads and ways which offered alternative routes. The great works of the 12\textsuperscript{th} century involving drainage and reclamation of new lands – which were realized in order to meet the soaring food demand due to the increasing population – allowed the building of roads even at the bottom of the valleys. While it is true that the Roman road network had military and strategic objectives, the communication infrastructures of the middle ages revealed a much more commercial character, connecting the large city centres – the focus of business life – to small and distant areas.

\textsuperscript{29} Such public services were calculated on the basis of the property: either on manses, for large properties, or on the pieces of land. Rochester bridge, for example, had to be maintained by different actors, the bishop of the city was committed to repair the first and third pylon, while the sixth was distributed among several landowners, see N. Neilson, \textit{Customary Rents}, in “Oxford Studies in Social and Legal History”, II, 1910, pp. 137-139; W.L. Warren, \textit{The Governance of Norman and Angevin England 1086-1272}, Stanford-California, 1987 pp. 33-34.


\textsuperscript{31} See R.C. van Caenegem, \textit{An Historical Introduction to Private Law}, Cambridge, 1992, chapter 3.

\textsuperscript{32} Ivi, p. 136.
At the origin of this enlarging and reinforcing process of the road network, “the road revolution” as Johan Plesner defined it\textsuperscript{33}, a system of financial provision to meet very high costs, entailing raw material and worker wages, was present. The expenditure for the officials’ wages was covered by the Communes’ revenues, just like the public fountains providing water to the citizens; conversely, expenses for other works – either in the city or mainly in the rural areas – were distributed among inhabitants living roadside, based on the principle of the adjoining dwelling’s responsibility. Based both on Roman and customary law, this principle relied on the concept – widespread all over Europe – that those benefiting from any improvement had to bear its cost. When such infrastructure required funding for expensive maintenance, and involved a larger group of people, citizens or rural communities (monasteries and churches included) of the adjoining village were asked to pay for the expenses.

In order to estimate the respective costs for each participating village, roads were divided into sections and the rural communities located along the border had to pay their quota. We have scant evidence about the exact amount of money of each quota, but we know that in 1296 for the maintenance of Via Francigena, quotas were established per paying person rather than per village or commune, amounting to 1.75%, 1.5% and 1% of the individual income, for the following pieces of road: S. Quirico-Lucignano, Lucignano-Isola and Isola Siena. Some more accurate and representative data are available for the 14th century: in 1306 for repairing 30 km of Via Francigena (works that included digging, and paving) 2,733 lire and 19 solds were spent. The total sum was shared among 51 villages in proportion to the villages’ income; with quotas ranging from 3 to 302 lire\textsuperscript{34}.

Also in the area of the Alps, it was the Communes placed at the Alpine valleys which solicited the local powers in order to reorganize management of their roads. The first documents regarding the alpine roads date back to 1269 and refer to the agreement that the city of Milan conducted with the communities in Blenio and Levantina valleys – which controlled the nearby area of Lucomagno and of the Gotthard (namely the routes leading to Switzerland and Germany) – in order to oblige them to guarantee the maintenance of the roads. Three years later Milan made an agreement with a citizen of Sion, who would receive a small amount of money for every bulk of goods transported; in turn the citizen had to keep the road along the village of Verdoz (placed beyond the Gotthard, along the Rhone Valley, up to the lake of Geneva and finally to France and Champagne fairs) in good condition. The Earl of Savoy, forced continuously by the city of Milan, started repairing the street after Sion, funding the work through a toll to be paid in Martigny\textsuperscript{35}.

The first step made by territorial powers in managing the Alpine passes coincided with the toll-grant to private individuals (entrepreneurs), so that, in return of the contract, they could self-finance the works needed for maintaining the road. The

\textsuperscript{33} See J. Plesner, \textit{Una rivoluzione stradale del Dugento}, Firenze, 1980.

\textsuperscript{34} W.M. Bowski, \textit{The Medieval Italian Commune Siena under the Nine 1287-1355}, California,1980, pp. 16-46.

second step involved small villages in repairing bridges and the road network, in proportion to the economic status of the community. The passage from the first phase (addressed to develop the road infrastructure, CAPEX), to the second one (devoted to maintaining it, OPEX), is witnessed by the case of an entrepreneur from the Blenio valley who was paid to build and keep in good condition a bridge, whose management had to pass under the valley three years later.\footnote{36. See K. Meyer, Blenio e Leventina da Barbarossa a Enrico VII. Un contributo alla storia del Ticino nel Medioevo, con documenti, Bellinzona, 1977, p. 52.}

The Alpine area was hence influenced by the two different legal spheres: the southern area was based on the Roman law – strengthened by the adoption of Giustinianus’ Corpus Iuris Civilis instituted in the 12th century – according to which the adjoining dwellings were obliged to maintain the roads, through financial funds or human force; the northern Alpine area was based on the common law – established in the 13th century – according to which those who received tolls had to sustain the expenses regarding the street maintenance. The latter can explain the privilege given by Albert I to the Earl of Tirol in 1305, in order to levy tolls, so that those who benefited from the road should care about the works needed for construction and maintenance.\footnote{37. In the regions based on the Roman law, above all in the southern areas, the local communities were committed by the landowner, very often the bishop, or the prince, to provide labour force and material. Conversely, in the areas characterized by the common law, a contract was drawn up in turn of financial benefits, such as tolls or tax exemption, see J-F. Bergier, Conclusioni, p. 255.}

Both models widely spread aiming at increasing traffic and trade in the road network.

From the second half of the 14th century several measures contributed to augment land traffic and to partly change the infrastructure financing systems. Demography and economy started growing after the Black Death (1348) and as a consequence commercial exchanges increased as well. In all Europe political entities extended their power: in central-northern Italy Seignories substituted the small communities; the Angioinis settled in southern Italy and in the rest of Europe monarchies (as well as the Hanseatic cities) grew, strengthened and struggled to enlarge their territories; the ways of communication began to be part of an enlarged political strategy. Several political territories strove to have the dominion of important traffic roads. The Duchy of Milan represents a significant example: at the end of the century it financed several hospitals placed in the western valleys of the Alps and intensified the maintenance of those Alpine passes. Transport underwent a sort of evolution, or ‘revolution’ as Henri Dubois argued, since wagons substituted pack animals; such change implied more robust roads and stronger maintenance works, but at the same time it entailed more competitive unit costs of goods and an increase of traffic.

Along the major transalpine routes (St. Bernard, Cenisio, St. Gotthard) expenditure for keeping roads in good condition were still covered by tolls, often coupled with some private entrepreneurs’ funds. Between 1348 and 1403 in Salins, in the imperial Borgogne, for instance, a group of three sauneries, which used the route Maurienne for wood supply and salt shipment, the maintenance works had been privately financed 74 times.\footnote{38. See O. Stolz, Der geschichtliche Inhalt der Rechnungsbücher der Tiroler Landesfürsten von 1288-1350, Innsbruck, 1957, p. 46}

Similarly in the areas of the Po Valley –
following the Latin tradition – the Communes had to pay for road maintenance, yet compulsory work was gradually substituted by specific taxes. Even though we do not have overall data, there is a great deal of evidence – for instance the Community of Geradadda, in the State of Milan – confirming that these specific taxes were direct taxes, in the form of the *taglia*, apportioned for 1/3 on the basis of personal wealth and for 2/3 on the basis of community components.

In the Italian Peninsula, as in the main continental monarchies, the passage from ‘domain state’ to ‘tax state’ was taking place. The latter was based on an increasingly complex financing system, founded on a calibrated range of taxes and loans and backed up by a centralized and ramified administrative structure. Such systems allowed the governors to use taxation in order to support the costs of infrastructure provision and maintenance.

In the State of Milan we have empirical evidence that, apart from the overriding concern to cover military expenses, new taxes were also levied for the construction and enlargement of canals in the Milanese plain. From the second half of the 14th to the second half of the 15th century the Viscontis were pushed to directly manage the internal navigation system as a result of its increasing importance and due to the possibilities offered by a well-structured fiscal system, eventually eliminating the interference of private citizens. During the 13th century the Naviglio Grande, the canal built in 1179 from the Ticino river to Milan and designed for irrigation purposes, became an important communication route. Through the control of navigation, the State’s revenues increased. In 1359 Galeazzo II started a canal from Milan to Pavia (where Ticino meets Po) which was made entirely navigable in 1473 thanks to Galeazzo Maria. In the same period the Martesana was built connecting Milan to the Adda river. At the end of the 15th century, from 1494 to 1499, the entire navigation system (Naviglio Grande, Martesana, Muzza, Bereguardo) would provide 32,320 lire (about 4% of all state incomes).

### 4. Financing Roads and Canals in the Early Modern Age

At the beginning of the 16th century the rise of the State spread all over Europe, even if each country moved on at a different pace. Nation states clearly emerged in England, Spain and France, but features of a modern absolutist state – notably the military, diplomatic, administrative and financial spheres – are present in the Italian regions, too. In this state-building process public finance played a crucial role. A substantial rise in public revenues to sustain the overall growth of government spending on defence, state bureaucracy, building programmes was now required.


42. ASMI, Sforzesco, folder 1136, 16 November 1499.
The far-reaching changes in the State’s administrative machinery and in the relationship between central governments and local communities; the improvements in the methods of assessment and collection of taxes; and the attempt to spread a rapidly increasing tax burden in a regularized way, are all elements that define the ‘fiscal State’. The military conflicts and the resources necessary to participate in them had been the driving element in the emergence of what can be better defined the ‘fiscal-military State’; armies were much larger, further complex in composition and structure, more permanent and much more expensive\textsuperscript{43}, but the creation of a more organized fiscal system constituted an important source, useful to cover the expenses of infrastructures, too.

On a theoretical level, the Second Scholastic reinforces the medieval concept stating that a civil community is an institution of natural right (\textit{ius naturale}), in which the State’s goal is the common good. In the 17\textsuperscript{th}-18\textsuperscript{th} centuries, the giusnaturalism (from Grotius, to Pufendorf, Hobbes, etc.) and the theory of sovereignty by Bodin, conferred to the monarch’s ordinances, issued for the common good, the character of law, fundamental for the State, and for this reason, inviolable by the king himself. The State became more and more involved in those works of common interest and of public necessity. It also reached a more and more solid theoretical basis as a lawful and legitimate exchange for the ever-growing fiscal requirements of the king. The intervention and activity in public works became – even if it was very limited – a founding element of nation- and regional-States. Public authority progressively centralized those offices which were committed to control the maintenance of roads and bridges and extended the control from the main roads to the minor ones of the countryside; the burden of concretely maintaining the roads yet belonged to the individuals, the communities or the adjacent institutions – as always, on the basis of the adjoining dwellings principle.

4.1 Bills of exchange, \textit{censi consegnativi} and scope taxes in the Continent

In the State of Milan the public management of the road network acquired a relevant role when the \textit{Novae Constitutiones} (including all the State’s laws) were issued in 1541 which defined the power given to the Judge of roads. He was nominated by the \textit{Vicario di Provvisione} (the chief of the economic city administration), but he was bound to the approval and acknowledgement of the State Governor. His office consisted of six noblemen, the road controllers (who were committed to inspect the condition of roads and make a report to the Judge), three engineers, a master builder for the technical part, a cashier and an accountant, who was in charge to follow the bureaucratic commitments. His main task consisted in filling in the section of \textit{fatte}, namely stretches of road whose maintenance had to be committed to the \textit{Terre} (Municipalities), which constituted the Milan countryside.

\textsuperscript{43} Although there is disagreement about the time in which the military revolution took place (for Roberts it occurred between 1560 and 1660, for Jeremy Black from 1660 to 1720), all agree that the European way of war and the military establishments were highly different in 1700 from those of 1500, see R. Bonney, \textit{Introduction} in Id. (ed.), \textit{The rise of the Fiscal State in Europe, c. 1200-1815}, Oxford, 1999, pp. 1-14.
According to these new laws, the costs related to the maintenance of roads – passing through the provinces of the Duchy (they amounted to 17 in the 14th century, and decreased to 14 in the 16th century) – had to be supported exclusively by the rural communities in proportion to the quota of direct taxes, which was apportioned to them. Each municipality (Terra) was assigned a stretch of road (fatta), which was proportional to the direct tax (salt tax) they had to pay. At the end of the 16th century, numerous attempts had been made by the communities in order to oblige also the cities to participate in the division of the road burdens, but it was a vain effort.

Against this backdrop, the management of the internal navigation in the Duchy of Milan became ever more centralized and direct. From 1553 and 1562 the total revenues of the navigli (the city canals) transit tolls amounted to 88,000 lire, equal to 5-7% of the State’s global revenue; but 1563 documents charted that those monies never reached the public coffers as they were all spent to maintain and improve the navigation system. Eight years later, works for repairing and enlarging the Naviglio Grande required an investment for which it was necessary to sell in advance the revenues originated by those tolls (this is the form of public debt assumed in most of the European countries). This meant stopping receiving those revenues for an unlimited period.

When in 1593 further works were needed to make navigable (without interruption) the course of the Adda river, the only solution was shifting the expenditure to the city of Milan that then ran into short-term debts through bills of exchange for almost 12,000 lire. Thanks to the significant innovation of pactum de ricorsa, these bills of exchange were frequently renewed at the Bisenzione exchange fairs (located in Piacenza from 1579), which created an efficient financial network under the Genoese control and integrated several credit markets, like those in Genoa, Florence, Venice and Milan. Bisenzione was in many ways an offshore capital market which operated on an international scale.

The legal forms used by States, Municipalities and private citizens to draw short-term debts for financing infrastructure works were different, from loan policies, to credit advances and bills of exchange. On the contrary, for long-term financing of infrastructure, specifically for financing the capital expenditures, the so called censi consegnativi (redeemable loans backed by collateral) were used, which widely
spread in the Catholic countries (though not only) from the second half of the 16th century.

In the age of political Absolutism, modern Roman law was becoming apparent in continental Europe. After the Middle Ages – in which the Roman law (present in Italian territories) coexisted with the Germanic law (based on customs and in force in German territories, in northern France) – in 1500 the learned Roman law was taking root in Germany, southern France, the Netherlands and Spain, and the European *ius commune* was progressively taking shape.

In the first half of the 16th century several distinct motivations (distinct in the substance yet equal in the form) arose, which pushed towards a legitimate acknowledgment of loans on interest. On the one hand the Church rather than denying any interest rates, was in favour of a modest one. The Church itself was willing to take part in the capital supply. Religious institutions, monasteries, convents, and other type of organizations such as the confraternities, were in fact so rich in capitals, coming from dowries, donations and bequests, that loans could be a fruitful and safe form of investment. On the other hand, the most dynamic legal and merchant fields were emphasizing the productive potentiality of money, which was in the hands of operators involved in trade and business. They were increasing the common good and were not inclined to usury. Moreover, at the end of the 14th century, in the Spanish regions a type of long-term public debt was spreading, which was based on the anticipated sale of revenues. The interest rate paid to the underwriters was similar to the rent gained from real estate. In 1569, therefore, with the bull *Cum onus* Pius V ratified the final approval of the *censo consegnativo*, a reddenable loan backed by a collateral (normally a piece of land or house), based on a notarial contract *empiotio cum locatione* (literally ‘sale with lease’), that confirmed its redeemability; in the *censi* ownership of the borrower’s property was transferred to the lender in return for the loan; interest was then paid as if it were rent for the continuous use of the property by the borrower. Such contracts offered, to private individuals, a fully lawful interest rate ranging from 4 to 7 per cent in the 16th and 17th centuries and for a limited time, normally from five to seven years. Through this type of census, communities and private individuals from Italy, France and Spain (mainly catholic countries) collected money to build and maintain roads, bridges and canals during the 17th and 18th centuries. Many lenders were well-off merchants and urban patricians, as in the case of Verona. At the end of the 17th century, the city –

48. Many elements can explain the wide spread of Roman law in the regions of ‘common law’: backwardness of ‘the common law’ compared to developing societies; courts that were populated by lawyers, whose education was based on the Roman law, which underwent a renovation in the 12th century with *Corpus iuris civilis* by Giustinianus, and the Humanistic School linked to the first Italian universities, see van Caenegem, *An Historical Introduction to Private Law*, chapter 3.


following a violent flood of the river Adige – required a huge sum of money to be raised quickly in order to repair the banks destroyed by the flood. The capital was lent to the city – the *Magnifica Città* – by Francesco Manzoni a nobleman from Padua, who gave the city immediately 16,000 ducats, namely 99,200 lire venete, at 4 per cent of interest rate. Some years later, the city wanted to extinguish its debt and withdrew half of the sum from the city Pawnshop (this money was ‘di ragione’ namely was owned by the Hospital SS. Giacomo and Lazzaro) and borrowed the other half from another nobleman of Verona, the Earl Piero Zazzaroni, who in those years was also a member (Consigliere) of the Commune. Zazzaroni lent 9,000 ducats for ten years at 4 per cent to the city that used the butchers’ shops and the ghetto houses as collateral.

But most of money lenders were ecclesiastical such as religious and pious bodies, as well as lay institutions. They became the most dynamic segment of capital supply in both catholic, and non-catholic, European countries. In the middle of the 17th century in Emilia, north-centre Italy, the *censi consegnativi* provided by convents, confraternities and lay organizations (e.g. *fabbricerie*, etc.) covered almost 2/5 of the global capital supply. In 1602 and 1605 Venice authority issued two laws which obliged all the religious and pious institutions to sell within two years all the real estate they had received *ob piam causam*. Such institutions rich in liquidity invested their money in *livelli* (the Venetian type of loans). Through the participation of these institutions (the ‘Compagnia di San Paolo di Torino’, the ‘Fabbrica del Duomo’ of Milan, as well as the ‘Monastero de San Miguel de Valencia’ and the ‘Congregacion de San Benito de Valladolid’ just to mention a few) in the credit market, the increasing forced saving (made of dowries, bequests of the pious institutions and confraternities), were transformed into direct investments towards infrastructure (notwithstanding the most part of debts contracted by the communities needed to meet the rising fiscal pressure linked to military needs).

In this period the interest of public authorities in the Alpine roads augmented, but the control remained in the hands of private entrepreneurs. In 1708, for instance, the agent Thomas Massner of Coira promoted a new stretch of road, from St. Giacomo’s valley up to the Spluga pass – the so-called Cardinello road. For digging purposes gunpowder was used for the first time. The Spluga passage had been created in the late Roman age. Flavius Stilicho, in the 4th century AD, used to pass through that way to reach the German territories, under the Roman Empire. The subjects were in charge of the maintenance of the route and the provisioning stops along the passage, and the transport of goods. This rule remained in the following reigns of the Merovingians, the Franks and the Carolingians, who, drawing upon the Roman law,

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51. 1 ducat equals 6 lire and 4 soldi.
reckoned roads a public good, thus all citizens were obliged to contribute to the works concerning building, repairing and maintaining. In the 9th century, groups of native individuals were committed to protect passengers, provide horses and carts. Between the 12th and 14th century the Geleitregal (regalian right of escort) was born (also called *ius conductus*) which entailed all the rights and obligations of the subjects, concerning roads, tolls, transport and safety. At the beginning such privilege pertained only to kings, but when the king authority lost his power, the right moved to the territorial governors, such as the bishop prince of Coira. Towards the end of the 14th century he had also the right of co-managing and the right of veto. After the decline of the bishop and feudal authorities in the 16th century, the Commune claimed those rights and the obligations of the *jus conductus*. The route was used mainly by merchants (as it was the shortest way to go from Milan to the lake of Constance, and from Coira to Chiavenna), and was enlarged and improved during the middles ages. We can very likely presume that the maintenance and repair of the route was financed with part of the revenues paid for the passage. For transportation, merchants had to pay three (or four) tariffs: the transport tariff, an extra tariff to be paid in winter (for the inconvenience caused by the snow), the Fürleiti (namely the tariff for every transported package (*collo* of goods) and finally the Zoll (toll) in Splügen and Reichenau. For goods transported for personal use, only the toll had to be paid. In the 18th century an alternative route was built by an entrepreneur, Thomas Massner, who in 1708 presented the project to the federal Diet. The plan was quite immediately approved, representing the first road financed by the Three Leagues. Such work was financed by the extra price of 10 Kreuzer (per package) on the goods transported to Chiavenna. The stones for the road surface and the walls were provided by the valley dwellers. Massner was committed to personally collect the extra tariff and manage the financial aspects of the project. He was also appointed by the Three Leagues to manage the Hausegeld, that is the coffer of the tolls on goods in transit as well as the coffer of the Three Leagues. Once the road was finished, the 10 Kreuzer of extra tax remained, and was invested in the building of new roads such as part of the Rofla road (1723), the Viama road (1733), the two stone bridges on the Viamala way (1738-39), the maintenance of roads and bridges in Saint Giacomo’s Valley (1755), and the wood bridge of Thusis (1757).

In many other cases where the local authority did not actively participated in the building of infrastructure, the central authority intervened in their construction, financing them through scope taxes.

In southern Italy, too, the Spanish government, which succeeded the Aragonesi in 1500, became directly involved in the road policy, which mainly aimed at raising the stagnant domestic market.

In 1559, once the disastrous state in which not only the local, but also the bigger provincial and national communication links were noticed, and once it was realized that landowners – public and private – of the plots of lands through which roads

55. Ivi, p. 18.
56. Ivi, p. 33.
57. The road was started in 1710 and finished in 1714.
58. Ivi, p. 34.
passed, would never get involved in the building of roads or in the necessary works (bridges, water drainage, etc.) nor in their maintenance, the Spaniards levied a tax of a copper coin (grana) per household, on all the twelve provinces into which the Reign of Neaples was divided. The incomes from this tax served to repair bridges and roads. Such tax was regularly collected by local treasurers, yet it is still not sure whether all the revenues were destined to a specific purpose. The activity of road building was, however, strongly encouraged. In 1562 the road going from Neaples to Torre del Greco was modernized and enlarged; in 1564 a bridge between Cava and Salerno was built, avoiding the necessity for the road to pass through the woods; in 1568 the route from Neaples to the Reign’s boundaries was opened up, building numerous bridges, twelve of them in the territory of Sessa Aurunca. In 1595 the Maddalena bridge was enlarged, in 1608 a wide bridge leading to the city of Cava was made and two years later the main road to Benevento was constructed. After the beginning of the Thirty Years War, namely after 1618, infrastructure works, including those related to the road system, declined, and almost stopped. Other issues affecting the Reign, together with Spain, directed most of the funds to solve more urgent problems – the funds being those that came from the tax specifically levied for bridges and roads.

Similarly, a process of progressive centralization was occurring in the 17th century France, enforced especially by Colbert’s policy. All the economic affairs were managed by the newly created General Controller of Finances (1655). Public works, as well as the infrastructure sector, became one of the main issues of the government’s agenda and were encouraged by the mercantilistic ideology, whose objectives were basically political as well as military. Previously only the road system was cared by the state, which nominated the Grand Voyer, Chief Inspector of Roads, (Sully at that time) who spent almost 6.5 % of total expenditure for building and improving national roads and bridges in 1609. He also started the Canal de Briare which connected the two main arteries of commerce, the Seine to the Loire. Infrastructure transport achieved new importance with Colbert who devoted large sums of the state’s finances to the building of the 242 km-long Canal du Midi, which was completed in 1681 and – linking the Garonne, and consequently the Atlantic, to the Mediterranean – represented the greatest public work sponsored by the monarchy. In the 18th century great attention was paid to the building of roads and bridges and a new specific administration was created – the Ponts et Chaussées – gathering a group of highly specialized engineers. Beside this, the École nationale des ponts et chaussées, training future engineers, and famous particularly during the 18th-19th centuries. Through that school, the State took the control over the planning and building of roads, bridges as well as canals. By 1730s a general plan of royal roads was drawn up. Works were planned and managed by the Intendants, “who resorted to compulsory labour by the peasantry – corvées royale”. At the end of the century France was provided by almost 40,000 km of roads. “Undoubtedly, the state’s intervention to improve transport had economic motivations (and had been demanded by the business community), but strategic considerations also played their

59. The canal building was started by soldiers in 1607 and completed only in 1642, F. Crouzet, Economic factors and the building of the French nation-state, in A. Theicova, H. Matis (eds), Nation, State and the Economy in History, Cambridge, CUP, 2003, p. 51.
role: better roads meant faster movements of troops – to the frontiers or to places where disturbances broke out. The star-shaped road system that radiated from Paris was not entirely in agreement with the needs of trade.\(^\text{60}\).

In the rest of the Continent, however, the process of centralization, reorganization and intervention in the infrastructure sector reached its peak under the Enlightened Absolutism, which characterizes most of the countries of continental Europe during the second half of the 18th century. In this time span the reforming capacity of central power strengthened and coordinated the process of modernization of the State and of society, thanks to an efficient bureaucracy and to a varied cultural and rationalist patrimony. The Enlightenment forced government into order and to act for the common good. Albeit in a different way and with different results, the economic development and the expansion of the productive forces constitute one of the main goals of these States, as basic elements contributing to the ‘public happiness’ and as indispensable conditions for increasing the State revenues, urged by the growing war needs. All sectors were involved in reaching these aims: in the second book of *Discorsi* on the commercial balance sheet of the State of Milan by Baldassarre Scorza, after the equalization of taxes, the payment and elimination of public debts, the vigilance on public administration, the privatization of common lands and the relieves of (tax) exemptions, we find the “aprimento di nuovi canali, e l’adattamento della private e pubbliche strade” (that is: opening of new canals and improvement of private and public roads)\(^\text{61}\). On the continent, countries – still the absolute governments – paid much attention to infrastructure works, like streets, harbours and canals, aiming at liberalizing trade and integrating new commercial sectors, sustaining in this way their economy. In the Austrian reign, Prussia and France, as well as in the States of the Italian Peninsula, intervention in these sectors became one of the priorities of the political economy even though it was managed in different ways. In the Habsburg Empire, during the Reign of Joseph II, toll leaseholders were introduced for the main roads, but this proved a mistake due to the notorious lack of a lively class of contractors that failed in servicing these routes.

In the State of Milan, where the Habsburgs of Austria succeeded the Spaniards at the onset of the 18th century, the road infrastructure network was reclassified – in 1770 – into main or provincial roads, communal roads and private roads, and the expenditure for maintenance were more evenly distributed by involving the cities, too. All the expenses of the provincial roads, namely those radiating from the cities to the provinces, had to be covered by the provinces; the costs of the communal roads, namely those not considered to be provincial ones, had to be covered by the Communes (and thus even the cities were charged) and eventually, the private roads by their users. The intense programme of road restoration and building – which created a ramified road network widespread in the whole State within twenty years and which initiated an improved delivery of the works needed – was linked to the substitution of the system of *fatte*, charged to the ‘rustici’ (village inhabitants), with that of tolls and scope taxes that were contracted out to local and active

60. Ivi, pp. 51-52.
entrepreneurs. It was the State of Milan that still directly covered the costs for building a new road system, serving long distance commerce, and for digging new canals and creating new bridges, using the state revenues. The expenses for public works rose six times from 1761 to 1794, going from 0.84 of the total revenues to 5 per cent. Most of the costs were absorbed by the building of roads and canals for trading goods, which had sometimes been continued as grant initiatives made to private citizens. In the 1760s and 1770s huge investments were made by the government to develop and improve the harbours in Mesola, in order to provide a direct link, via water, to the Habsburg Harbour in Trieste and the Danubian Basin, but the merchant flow towards the Adriatic town never reached expectations. In 1777 the Paderno canal was opened having been started four years earlier. It connected the Lake of Como with the Martesana canal, leading to Milan; while the Naviglio Pavese, which had been started in 1773, remained only a project, until the age of Napoleon.

In 1777 a paved street Maloia-Engadina was opened, that facilitated trade exchanges with northern Europe, entering a wider plan of road network that linked the countries subjected to the Austrian reign and that had another benchmark in the road of Abetone between Pistoia and Modena.

4.2 Turnpike Trusts and Canal Companies in England

In England the growing attention that government paid to the infrastructure issue, which defined the early modern age, assumed peculiar features, very different from the continent, dynamically interplaying with the great expansion that would take place in the last quarter of the 18th century. This country was undertaking a path which was culturally in evolution, and that, from an institutional and political point of view, was advantageous to the economic process, much more than the continental areas. Already by the end of the 12th century, the kings’ Court created a national and unique law based on customs, namely the customary law, which was ‘common’ to the English reign and that hindered the spreading of the European ius commune.

Being much more flexible and able to adapt to social changes (it is regulated justice on the basis of changed habits and established by examined cases which become patterns for future cases rather than compliance to a set of laws which only after very long periods could be changed) this type of law progressively reinforced protection to private interests against other interests, but also against the State’s obtrusiveness. It contemporaneously imposed rules for respecting a general or common interest. It is quite well known that, from the issue of Magna Charta in 1215, the English monarchy became progressively less absolute. The Tudor dynasty,
who succeeded the Plantagenets in 1485, ruled in respect of the Parliament’s prerogatives, which represented the interests of a very lively aristocracy and mercantile class.

The Tudors’ Statutes, which had given the responsibility to each parish to maintain all its roads, proved to be soon inadequate for the highways that were used by long-trade merchants and wagoners. As commerce developed, the growing numbers of heavy carts and carriages heavily damaged these roads and could not be remedied by the piecemeal approach to road maintenance, based on the use of parish financing main roads improvements using local taxes. In 1663, an alternative method was introduced to coordinate effort on a single street that passed through several parishes: an Act of Parliament gave the local justices powers to erect tollgates on a section of the Great North Road between the Hertfordshire and Huntingdonshire.

In 1696 during the reign of William III the first Turnpike Act (for Surrey) was passed and was meant to repair routes between Reigate in Surrey and Crawley in Sussex; the act made provision to erect turnpikes, and appointed toll collectors, to appoint, in turn, surveyors, who were authorized by order of the Justices to borrow money at 5 per cent, on security of the tolls. According to the basic scheme, turnpike trustees would manage resources from several parishes through which the roads passed, would augment this with tolls from foreign users and invest the whole to the maintenance of the main roads. This turned out to be the pattern for turnpike of a growing number of roads, sought by those who wished to improve the flow of commerce through their part of a county. The proposal to turnpike a particular section of road was normally a local initiative and a separate Act of Parliament was required to create each trust. The Act gave the trustees responsibility for maintaining a specified part of the existing highway, and the right to collect tolls from those using the road. Local gentlemen, clergy and merchants were nominated as trustees. They in turn appointed a clerk, a treasurer and a surveyor to concretely manage and maintain the streets, and were paid directly by the trust. Trustees were not remunerated to avoid the potential for rent-seeking because of their monopoly of service; they received indirect benefits from the better transport, which improved access to markets and led to increases in rental income and trade. Parliament also pursued more indirect strategies by allowing competing trusts to enter the market and by requiring that trustees own property. Although trusts initially organized the collection of tolls directly, it became common for them to auction a lease to collect tolls. The grants of a trust were normally limited to 21 years, after which it was assumed that the responsibility for the now-improved road would be handed back to the parishes.

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In 1688 the Glorious Revolution and the Bill of Rights made England a Constitutional Monarchy, in which public finance was under the control of the Parliament and it was experiencing the so called ‘financial revolution’, which primarily consisted of: 1) the funded public debt (cushioned in the balance sheet), that was managed by the Bank of England, which obtained the monopoly to issue banknotes; 2) the introduction, for the first time in 1696, of the balance sheet of the Exchequer; 3) the negotiability and transferability of public bonds; 4) the nationalization of tax collection and rationalization of the monetary system by creating the Gold Standard.

Nevertheless the introduction of toll gates was resented by some local communities which had freely used the routes for centuries and were suspicious of abuses of some trustees. In eighteenth century-Britain, nearly 1,000 turnpike trusts were established along 20,000 miles of road, resulting in one of the most expensive toll road networks in history, connecting roads, routes over new bridges, and new routes in the growing industrial areas. As Dan Bogart has recently pointed out, turnpike trusts spent between 10 and 20 times more than the parishes they replaced. Parishes were forced to rely on local taxes, and therefore they were less likely to undertake road improvements that largely benefited road-users passing through their jurisdiction. Turnpike trusts addressed this problem by levying tolls and thereby forcing road-users to contribute to the costs of investment. They also improved coordination by replacing a multitude of parishes with a single body of trustees who could direct investment over an entire roadway or a network of roads. Solving borrowing constraints, faced by parishes, they could issue debt at a low cost and overtook intra-parish disputes between labourers and landowners concerning the level of investment and the relative tax burden paid by each group, transferring control rights to local property owners, who had a common interest in financing investment.

In this period, the English road transport sector experienced a number of innovations, including developments in wagon and carriage design, changes in the technique of road building, improvements in horse breeding, and increases in firm-size. The cumulative effect of all these innovations was 40 per cent reduction in freight charges, a 7.5 per cent reduction in passenger fares, and a 60 per cent reduction in passenger travel times. The quantitative evidence suggests that turnpike trusts contributed to approximately half of the 40 per cent reduction in freight charges during this phase.

Turnpike trusts represented a significant pattern of an organizational change that contributed to lower transport costs and improved the quality of services. They constituted one of the best examples of an institution that was both a cause and a consequence of growth, and responded to the expanding economy by satisfying existing or potential demand for road transport services. However, they also created demand for such services by lowering freight charges and travel times.

70. In *The Wealth of Nations*, Adam Smith suggested that abuses by trustees made the tolls twice as heavy as was necessary for the road network maintenance.


Yet the institutional and organizational change of infrastructure financing, which had enormous consequences also on modern economic growth, was the evolution of joint stock companies in England. Developing the regulated companies, for ordering major activities, and the limited partnerships, inherited by the Italian finance of Renaissance, starting from late 16th to the beginning of the 17th century in England as well as France and the Netherlands, state-granted monopoly rights were issued with transferable shares in joint-stock form. The reliance on joint stock introduced distinct advantages in mobilizing capital, by reducing transaction costs (in particular information and agency costs lowered by more valuable communication flows and good techniques for monitoring performance) and by enhancing investor liquidity. Along all the 17th century overseas leading joint-stock companies prospered because they managed to achieve before unfeasible “economies of scale and scope of operations by concentrating vast amount of capital in a single enterprise”\(^3\). In 1720 the crumble of John Law’s Compagnie du Mississippi and the South Sea Bubble – which both demonstrated the limits of joint-stock equity conversions as a means for lessening huge public debt levels – had different repercussions on the development of finance in France and England; in the former, the disruption installed a profound distrust of all financial activities, while in the latter, the panic led to state intervention to reorganize rather than liquidate the endangered financial institutions. In England the following Bubble Act (11th June 1720) imposed severe restrictions on the formation of the new joint-stock companies and for over a century new businesses were organized primarily as partnerships or joint venture associations (and some historians maintain that this may have slowed down the progress of industrialization).

A remarkable exception to this general prohibition was the use of the joint-stock form for building canals and related enterprises during the mid-18th century. The need for effective internal transports improved the river navigation from 1660 to 1730, while merchants and entrepreneurs became interested in navigation pitted against millers who favoured dams, fishermen with weirs, and towns on other rivers fearing diversion of water or loss of traffic. Despite such a successes as the Aire and Calder Company linking Leeds with the inner area by canal boat to Hull on the coast, river improvement was not sufficient\(^4\). In the middle of the 18th century canalization had therefore been started and the first wave of joint-stock companies in England under the Bubble Act began, opening up the path to an increasing use of them in the 19th century. The Duke of Bridgewater canal connecting the coal mines on his estates to Manchester, ended in 1761, spurred the movement. Between 1730 and 1790, canals in Britain doubled in length and reached 2,200 miles. Demand was largely for transport of coal which could not be moved economically by road, while deviations from the restrictive policy toward joint-stock formation were tolerated because of the quasi-public nature and size of the enterprises, as well as the impeccable background of their chief sponsors, who were often noblemen\(^5\). The initiative was mainly taken

by local landowners (and especially by the local – not London – mercantile community), who provided most of the capital; industrialists, such as Bolton and Watt and Wedgwood, were deeply interested in promoting the canal system to move their items and outputs more cheaply and more safely.

Between 1791 and 1794, 81 acts were passed allowing the construction of canals and the canal mania burst, reinforced by the sharp decline in the return on consols after the American War of Independence and the outflow of capital from France, caused by the Reign of Terror in early 1793. The 42 new canals cost £6.5 million and original share denominations were large: £200 was rife, while shares less than £50 each were rare. But speculation was not so prevailing: at least 56 per cent of the original shareholders buying shares after 1789, retained ownership in 180076.

In France, the State played a different role in promoting navigation ways, such as infrastructure as a whole, and most of the canals and routes were realized by public and private intervention77, as the case study of ‘Pont de la Mulatière’ (1766-1915) analyzed by Hugh Goldsmith.78 The project was promoted and financed by Antoine-Michel Perrache, who gathered a group of investors and in 1771 created a specific company, namely the Compagnie Perrache. The bridge crossed the River Saône in the city of Lyon. Notwithstanding a first scepticism by the citizens, the project was approved and the State granted some pieces of lands. When its founding father died, after some years the Company was taken over by his sister who, together with the Comte de Laurencin, borrowed funds in order to complete the project. The construction of the bridge, made from wood, was finished in 1782 and just the following year it was destroyed by a flood. In 1784 the king Louis XVI signed a Treaty according to which he would re-build a new bridge made of stones. In 1789, when the French Revolution broke out, the works were suspended, but soon after, following a new Treaty, the bridge was finally built. To finance the project future tolls were used ‘under a 99 year lease’. The works for the realization of the bridge finished in 1792.

Capital was collected by issuing up to 880 shares for 500 livre each, “potentially raising an additional 440,000 livre”. Those share were at fixed interest rate of 6 per cent plus a 20 per cent premium “when the share is bought back by the company”79.

Although broad, impersonal financial markets had emerged to facilitate the sale of government debt obligations, they slowly became accessible to corporate securities during the last decades of the 18th century and the early 19th because of the quasi-public nature of the first issuing entities, canals and early railroads companies (that we will deal in the next research step). Before 1800, many corporate bodies had been formed to serve specific public functions; corporations were also effective mechanism for blending the economic interests of the state and of private groups in a mutual beneficial way. The distinction between public and private corporations was

76. See Kindleberger, A Financial History of Western Europe, p. 198.
77. Skempton, Canals and river navigation before 1750.
78. Subsequently a railway line connecting Lyon to Saint-Étienne was built by the Segun Company. After twenty years (1846) a new bridge was realized. In 1860 the city removed the toll and ‘let long term maintenance contract’. In 1915 the work was rebuilt again and financed by the State, see Hugh Goldsmith, Le Pont de la Mulatière (draft version)
79. Ibid.
not sharply defined at that time. The early canals in Europe (as well as in USA) were considered as public improvements whose establishment was vital to enhancing local economic fortunes. This often motivated prominent local leaders to encourage promoters of new lines to serve their towns and to persuade their neighbours to support these projects, by purchasing the securities of the companies. Moreover governments played key roles in helping to establish early canals, railroads and any capital-intensive infrastructure.

The great economic expansion which was taking place in some regions of England during the last quarter of the 18th century had to change – among others – corporate finance and infrastructure financing fundamentally. And infrastructure finance in the age of modern economic growth will be the next subject of our research.

5. Concluding Remarks

Despite the analysis is still not complete and the paper represents only a preliminary step, it has been possible to outline a taxonomy of the European infrastructure finance from the Roman Age to the 18th century (see the synoptic table in figure 1), and draw some remarks which may be used for a further in-depth research.

First, we pointed out that the emergence and settlement of infrastructure financing typologies were highly influenced by relevant factors that could range from geomorphological features to institutional, legal and economic traits in which they were embodied. A set of variables, that includes both, supply-side and demand-side elements, institutional factors such as geomorphological features, shaped path-dependent solutions, locking in evolution for long time; at the end of the Roman Empire, the principle stated in the Giustinianus’ Codex – according to which anyone benefiting from the use of infrastructure was obliged to take care about its maintenance and repair – started two main paths:

a) in the countries based on Roman law, compulsory works widely spread; these will then be transformed into ‘scope taxes’, the support of the affluent and the transfer from central State revenues;

b) in the countries based on customary law and common law (as well as in transit areas), toll systems became predominant and they will be progressively entrusted first to public and then to private management which culminated in the adoption of joint stock companies for canals building.

Second, nevertheless the coming out of different patterns, financial solutions propagated and circulated; every wave of infrastructure innovation and improvement relied on financing solutions that enhanced previous techniques and instruments (i.e. scope taxes were based on the tax state, and joint stock companies on silent partnerships and regulated companies).

Third, the typologies of infrastructure financing did not follow a progressive linear evolution from simple to complex forms; the appearance of a new typology of
infrastructure finance did not necessarily exclude the use of the previous ones and they often coexisted for long time.

Fourth, history teaches us that one single model or pattern, fitting all at the same time, do not exist. The same financing system can be successful in one country while it can fail in others, or even in other parts of the same state. The disastrous introduction of toll-contracting in the Austria crown lands and the productive outcome of the same system in Austrian Lombardy; the strong dualism that occurred in the economic development of Italy (the road system in the south and in the north of Italy, that will perpetuate with the railways); the different evolution followed by the joint stock companies in France and in England, are all elements highlighting that it is not only a matter of finding out the ‘successful’ financial instrument. Indeed, some societies proved to be more dynamic and with a more ‘risk propensity’ than others; infrastructure that provided high revenues, such as canals and roads for commerce, were different from, for instance, religious roads; to build a canal in the Netherlands, or in the Po Valley, requires fewer difficulties than creating a canal in a desert region. Although the specificities of each context, some solutions adopted in infrastructure finance proved to be pioneer and innovative on a broader and long-run economic score (i.e. joint stock companies for canals under Bubble Act restriction).

Finally, our analysis shows that in pre-modern Europe, financing infrastructure strongly depended on the motivations and the goals with which they had been built. In the Middle Ages not all the infrastructure had ‘economic’ or military aims. Civilization could be bettered also through non profit infrastructure (see public fountains, aqueducts). The canals in the late Middle Ages could be initiatives spurred by the local governments, but private initiatives, could also play a crucial role in building infrastructure. A mixture of public and private intervention proved to be successful in the Cardinello road, where a private entrepreneur projected and managed a new route crossing the Alps with the help of the authorities which gave him permissions and funds to track the way. And the 18th-century England partnerships were also a mechanism for blending the economic commitments of the State and the interests of private groups of citizens in a mutual beneficial link.
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