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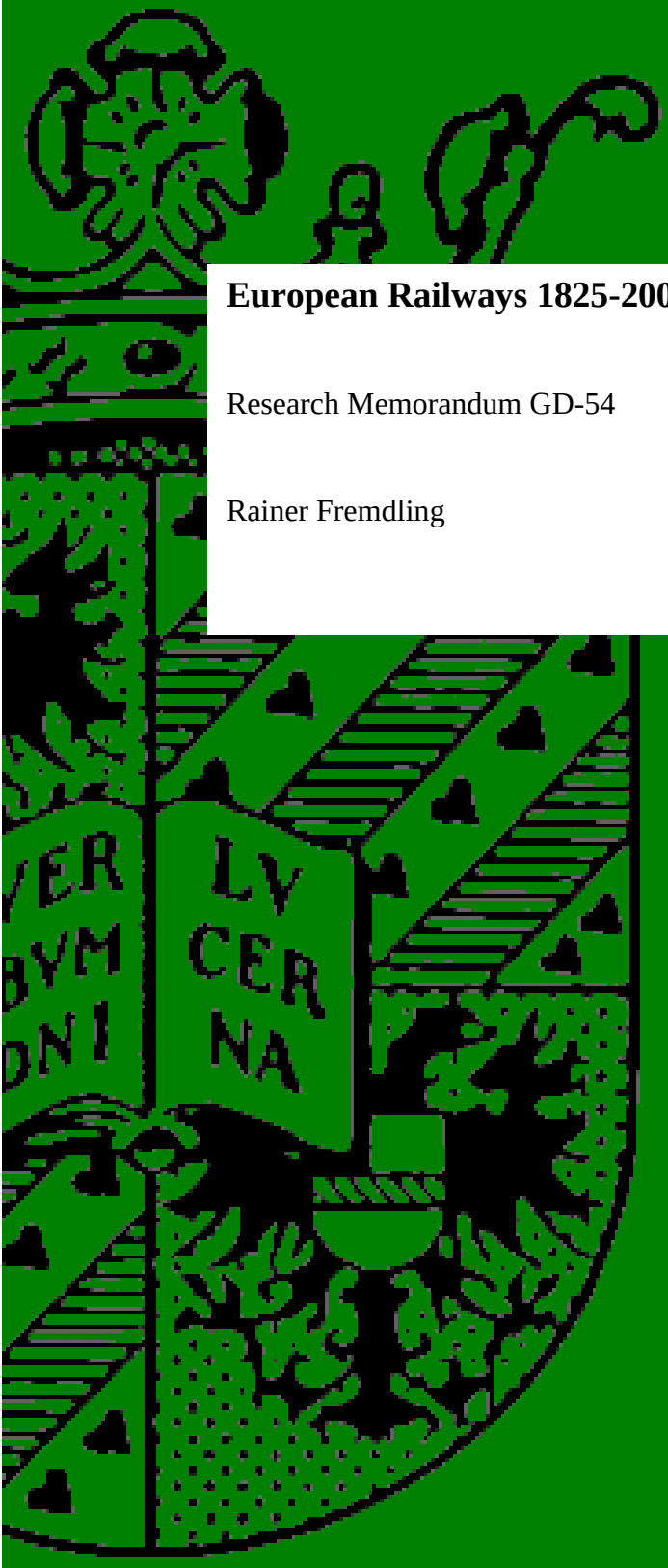

European Railways 1825-2001, an Overview

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RESEARCH MEMORANDUM

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1 This article is a slightly modified version of the original manuscript, translated into Dutch and French, for a book to commemorate 150 years of Belgian railways and the 75th anniversary of the Belgian National Railways, see R. Fremdling, De Europese spoorwegen 1825-2001, een overzicht, in: B. van der Herten / M. van Meerten / G. Verbeurgt (eds.), Sporen in België. 175 jaar spoorwegen, 75 jaar NMBS, Leuven 2001, pp. 21-29. R. Fremdling, Les chemins de fers en Europe, 1825-2001: un survol, in: B. van der Herten / M. van Meerten / G. Verbeurgt (eds.), Le temps du train. 175 ans de chemins de fers en Belgique, 75e anniversaire de la SNCB, Louvain 2001, pp. 21-29.
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1. Introduction

Hardly any other innovation symbolises and embodies the process of industrialisation during the 19th century as the railway does. The very symbol of rapid progress combined central innovations and materials of the first phase of industrialisation in Europe: The steam engine placed on iron wheels consumed coal and drew its load on iron and later steel rails. These rails had been rolled from wrought iron, which in turn was refined pig iron smelted in a coal-consuming blast furnace.
The genesis of this new mode of transportation is traced back to the first industrial nation, namely Britain. Here, the points were switched for the path-breaking innovation of the railway for other countries as well. Hence it seems logical to discuss its coming into being in the country of origin.

2.1 England

Track dependent vehicles existed long before the locomotive was invented. The wooden tracks in German mines during the 16th century very often are considered as the forerunner of the railway. In the same century, they had been introduced to English coalmines. In the 17th century, wooden rails were also used on the surface in order to haul the coal from the mine to the river. As these wooden rails easily were damaged they increasingly were plated with iron sheets. During the last third of the 18th century, British engineers tinkered with different versions of cast iron rails. Fixed on wooden or stone sleepers, cast iron rails with a high profile and a head-like widening became very common. The wagons were still drawn by horses. Faster and cheaper than hitherto, they hauled heavy loads of coal over land. Due to the nature of cast iron the rails easily broke. The molten pig iron could be cast into the desired shape without major difficulties; the finished product was brittle, though. Not before the early 19th century, after a long process of trial and error, were English iron masters able to roll tough rails from wrought iron.[2] Finally these wrought iron rails were rolled in a shape with a mushroom cross-section. For the Stockton-Darlington line (opened 1825) and the Liverpool-Manchester line (opened 1830) these rails were fixed with cast iron chairs on sleepers from wood or stone.
Substituting the tough wrought iron rails for the brittle cast iron rails was an important precondition for the heavy steam locomotive to run on the tracks.

The development of steam-driven vehicles over land was not at all necessarily directed towards the locomotive tied to the track-dependent railway, though. The frequently very steep gradients of existing railway lines confirmed people in their belief that a heavy steam-driven wagon would not find enough frictional resistance on the smooth iron rails. Not alone in England quite a lot of tinkerers developed steam-driven wagons for ordinary roads. They did move indeed, but proved too heavy and too clumsy for the then existing roads and remained nothing more than the admired hobby of inventors and enthusiasts. Trevithick, who surely was both, constructed a steam-locomotive, which in 1804 drew wagons on a usually horse-powered railway line in South-Wales (Merthyr-Tydvil-Railway). The smooth driving wheels, supplied with nails on the outside, turned it into some kind of a gear of rack railway. After numerous trials and errors, Hedley succeeded in 1813 to construct the first useful steam locomotive for a railway hauling coal. It merely used smooth driving wheels.

[2] The carbon content of the iron is the major cause for the different properties of cast versus wrought iron.

The most successful constructor of steam locomotives became George Stephenson (1781-1841), engineering master in coal mining, who built and improved those vehicles from 1814 onwards. For the Stockton and Darlington railway line, he delivered a machine, which merely complemented a stationary steam engine. Its power was transmitted to the wagon by a cable. On this public railway line, horses still drew the wagons for passenger transport. It can be concluded that the technical break-through of the iron railway and the steam-driven locomotive occurred within the coal-mining sector. With the complete opening of the 50-km long railway line between Liverpool and Manchester in 1830 the true railway age began as a mass transportation mode. On this line, steam-powered locomotives alone drew the wagons for the first time. On the section completed at Rainhill in 1829, Stephenson's "Rocket" won the races against competing locomotive constructors. Using locomotives exclusively was by no means a matter of course, though. Drawing devices such as horses or a cable of stationary steam engines used for the Stockton-Darlington railway had also been considered. A second new feature was the fact that the Liverpool-Manchester Railway Company exclusively operated the railway line itself. Although early railway legislation in England (and later in Continental Europe) stipulated that railway lines like an ordinary road in principal should be open for different users who paid a toll the Liverpool-Manchester company enjoyed a monopoly on its own(ed) tracks. Thirdly, this line was mainly used for the transport of passengers, which had not been foreseen. Until 1845, passengers generated twice as much revenue as the shipment of goods transportation.

The line connected the most import industrial and merchant cities of this part of England and paid its shareholders on a regular basis a dividend of 9,5 %. In a country dominated by Manchester capitalism these profits convinced people to invest in railways. Before the Liverpool-Manchester line, railways had been built merely for local needs or in order to complement shipment on canals and rivers. Since the two building booms (1834-37 and 1844-47), trunk lines connected the major cities. At the beginning of the 1850s, more than 10000 km of privately built and operated railways spanned an extended network over Britain. At that time, this was far more than in any other European country (see Table 1). As Britain began building railways at the end of her industrial revolution railways were no major cause of this path-breaking event there. From the 1830s to the 1850s, however, railway building dominated the British economy in such a way that it determined the business cycle.[3] Furthermore, British engineers and workers acquired the know-how which indirectly and directly was used for railway construction on the Continent. To some countries, i.e. Germany and the Netherlands, British factories delivered rolled rails and locomotives as the major investment goods. Without British know-how and British industrial capacity railway construction on the Continent would have been severely retarded.

In the following, the development of European railways is exemplified by mainly drawing on Belgium (B), Germany (D), France (F), the Netherlands (NL) and the United Kingdom (UK). No full coverage of their railway histories is however attempted for.

[3] *G.R. Hawke*, Railways and Economic Growth in England and Wales 1840-1870, Oxford 1970, pp. 187 ff.; *T. R. Gourvish*, Railways and the British Economy 1830-1914, London 1980, pp.33 ff.

2.2 Continental Railways and the Role of the State[4]

In many respects, Britain was the model for railway construction on the Continent and the success of the Liverpool-Manchester line gave a boost to discussions and plans in numerous countries. On the Continent it was, however, not that clear that building and running railways should be left solely to private initiative. In contrast to the Anglo-Saxon tradition, on the Continent the engagement of the state in economic affairs was not only considered as acceptable but for many people even desirable. Even with the coming of liberalism as dominant political doctrine, state intervention had deeper roots on the Continent than on the British islands.

Belgium was not only the pioneer in railway construction on the Continent but furthermore in its institutional choice: i.e. building and running state railways. The state railways became the core of a network that deliberately was complemented by privately owned and operated railways mainly built between 1845 and 1870. In this "liberal" period, even in Belgium private lines became to dominate the railway system.

In contrast to Belgium, the French authorities were rather reluctant about a state involvement. Although around 1841 some 1000 km of private railway lines had been granted a concession (650 km were then in operation), it was not before the railway law of 1842 that a decision was achieved about government's involvement. A radial network of trunk lines with Paris as its centre was planned. The state financed the basic infrastructure, whereas private companies operated the railways. They, however, had to finance the complementary infrastructure, e.g. rails and the rolling stock. Quarrels, about which cities should or should not be connected by the lines in the first round, severely retarded railway construction. Less than 3000 km were in operation in 1850, whereas in the German states nearly twice as much had been built (see Table 1). During the 1850s, the numerous companies were reduced to 6 companies; each of them got nearly a monopoly in their respective areas, five in their radial sectors around Paris. During the 1860s, a "second network" emerged and the government guaranteed the interest on the obligations issued by the private companies for financing the construction.

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[4] Detailed references are deliberatedly not made. For those who want to consult major works on Continental railway history, the following references are given: In general, see *F. Voigt*, Verkehr, Die Entwicklung des Verkehrssystems, Berlin 1965 and for more recent years *P. Nijkamp (ed.)*, Europe on the Move, Recent Developments in European Communications and Transport Activity Research, Avebury 1993; *P. Nijkamp / J.M. Vleugel*, Missing Transport Networks in Europe, Avebury 1994; *T. Kiriazidis*, European Transport: Problems and Policies, Avebury 1994; for Belgium, *B. van der Herten*, De ontwikkeling van communicatie en transport in België tijdens de lange 19de eeuw, doctoral dissertation, Leuven 2000*; M. Laffut*, Belgium, in: *P. O'Brien (ed.)*, Railways and the Economic Developmnet of Western Europe 1830-1914, London 1983, pp. 203-226; for Germany, *R. Fremdling / R. Federspiel / A. Kunz (eds.)*, Statistik der Eisenbahnen in Deutschland 1835-1989, St. Katharinen 1995; *R. Fremdling*, Eisenbahnen und deutsches Wirtschaftswachstum 1840-1879, Dortmund 1975; *Zug der Zeit – Zeit der Züge*, Deutsche Eisenbahn 1835-1985, Berlin 1985; for the Netherlands, *J.A. Faber (ed.)*, Het spoor, 150 jaar spoorwegen in Nederland, Utrecht 1989; *J.H. Jonckers Nieboer*, Geschiedenis der Nederlandsche spoorwegen 1832-1938, Rotterdam 1938; *P. Groote*, Kapitaalvorming in infrastructuur in Nederland 1800-1913, Cappelle aan de IJssel 1995. English version: Infrastructure and Dutch Economic Development, Utrecht/Groningen 1996; for Britain, *Gourvish* a.a.O. 1980 and *T.R. Gourvish*, The Regulation of Britains's Railways: Past, Present and Future, in: *L Andersson Skog / O. Krantz (eds.)* Institutions in the Transport and Communications Industries, Canton Mass. 1999, pp. 17-132*; G.W. Crompton*, Railway Nationalization in the United Kingdom, in*: L. Andersson-Skog / O. Krantz (eds.)*, Institutions in the Transport and Communications Industries, Canton Mass. 1999, pp. 133-151; *P.S. Bagwell*, The Transport Revolution 1770-1985, London 1988; for France, *F. Caron*, Histoire de l'exploitation d'un grand réseau, La Compagnie du Chemin de Fer du Nord 1846-1937, Paris 1973 and *F. Caron*, Histoire des chemins de fer en France 1740-1833, Paris 1997.

Promoter of the first concrete plan to actually build a railway line in the Netherlands was Bake, an army officer. On an official voyage to England he had seen the success of the Liverpool-Manchester line and planned a line connecting Amsterdam with Cologne. He intended to finance the project with private capital as a joint-stock company like in England. In 1834, the entire project was given up, because neither in Amsterdam nor in Cologne sufficient subscribers for the shares could be summoned up. That failure is typical of numerous early railway plans all over Europe. It was due to several misjudgements: Bake's railway line was planned mainly for the shipment of goods while nearly all successful early railway services were mainly based on the transportation of passengers. In those years, the territorial competition among countries, provinces and cities blocked many a railway construction, above all when a line would have crossed state borders. If the direct profitability of a new railway line was questionable, the indirect benefits had to be convincingly substantial in order to get the support of local merchants and even more importantly, of the administration of municipalities and countries. In the case of Bake's plan, Rotterdam right from the beginning opposed this Iron Rhine from Amsterdam to Cologne. The city obviously considered its position as seaport and the transit trade on the Rhine to Cologne to be in danger. In Cologne on the other hand, the transit fees on the Rhine levied by the Dutch government for long had been regarded as a severe obstacle of a free shipment on the Rhine. That is why Cologne merchants and authorities were eagerly looking for alternative transit routes. An Iron Rhine to Amsterdam was not their first choice, though. They favoured an Iron Rhine from Cologne to Antwerp or a railway line between the rivers Weser and Rhine. (In the first instance, these plans were based on the same misjudgements as Bake's.)
In those early years of the railway, private initiative thus very often failed for several reasons. Only where a government guaranteed a minimum profit (e.g. in Prussia) or where it constructed railways of itself (e.g. Belgium)[5] long distance lines or a nationwide network could emerge. Private railway companies (and later networks) only succeeded if there was sufficient demand of passenger service between certain cities. It is hence perfectly understandable that the first successful railway connection in the Netherlands was the line between Amsterdam and Rotterdam. The line was widely built exactly parallel to the existing canal with the *trekvaart* for passenger transportation. The first part of the *"Hollandsche IJzeren Spoorweg Maatschappij" (HSM)* was opened in 1839 between Amsterdam and Haarlem, the entire line until Rotterdam was not finished before 1847. Although the profitability of the line barely exceeded the interest rates paid on Dutch state bonds the company subsequently succeeded in raising sufficient shareholder capital for building up one of the three major railway networks in the Netherlands.

The failure of Bake's initiative did not stifle the plan to construct a railway line from Amsterdam to Prussia. The second attempt undertaken by the king and the government to finance the line on the expense of the state failed in parliament in 1838, though. Due to the personal commitment of the king, who gave a guarantee on the interest payment of a loan the private railway company *"Nederlandsche Rijnspoorweg Maatschappy" (NRS)* was founded and construction works finally began. The company followed the strategy of opening connections between major cities step by step. From 1843 to 1845, the lines from Amsterdam to Utrecht and from Utrecht to Arnhem were built.

[5] Originally, the state-owned Belgian network had been designed mainly for the transit trade of goods. Ironically the first part opened between Brussels and Mechelen (1835), succeeded just in the transportation of passengers, and for the transportation of goods there was no sufficient rolling stock. See *Van der Herten*, a.a.O., pp. 349 f.

Even before the line crossing the state border to Prussia was finished in 1856, the *NRS* opened a profitable sideline from Utrecht to Rotterdam. It served the densely populated *randstad* with its high demand for passenger transportation. The general rule, that demand-induced railway construction for passenger services made railways successful prevailed in the 1840s and 1850s.
Beyond the west of the country, no privately built network of railway lines came into being. In particular, all plans for long distance railway connections to the eastern neighbours in Germany proved to be no more than *papieren spoorwegen:* railways sketched on paper instead of actually being built.

The Dutch government realised that a nationwide railway network would hardly be achieved by private initiative alone. Although the Dutch political scene was overwhelmingly dominated by liberal laissez-faire politicians, the government in 1860 decided to construct a national railway network beyond the west of the country at the expense of the state budget. The liberal government provided only the infrastructure, whereas the exploitation was assigned to a private company, namely the *Maatschappij tot Exploitatie van Staatsspoorwegen (SS).*

The traditional historiography of railways in Germany has emphasised the active role played by the state in promoting the introduction of this new means of transport. Historians have argued that during the 1830s the relatively backward German economy had not generated enough demand for transportation services to permit the running of profitable privately owned railways. Having decided to mobilise the necessary funds for this capital-intensive and costly enterprise, governmental authorities had the choice of either subsidising private railway construction or running the lines themselves. Furthermore, the actual involvement of German states with railways leads to the impression that they played a positive and decisive role in their promotion. At that time, the 1830s and 1840s, the entity that in 1871 became the German Empire still comprised 39 separate sovereign states. The extent of their involvement differed widely: some governments (e.g. Hanover, Brunswick, Baden and Württemberg) built state-owned systems; whereas in states like Prussia and Saxony privately-owned railways dominated the rapidly expanding system right from its beginnings. In these latter cases governmental influence on privately owned companies spanned a spectrum of relationships from examples where the state was a major shareholder to cases where the governments guaranteed minimum returns on private share capital. In some states civil servants even ran privately owned companies when they had performed inefficiently.

Nevertheless, and in contrast to the impression that states played a positive role in the development of railways, a systematic analysis of the evidence reveals that state intervention often hindered the development, especially during the 1830s. States adopted a negative attitude to railways when they thought they caused 'trade diversion' instead of 'trade creation'. Thus several governments rather reluctantly granted concessions to private companies which planned lines that crossed state borders. Such lines usually followed existing trade routes, and merely linked well-established and major commercial centres. Ironically it was this very attitude, which jealously viewed railway construction in terms of a zero sum game, that actually led to accelerated growth in the 1840s. As soon as a railway line was being built in a neighbouring state its rival felt compelled to construct one as well, in order to counteract the assumed 'trade diversion' effects. But by and large, railway construction by states or public support of private companies did not compensate for the obstacles

placed by governments on private initiatives. The breakthrough into a railway network must be attributed mainly to the efforts of private enterprise. The fact that railways were in general lucrative investments from the beginning suggests that their construction followed an existing demand for their services. The earliest railways paid for themselves even in the short run. It could be argued that without interference from governments concerned with particularistic aims, and with private companies allowed to determine the shape of their respective network, a comparable, and probably superior, railway system would have emerged. State financial support might never have been necessary, and railway construction would have taken off somewhat earlier and proceeded more rapidly than it actually did under a regime of bureaucratic interference and delay.

To conclude this chapter, a brief remark of railway's general impact on the economies is due. In contrast to Britain railway service and railway construction on the Continent was crucial for the first round of the process of industrialisation or modern economic growth. Through cheaper transportation costs the railway helped to integrate the economies. In Belgium and the Netherlands, it complemented a system of waterways and roads that was rather well developed for that time. In France and Germany, the railways for the first time provided an efficient and cheap nationwide transportation system. Thus the railways not only served their very first customers, namely the transportation of passengers and high value good, but increasingly they transported bulky goods, like coal over long distances. Strong backward linkage effects stimulating the heavy industry to supply the main investment goods for railway construction accompanied these forward linkage effects. In the Netherlands, the backward linkage effects mainly went to other countries by importing rails and rolling stock. In the first instance, British industry profited from this demand, but later also Belgian and German iron masters. In Belgium, state railway construction was even considered to assure the crucial demand for the expanding modern iron industry based on coal-using technologies. This issue had been discussed as early as the late 1820s, still under the "regime hollandais".[6] Because of nearly prohibitive import duties in France, investment goods for railway construction hardly could be imported. Thus railway demand assured the new iron mills designed according to the British model a profitable production of rails for the first time. In Germany, the *Zollverein* (the customs union of most German states) followed a moderate tariff policy. As German enterprises were hardly capable of meeting railway's demand for locomotives and rails, these were mainly imported from Britain but to some extent from Belgium as well. A rapid process of import substitution directed those demands increasingly to newly founded factories within Germany. The railway was the leading sector during Germany's industrial revolution between the 1840s and 1870s.

In Table 1, key figures on railway statistics are presented. The benchmark years clearly show that Britain possessed an early lead in railway construction, but by 1910, concerning the length of the networks, Germany and France had surpassed her. A better comparison among the countries is given when the population or the size of the country is taken into account. In terms of length of the network per capita, the UK also had a clear lead in 1850, followed by Belgium and Germany. In that respect, railway construction in France and more so in the Netherlands was rather disappointing. This picture changed in 1880, after an enormous increase of mileage in all of these countries. France and the

[6] See *B. Gales / F. Fremdling*, IJzerfabikanten en industriepolitiek onder koning Willem I: de enquête van 1828, in: NEHA-Jaarboek 57, 1994, pp. 287-347.

Netherlands had caught up considerably, but Britain was still ahead. In 1910, France and Germany had the highest mileage per capita. This is partly due to the large land areas in these rather thinly populated countries as compared with Belgium and the Netherlands. Per square kilometre, Belgium in 1880 and 1910 possessed the densest network. Consequently, in those years Belgium used its network highly intensive for passenger services as well.

3. Regulation, Competition, Collusion, Merger and Nationalisation

Early railway legislation both in Britain and on the Continent considered the railway as a road or a waterway to be used by different, independent carriers. Consequently, for privately-owned and –operated railways, the regulation laws in order to avoid monopoly exploitation concentrated on the tolls carriers had to pay for using the track. The regulation of tariffs charged for the transportation of passengers or goods was rather weak, because a competitive use of the track had been expected. Thus usually merely a maximum tariff or profit rate was fixed and the government had to agree upon tariff increases.[7] Because of economies of scale and technical improvements the costs of railway exploitation per unit of transport decreased anyway. Without a competition, these stipulations did not help against monopoly exploitation. In practise, competitive supply of railway services on the same track only occurred in very exceptional cases. In those countries where independent railway companies operated in overlapping networks (it did not matter if state-operated companies were involved) "running power" to a rival company was only granted for short distances. For longer distances, this was only done when those companies cooperated and revealed collusive behaviour in place of competing against each other.

In countries with a pure state railway system or in France, where private companies enjoyed neatly fenced-off area monopolies, other forms of competitive behaviour did not occur. That is why only overlapping networks of independent companies are treated in this section of the article. The two major strategies were the building of parallel tracks or a discriminatory fixing of tariffs. In the long run, building parallel tracks or connecting two locations with an alternative railway line proved a dead end. With increasing network density the existing company could threaten to reduce tariffs to variable costs and thus make "parallel building" unprofitable. Differential tariffs were also a dead end in the long run. Not only the public complained about this "unhealthy" competition, where on long distances rates were lower than on short monopolised routes, but also the railway companies themselves tried to secure their profits by forming cartels or by even merging into one company.

In laisser-faire Britain, as soon as in the 1840s, the first mergers occurred (in 1844 the "Midland Railway"). During the 1870s, more than 80% of the network was in the hands of just 8 companies. During the First World War, the railway system was run as state enterprise but in 1921 it was privatised and just 4 dominant companies with radial sectors around London prevailed. In some areas, the networks still were overlapping. Competitive elements disappeared, however, when in the 1930s, the companies agreed upon pooling the receipts in those areas. In 1947/48, the companies were

[7] In the case of Prussia, this kind of regulation is discussed on the basis of the related theoretical literature by *R. Fremdling / G. Knieps*, Competition, Regulation and Nationalization: The Prussian Railway System in the Nineteenth Century, in: Scandinavian Economic History Review 41, 1993, pp. 129-154.

nationalised, which was not due to inherent problems of the railways, but part of a broader political programme of the then ruling labour party.

In some of the continental countries, the move towards a state monopoly was more straightforward. In Belgium, between 1845 and 1870, private companies built and operated an increasing share of the network. By 1870, merely 25% of the network were in the hands of the state. On non-disputed connections, rather high monopoly tariffs were charged and in competition with state-served lines, artificially low tariffs were asked in order to attract additional traffic. The reaction of the government was simply to buy those private companies from 1870 onwards, i.e. the "Grand Central Belge" in 1897. In 1914, 4.500 km (out of 4800 km) of primary railway lines were operated by the state. The "Société Nationale des Chemins de fer Belges (SNCB)" got an autonomous status in 1926, but remained in the ownership of the state.

In Prussia, the government deliberately favoured parallel railway construction in order to counteract mergers and monopoly exploitation of the private companies. As soon as in the early 1870s, the government and the public became aware that a new regulation of the railway system was due. A commission of the Prussian parliament recommended the nationalisation of the railway infrastructure and a competitive exploitation of the network by private companies using the same tracks. This recommendation was not followed, though: After the plans had failed to found a railway system owned and operated by the state and being placed under the supervision of the government of the German Empire, the powerful member states of the German *Reich* nationalised their private companies. In Prussia, from 1879 onwards, the government bought the railways from the shareholders by offering them state bonds. In Bavaria and Saxony, this had been done even earlier and the other German states followed. In 1913, merely 6% of primary railways were still in private operation. In 1920, the railways of the federal states were integrated into the *Reichsbahn* with an autonomous status from 1924 onwards.[8]

During the 1860s and 1870s, the Netherlands developed the same pattern of railway competition as other countries with privately exploited railways. What Joncker-Nieboer labelled as the "competition of the three great powers", meant an oligopolistic structure with the construction of parallel routes and competition among alternative routes to the same destination. Contemporary observers and even transport historians of today used to denounce this organisation as "unhealthy competition" with "a hopeless confusion of tariffs and exploitations rights". In 1890, one of the three companies, the *NRS*, gave its concession back to the government. Subsequently, in the same year, the Dutch railways system was completely reorganised to form a worldwide probably unique arrangement. The design of "concentration and competition" divided the Dutch railway infrastructure between the two remaining large companies in such a way that both companies on their own lines served each larger city. Where a separate access per line was not possible both companies jointly used the same track competitively.

[8] The profits of the *Reichsbahn* had been tied to the reparation payment of the German Empire.

The Dutch were very well aware of the possibility of collusive behaviour. But on the one hand they trusted in the intermodal competition by boats on canals and rivers to restrain collusion and on the other hand the state had still the possibility to nationalise railway operation.
Contemporary observers admitted that the system of "concentration and competition" worked. Tariffs did decline indeed and the competition on the track, with both companies using the same line, did not bring about any technical or safety problems in principle. Even fierce opponents of this competition on the track did not complain about its technical feasibility. They rather disapproved of the waste of capital etc. (thus advancing the familiar arguments in favour of exploitation in one hand), but their main objection concerned the possibility that the companies could give back the concession in return for a generous compensation. It was the state guaranteeing for private capital that mainly worried contemporary observers. This guarantee was probably a shortcoming of the regulation arrangement made in 1890, but the argument is certainly no principal objection against competition on the track.
For the Dutch case it can be concluded that the risk for the state budget and the inherent tendency of network enterprises towards collusive behaviour finally paved the ground to abolish competition on the track. With the collaboration of the government a cartel or monopoly was established in 1917. And after heavy losses during the interwar years finally a state-monopoly was founded in 1937.
In France, a state monopoly was created in 1937 when the Société Nationale des Chemins de fer Français (SNCF) took over the exploitation of the 5 private companies and the 2 state owned networks. The move towards nationalisation was not in the first instance done in order to avoid monopoly exploitation. The companies had exploited regional monopolies, but their profits had been controlled and redistributed by a government agency. By a law from 1921 profits above a certain level were disposed into a "fonds commun" for companies which suffered losses. After the Great Depression of the 1930s heavy losses of all companies were a major reason for nationalisation.
These tendencies towards state monopolies in the long run are typical of all major European states. From about 1950 on, most people took for granted that railways are a natural monopoly to be owned and run by the state. With the coming of the automobile, the railway even threatened to be doomed to disappear or to retreat into mere niches of transportation.

4. The Decline and the Revival of Railways in Europe

During the interwar years and even more so after the second World War, European railways suffered from a new competition, namely the automobile both for goods and passenger transportation. This structural threat for the railways in the long run had been preshadowed during the worldwide economic crisis in the 1930s. In contrast to the 19th century, when cyclical fluctuations to a large extent were cushioned by the growth trend, at that time the railways formed an integral part of the economic slump and most of the railways suffered heavy losses. As it was considered merely a cyclical phenomenon the years of depression and the subsequent increased demand during the war hid the structural problem the railways had to face after the war. After 1945, railways in Western Europe became huge state-run monopolies whose increasing deficits were compensated for by the general budget. The structural problem of the railway as means of transportation was aggravated by an economic policy that favoured the automobile. The building of roads and motorways (*Autobahnen*) got priority over the railway. Its struggle against the automobile seemed to be a lost battle.
A rather defensive railway policy did not stay retreat and decline. The length of lines, given in Table 1 for some benchmark years, documents that. In all of the chosen countries, the mileage was at a peak in

1930. And after the war, the mileage decreased dramatically until recently (1998). Even more dramatically, the share of railroad in the overall transportation of goods and passengers shrank. For 15 countries of the European Union, Eurostat compiled figures on the modal split: In goods transport, railways had a share of 32.7% in 1970 and the figure (for 1997) reveals a steep decline to 14.5%. In passenger transport, the railway in the same years held a share of merely 10.1 and 5.8 respectively.[9] This description of the decline seemingly makes it a rhetoric question to ask: Do railways have a future in Europe? Actually, they do. First of all, the decline of railways during the second half of the 20th century surely is mainly a relative one. Output figures in Table 1 reveal that passenger transport absolutely grew. And even goods transport grew in certain countries or periods [10] With a declining network the productivity in the use of the mileage increased considerably (see Table 1).

The revival of the railways in Europe came about roughly in the last two decades. Increasing congestion on roads in short and long distance traffic made politicians and the public aware of the potential future of the railway. The more so as this type of transport pollutes the environment less than the automobile. On the technical side, the development of high speed trains and railway lines made the railway more attractive on long distances compared with the automobile and even the aircraft. France became the pioneer in introducing high-speed train services: when the first connection between Paris and Lyon was opened in 1983 the air travel market between the two cities collapsed. In Germany, high-speed trains, as in France, run on new-constructed or improved tracks. Italy, Belgium and the Netherlands joined or integrated the high-speed rail networks increasingly (see Tables 2 and 3). The most spectacular event was the opening of the channeltunnel in 1994. Currently Brussels has acquired a central position in the European high-speed railway network: From Brussels one can use these trains to Paris, London, Amsterdam and Cologne. In addition to new high-quality services for passenger transportation new lines for goods services are under construction or are revived, namely the Betuwe-route from Rotterdam to Germany, or the so-called "Iron Rhine" from Antwerp through the Netherlands to Germany.

In addition to these technical innovations, organisational or institutional reforms have been introduced or planned. In a number of West-European countries, railways have been or will be privatised. The aim is not to create a private monopoly in place of a state-owned one with a separation between ownership and exploitation of the network. For this, it is crucial that competing exploitation companies will (at least potentially) get access to the track owned by a network company. In line with the aims and regulations of the European Union policy, competitive railway services will even cross state or network boarders. Due to the heritage of former state monopolies, the railway infrastructures will probably remain tied to the national states of the European Union, though. This, however, should be no obstacle for service companies to operate on a European scale if the legal preconditions and the technical standard are designed in an appropriate European framework. We thus probably witness a return to the ideas and legislations on railways of the early 19th century when the railway was

[9] Goods transport in tkm as share of the total (road + railway + inland waterway + pipeline (oil)). Passenger transport in pkm as share of the total (passenger cars + busses and coaches + tram + metro + railway + air). Source: Eurostat, see notes on Table 1.

[10] The decline in goods transport in Germany between 1990 and 1998 is due to the impact of the unification. In the GDR's plan economy goods transport clearly got priority for using the railway. In 1998 it had been adapted to the West-German pattern.

considered a way open for independent users. Companies competing on the same track could use railways for long distance traffic crossing state boarders, then and now.

Appendix: Tables

Table 1

Railway Statistics for Belgium (B), Germany (G), France (F), The Netherlands (NL) and the United Kingdom (UK), 1850-1998

Year		1850	1880	1910	1930	1950	1970	1990	1998
Length of	B	916	4044	4634	5125	5046	4232	3479	3410
lines in	D	5875	34070	59320	58369	49819	43777	40981	38450
kilometres	F	2915	23089	40484	42400	41300	36117	34260	31727
	NL	181	1850	3199	3677	3204	3148	2798	2805
	UK	9799	25060	32184	32632	31353	19330	16914	16847
Passenger	B	0.15	1.3	4.6	7.0	7.0	7.6	6.5	7.1
transport in	D	0.8	6.5	35.4	44.3	48.8	56.9	62.1	62.7
1000 millions	F	0.8	5.9	16.8	29.2	26.4	41.0	63.8	64.3
of pkm	NL	0.0	0.4	1.3		6.2	8.0	11.1	14.8
	UK	1.7				32.5	30.6	33.4	35.4
Goods	B	0.09	1.8	4.9	7.1	5.5	7.9	8.4	7.6
transport in	D	0.3	13.0	51.8	55.3	58.2	113.0	101.7	73.6
1000 millions	F	0.5	10.4	21.5	40.9	38.9	67.6	50.7	54.0
of tkm	NL	0.0	0.3	1.1		3.0	3.7	3.1	3.8
	UK	1.2			29.1	36.2	24.5	15.8	17.4
Population in	B	4.4	5.5	7.4	8.1	8.6	9.6	10.0	10.2
millions	D	33.7	45.1	64.6	65.1	69.2	77.7	79.4	82.0
	F	36.3	39.0	41.2	41.6	41.8	50.8	56.7	58.8
	NL	3.1	4.0	5.9	7.9	10.1	13.0	15.0	15.7
	UK	20.6	29.4	40.5	44.6	50.4	55.6	57.6	59.1
Length of	B	208.2	735.3	626.2	632.7	586.7	440.8	347.9	334.3
lines per	D	174.3	755.4	918.3	896.6	719.9	563.4	516.1	468.9
capita in km	F	80.3	592.0	982.6	1019.2	988.0	711.0	604.2	539.6
per million	NL	58.4	462.5	542.2	465.4	317.2	242.2	186.5	178.6
inhabitants	UK	475.6	852.4	794.7	731.7	622.1	347.7	293.6	285.1

Table 1 (continued)

Year		1850	1880	1910	1930	1950	1970	1990	1998
Length of	B	30.0	132.6	151.9	168.0	165.4	138.8	114.1	111.8
lines per 1000	D	11.2	63.0	109.7	124.6	139.5	122.6	114.8	107.7
km2	F	5.4	43.0	75.5	77.9	75.9	66.4	63.0	58.3
	NL	5.6	56.9	98.4	113.1	87.5	75.9	67.4	67.6
	UK	42.8	109.5	140.7	142.6	128.4	79.2	69.3	69.0
Passenger transport (1000 pkm) per km railway line	B	164	321	993	1366	1387	1796	1868	2082
	D	136	191	597	759	980	1300	1515	1631
	F	274	256	415	689	639	1135	1862	2027
	NL	36	215	418		1935	2541	3967	5276
	UK	178				1037	1583	1975	2101
Goods	B	98	445	1057	1385	1090	1867	2414	2229
transport	D	5	382	873	947	1168	2581	2482	1914
(1000 tkm)	F	172	450	1280	990	942	1872	1480	1702
per km	NL	5	163	335		936	1175	1108	1355
railway line	UK	122			892	1155	1267	934	1033

Notes: The reader might find deviating figures in other sources than those used here. In most cases this is due to a different definition of the category used or a different estimation procedure.
D: 1950, 1970, 1990 including the GDR, UK: 1850-1913 only Great Britain
Sources: 1970-1998 *Eurostat* via internet (http://europa.eu.int/en/comm/dg07/tif/contents.htm)
Area of the countries: Based on several encyclopediae, the following figures were used (1000 km^2) B 30.5; D 1850 526.2, 1880-1910 540.7, 1930 470.5, 1950-1998 357; F 1850 544, 1880-1910 536.4, 1930-1998 544; NL 1850-1930 32.5, 1950 36.6, 1970-1998 41.5; UK (GB) 1850-1930 228.8, 1950-1998 244.1.
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Railway statistics, before 1970:
B: *Laffut*, 1983, and *B.R. Mitchell*, European Historical Statistics 1750-1970, London 1978; D: *Fremdling*, 1975, *Fremdling/Federspiel/Kunz*, 1995, and *Mitchell*, 1978;
F: *Mitchell*, 1978;NL: *Groote*, 1995 (length), *J.P. Smits*, Economische groei en structuurveranderingen in de Nederlandse dienstensector, 1850-1913, Amsterdam 1995, Appendix 2 (pkm, tkm 1850-1910); UK: estimated according to *Hawke*`s figures for England & Wales (+ 11%) in 1850; otherwise *Mitchell*, 1978.

Table 2

Railways: High Speed Rail Network Existing lines: length in km

	B	DK	D	E	F	I	S	UK*	EU15
1981	-	-	-	-	301	150	-	-	451
1983	-	-	-	-	417	150	-	-	567
1988	-	-	90	-	417	224	-	-	731
1990	-	-	90	-	699	224	-	-	1013
1991	-	-	428	-	699	224	-	-	1351
1992	-	-	428	471	737	246	-	-	1882
1993	-	-	428	471	1057	246	-	-	2202
1994	-	-	428	471	1159	246	-	52	2356
1995	-	-	428	471	1159	246	-	52	2356
1996	14	-	428	471	1246	246	-	52	2457
1997	88	15	428	471	1246	246	-	52	2546
1998	88	15	577	471	1246	246	31	52	2726
1999	88	15	577	471	1246	246	31	52	2726

Note:* UK (and France): Channel-tunnel; DK: Great Belt crossing; S: Flemingsberg-Jarna; E: Madrid-Seville; I: Rome-Florence; B: Brussels-French border
Source: Eurostat, see notes on Table 1.

Table 3

High Speed Lines under Construction

	Line	Length km under construction	Year of opening
B	(Brussels)Leuven-Bierset (Liège)	62	2002
B	Antwerp-Dutch frontier	38	2005
DK	Öresund crossing	18	2000
D	Cologne-Rhine/Main (Frankfort)	215	2002
D	Nuremberg-Ingolstadt	88	2003
E	Madrid-Lleida/Barcelona (3 sections)	296	2002
F	Valencia-Marseilles/Nîmes	250	2001
I	Rome-Naples	220	2003
I	Florence-Bologna	77	2005
NL	Amsterdam-Belgian border (sections)	120	2005
S	Nyland-Umeå	200	2006
UK	Channel Tunnel-Fawkham (London)	74	2003

Note: year of opening is indicative and subject to change
Source: Eurostat, see notes on Table 1.

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