

Competition between Dutch Skippers, German Shipowners, and the Transition to Steam

Hein A.M. Klemann

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Abstract

In the nineteenth century, Rhine skippers faced new competition. Firstly, in 1830, the Mainz Act abolished the monopolies on part of the Rhine for skippers from certain states. This economic liberalization created competition between skippers and also introduced more of a change for steam navigation on the river. The traditional skippers who had their ships towed upstream by teams of up to ten horses, but sailed downstream, now had to become more efficient. To this end, the horse stations were reorganized. However, from 1843 a train also ran from Antwerp to Cologne. This form of transport also posed a threat to the skipper. Moreover, the railways needed fixed bridges, meaning that a ferry or a pontoon bridge was no longer sufficient for traffic across the Rhine. This was probably the reason that small skippers gave up towing with horses around 1860 and started to use a steam tug when going upstream. Downstream they continued sailing on the wind and current. Only at the end of the nineteenth century, after a huge process of normalizing the river, did the scale of Rhine navigation increase substantially. It made Rhine navigation competitive again against the railways. German Rhine shipowners, often connected to large German industrial companies from the Ruhr area, began a process of utilizing increasingly longer tugs, with increasingly powerful tugboats and barges with increasing loading capacity. In doing so, they threatened the position of the small, independent, mostly Dutch Rhine skippers. From now on, those skippers also had to be tugged both upstream and downstream and had to purchase increasingly larger iron or steel barges. Such investments did not result in more revenue per trip but kept the trip at least somewhat rewarding enough to continue. However, to finance the investments in new barges, many Rhine skippers were forced to give up their homes on shore and take their families on board. This

not only limited the costs of their household, but also allowed savings by having the wife and children do the work of the skipper's servant. In this way they stayed in business, but not without becoming impoverished.

Introduction

In the last decades of the nineteenth century, navigation on the Rhine regained its position compared to the train as the dominant mode of transport between the Ruhr area, the industrial center of Westphalia, Prussia-Germany, and the North Sea ports. This recovery was essential for Rotterdam, the Dutch port at the Rhine estuary. It could now become the bulk port of the most important industrial region of the European continent and, in the twentieth century, the largest port in Europe and even the world. From the 1840s onward, German railways flourished, so that in the following decades the new rail transport system accounted for an increasing share of the growing freight transport between the fast-growing German industrial region and the ports on the North Sea. Thanks to its excellent rail connections, Antwerp, the Belgian port, became a leading center in the region. Although rail transport remained much more expensive per ton/kilometer than Rhine transport (see below: graph 5), rail transport was often cheaper in the end. Trains were not only cheaper because the distance Antwerp-Cologne was shorter than the distance Rotterdam-Cologne, but also because transport by train was faster and more reliable. Ice, or other weather conditions had much less influence on this form of transport than on inland shipping. Most important was, however, that railways could often transport the cargo of their most important customers to or from their final destination, while Rhine transport could only reach destinations along the river. These connections allowed transporters who used rail to realize enormous savings on transshipment costs. Only when, from the end of the nineteenth century, rail transport per ton/kilometer was no longer two to three times more expensive than Rhine navigation, but five to nine times more expensive, did the railway lose its position again.¹ From the 1840s, when the railways emerged, the port of Rotterdam, which was completely dependent on inland shipping, had to defend its position tooth and nail. That is why in the 1860s and 1870s the Netherlands invested enormous sums of money in the *Nieuwe Waterweg*,

1 Hein A.M. Klemann and Joep Schenk, 'Competition in the Rhine delta. Waterways, railways and ports, 1870-1913', *Economic History Review* 66:3 (2013) 826-847, there 839.

a canal that directly connected Rotterdam to the North Sea. Moreover, from the 1860s onwards, the navigation channel of the Rhine in both the Netherlands and Germany was adapted to modern large-scale steam towing. As a result, from the 1880s onwards, when the necessary hydrotechnical construction works were completed, Rhine navigation was able to recover a growing share of the cargo, especially bulk. In a period when inland shipping disappeared almost everywhere else, this situation was exceptional. The reason for it was that between 1870 and 1913, transport costs for Rhine traffic (adjusted for the general price developments) fell by as much as 81 percent, while German rail freight rates fell by only 36 percent and Dutch by no more than 11 percent.²

The much lower Rhine navigation rates became possible when the engineering works known as the normalization of the Rhine opened up the river to enormous trains of barges, each with a carrying capacity many times greater than that of traditional sailing barges. Upstream and more and more also downstream, these new barges were no longer towed by horses but pulled by steam tugs.³ To increase the efficiency and competitiveness of Rhine navigation, it was not enough to normalize the river, but the scale of navigation also had to increase. To realize the restoration of Rhine navigation, all skippers had to participate in this process of technical transformation. If they did not do so, the market forced them to disappear. The question here is not how Rhine navigation was able to regain its competitiveness, but how traditional skippers survived, faced with the new technology and much lower freight rates. The process of change required for this survival began with the introduction of steam navigation on the river.

To understand how the Rhine skippers adapted to the new situation, the adjustment period must be divided into three parts. Steamships appeared on the Rhine as early as the 1820s and especially in the 1830s. In response, traditional skippers reorganized horse stations to shorten their wait time for fresh horses and thus reduce their costs, without solving the problem that the use of horses kept their barges small and the speed of those ships low. It was only between 1850 and 1860 that horse-towing was replaced by steam tugs. As with tow horses, self-employed skippers used such tugboats only in an upstream direction.

2 Klemann and Schenk, 'Competition in the Rhine delta', 839.

3 Klemann and Schenk, 'Competition in the Rhine delta', passim; the maximum capacity of a big coal-barge grew from less than 500 tons before 1860, to 529 tons between 1871 and 1880, and 929 tons in the next decade, reaching 1,277 tons in the 1890s. E.J. Clapp, *The navigable Rhine. The development of its shipping, the basis of the prosperity of its commerce and its traffic in 1907* (Boston 1911) 43.

They sailed downriver to save on tugboat fees, as well as to keep their distance from the steamboat companies.

Twenty-five years later, when the normalization of the Rhine was completed, the size of the ships multiplied several times. Yet it was not until the early twentieth century that wooden sailing ships disappeared and trains of iron or steel steam tugs, up to 400 meters long, became common in both directions.⁴ To finance the large investments now required for the adaptation, small, self-employed Rhine skippers took out loans from friends, family, or a bank. To repay these loans, but also to adapt to their lower incomes, they had to cut back on everything. That is why almost all independent Rhine skippers gave up their homes on shore sometime between 1870 and 1900 and took their families on board. It was a huge cutback because the family could now also lend a helping hand. Thus, a paid skipper's assistant also became redundant. This decision to live on their barge with their families had major consequences for their daily lives and their social position. Although Rhine skippers had a high status in the world of skippers, people from the shore, as they called the outsiders, classified them as vagrants from the moment they took their families on board. They were often placed in the same social category as fairground workers and trailer home residents. When compulsory primary education was introduced in 1901, skipper's children were exempted from it. In the short term, that exemption was a solution; over time, however, it reinforced the isolation of the skipper's world and gave their children a bad start in a world in which formal education was becoming increasingly important. Nevertheless, the skippers adapted to keep the Rhine intact as an important transport route and, above all, to keep their business running. They made at least three such adaptations in the nineteenth and early twentieth centuries. The recurring need to do so and its consequences are discussed here.

The introduction of steam: The first step

Around 1850, because there were no train connections yet, 90 percent of all cross-border traffic between the Netherlands and Germany consisted of Rhine traffic.⁵ The scale of Rhine navigation was many times greater than that of the only alternative: horse-drawn carts.

4 Clapp, *The navigable Rhine*, 44.

5 See: Agnes Lewe, 'Invoer te lande verboden.' *Een verkenning van de handel over landwegen tussen Nederland en de Pruisische provincies Rijnland en Westfalen, 1836-1857* (Hilversum 1995) passim.

Because the current was usually stronger than the wind, horses were also used to tow ships upstream until the introduction of steam power. Such ships were therefore small. A strong horse can pull about 40 tons over water. The volume of Rhine navigation was therefore extremely small compared to that of current inland navigation, but about 30 times larger than transport by horse-drawn carts. In addition, a number of horses could be used on the towpaths at the same time, provided they were harnessed one after the other.⁶ To keep such teams of horses manageable and to prevent free-riding behavior in these animals, the maximum size of such teams was eight to ten horses. Therefore, ship and cargo together could not weigh more than 350-400 tons. That this capacity was not much was a limited problem, because sand and gravel banks, rocks, shoals, and all kinds of other obstacles made the river impassable for larger ships anyway. Therefore, in 1850 the loading capacity of the largest Rhine barge was still around 400 tons, and most were considerably smaller.⁷ Nearly 60 percent of the 8,500 ships that called at the Cologne Rhine port in these years had a loading capacity of less than 125 tons. The capacity of the remaining 40 percent rarely exceeded 250 tons.⁸ Further upstream, where the waterway was full of rocks, sandbanks, gravel, and rapids, the ships were even smaller. That is why around 1850, in addition to the approximately 100 steamships, 3,000 draft horses still were used along the Rhine.⁹

From the 1820s onward, paddle steamers conquered a place on the river, and as early as 1823 it became possible to go by steamboat from Rotterdam to Nijmegen, near the German border, every other day.¹⁰ Steam power received a boost when the Rhine states signed the Act of Mainz in 1830. This treaty freed Rhine navigation from monopolies, the remnants of staple markets, and other institutional barriers, while tolls were significantly reduced. Now that the monopolies that skippers of a certain nationality de facto had on a part of the Rhine came to an end, Rhine transport opened up to competition. It also meant that the

6 V. Kurs, 'Schiffahrtsstraßen im Deutschen Reich. Ihre bisherige und zukünftige Entwicklung und ihre gegenwärtige wirtschaftliche und finanzielle Ausnützung', *Jahrbücher für Nationalökonomie und Statistik* 3 (1895) 641-705, here 664.

7 Clapp, *The navigable Rhine*, 24.

8 G. Schirges, *Der Rheinstrom. Ein Beitrag zur Kenntniß der Geschichte, Handelsstatistik und Gesetzgebung des Rheins* (Mainz 1857) 75.

9 Heinrich Meidinger, *Die deutschen Ströme in ihrem Verkehrs- und Handels-verhältnissen* (Frankfurt am Main 1861) 2: *Der Rhein*, 73.

10 H.W. Lintsen et al. (eds), *Geschiedenis van de techniek in Nederland. De wording van een moderne samenleving 1800 - 1890* (Zutphen 1993) *Part IV*, 74.

implementation of new technology became easier. As a result, steam navigation and thus the speed of inland shipping increased enormously. Naturally, the traditional skippers were afraid of this new competition. Steamboats hardly posed a problem as long as they were only used for passenger transport, often for the benefit of romantic Britons who, inspired by poets such as Lord Byron, visited the idealized Rhine. However, they became a problem when steam shipping entered the freight markets.¹¹ The first steamers in that market had a huge impact, as they put pressure on skippers to limit the length of their journey.

Traditionally, the 200-kilometer journey from Rotterdam to Cologne took ten to twenty days. The first steamboats did it in three to five days. Because this travel took less time and money, it was necessary for traditional skippers to do something to defend their position. The main reason that their upriver journeys lasted so extremely long – their speed was only ten to twenty kilometers a day – was the time they spent waiting for fresh horses. Since horse station owners often also owned pubs, they did not want the skippers to resume their trip too soon. To keep beer sales high, the skippers had to wait for some time before new horses became available. The horse station on the Dutch-Prussian border was especially notorious. At other horse stations, the owners could not stretch their stay too long. When the horses had eaten and had some rest, the skippers were able to continue their journey, if necessary, with the same animals. However, because Dutch horse-owners did not want their animals to cross the Prussian border, the skippers had to wait at the border station until Prussian horses were available. The resulting delay could last up to a week.

After the introduction of steam power, Rotterdam skippers themselves reorganized the horse stations. It turned out to be possible to shorten the journey from Rotterdam to Cologne to five or six days. This time was longer than a steamer would take, but fast enough to keep the skippers competitive without implementing the new technology. For these self-employed people, this method was the only way to survive, as most did not have the skills to operate a steam engine themselves, nor the money to buy one. Steamers were introduced by people from the shore, entrepreneurs from outside the skipper's world with capital

11 Bernhard Weber-Brosamer, 'Die Weltordnung will weder Stillstand noch Rückschritt'. Zur Einführung der Dampfschiffahrt und ihren wirtschaftspolitischen Auswirkungen', in: Clemens von Loos-Corswarem and Georg Mölich (eds), *Der Rhein als Verkehrsweg. Politik, Recht und Wirtschaft seit dem 18. Jahrhundert* (Bottrop 2007) 93-116, there 94.

and technical knowledge.¹² They seemed a threat, but for now the better organized horse stations kept the skippers going. Because small German skippers on the more upstream parts of the river were less alert and did not reorganize their horse stations, many of them already lost their position in the 1830s. Of course, they complained. Until the Mainz Act of 1830, their position was protected by monopolies and state regulation. All Rhine skippers were used to such protected markets and therefore found the competition with steamships by people from outside their world not only threatening, but even unfair. Therefore, they demanded protection again.

During the German Revolution of 1848, traditional skippers, line riders (the tow-horse drivers), and the owners of horse stations used shotguns against steamboats and even tried to steal cannons from the army of the Grand Duchy of Baden, a middle-sized German state, to use them against their competitors.¹³ Because of the violence used by the skippers on the Middle Rhine against steamships, the army of the Grand Duchy of Hesse (Hesse-Darmstadt) had to protect these modern ships and their crews.¹⁴ The protests of traditional skippers were supported by people living on the river banks, as strong waves from steamboats damaged their housing.¹⁵ Therefore, after their aggression failed, the skippers sent petitions to the revolutionary 1848 German Parliament in Frankfurt-am-Main and the Central Commission for the Navigation on the Rhine (CCNR), the supranational organization founded by the Congress of Vienna in 1815 to liberalize Rhine navigation. During the CCNR meeting of 1848 it was proposed to help the skippers and not to issue new permits for steamboats.¹⁶ The Dutch government opposed this idea. Since the opening of the Cologne-Antwerp railway line in 1843, Dutch skippers had been affected by the competition from this railway line, and the Dutch ports had suffered from the increased

12 Jan Sepp, 'De beurtvaart', *Spiegel der zeilvaart* (6) 9 [https://www.lvbhb.nl/kennis-ervaringen/geschiedenis/geschiedenis-binnenscheepvaart/de-beurtvaart/\(2/10/2017\)](https://www.lvbhb.nl/kennis-ervaringen/geschiedenis/geschiedenis-binnenscheepvaart/de-beurtvaart/(2/10/2017)).

13 Weber-Brosamer, 'Die Weltordnung', 101 et seq.; '198. De Kommissaris bij de Centrale Commissie voor de Rijnvaart Travers aan de Minister van Buitenlandse Zaken Schimmelpennick, 6 april 1841. La.M. no. 15. Exh. 8 april 1848 no. 23 (B.Z. 1475)', in: Rijks Geschiedkundige Publicatie (hereafter RGP), *Buitenlandse Politiek van Nederland 1848-1945*, 1.1.1848-GS 139. 141.

14 '205. De Kommissaris bij de Centrale Commissie voor de Rijnvaart Travers aan Minister van Buitenlandse Zaken Schimmelpennick, Mannheim 3 mei 1848. La.M. No. 19 Exh. 5 mei 1848 no. 20. (BZ 1478)', in: RGP, *Buitenlandse Politiek*, GS 139.

15 Guido Thiemeyer, Isabel Toelle, 'Supranationalität im 19. Jahrhundert? Die Beispiele der Zentralkommission für die Rheinschiffahrt und des Octroi-vertrages 1804-1851', *Journal of European Integration History* 17:2 (2011) 177-196, 191.

16 'Pruissen. Berlin, 7 Augustus.' *Leydse Courant*, 11-08-1848, Dag.



Illustration 1 Bronze memorial plaque at the passage from the Markt to the bank of the Rhine in Kaiserswerth (source: https://www.duesseldorf-entdecken.de/wp-content/uploads/2018/05/IMG_20180506_170754.jpg)

competitiveness of Antwerp. This competition was a major threat to the Dutch position as the transit country of this part of Europe; to traditional skippers, who were often Dutch, however, steam barges seemed a more immediate threat.¹⁷ Nevertheless, The Hague argued for a complete liberalization of Rhine navigation by reducing tolls and shipping charges. The German Rhine states were not immediately in favor of this reduction but also opposed limiting steam navigation.

Sailing only downstream: The second step

In 1850, approximately 3,000 hunting horses were still used along the Rhine for towing upstream. Ten years later, such horses were a memory. Steam tugs took over their job. It made Rhine navigation less romantic,

¹⁷ '398. Minister van Buitenlandse Zaken Bentinck aan de Kommissaris bij de Centrale Kommissie voor de Rijnvaart Travers, 8 Augustus 1848, No. 62 (BZ 1487); '399 Minister van Buitenlandse Zaken Bentinck aan de Kommissaris bij de Centrale Kommissie voor de Rijnvaart Travers, 8 Augustus 1848, No. 63 (BZ 1487); in: RGP, *Buitenlandse Politiek*, GS 139; A.D. van Assendelft de Coningh, 'De ongelden op het verkeer te land en te water en hun aequivalent', *De Economist* 1878, 314-339.

but more reliable and therefore more competitive. Nevertheless, at the time when railways were developing throughout Europe, especially in Germany, not only inland navigation, but even inland navigation with small, independent skippers survived on the Rhine. In the German countries, the train became the dominant means of transport, and even in the Netherlands, the Railway Act of 1860 allowed for its spread. In the past, many parts of the country, now served by railways, were isolated or connected only by narrow waterways, navigated by small boats operated by traditional skippers. If there was no suitable wind, they were towed by a horse, but often also by a skipper's boy or the skipper's wife. Skippers were charming enough to name their ships after their wives, but the terrible towing job was often her duty. They themselves remained at the helm.

In the second half of the century, inland shipping lost its competitiveness compared to rail. This loss applied not only to the many small waterways, but also to the Rhine.¹⁸ Large-scale hydrotechnical projects to straighten the river, deepen the channel, and remove all kinds of natural obstacles – a process known as the normalization of the Rhine – was supposed to restore the former position of river navigation. Prussia started these normalization projects as early as the 1850s. The Berlin government feared that the Ruhr area – Prussia's important, rapidly developing but landlocked industrial region – would lose its competitiveness if the railways destroyed Rhine navigation and the still private railway companies could then demand monopoly prices for their services.¹⁹ That is why Prussia established the *Rheinstrombauverwaltung* – Rhine River Construction Administration – as early as 1850, as an organization to develop plans for straightening and deepening the river and removing all kind of obstacles from its channel. Through political pressure, this powerful, and in the 1860s even aggressive German state, succeeded in forcing the other Rhine states, including the Netherlands, to participate in large-scale hydrotechnical construction projects.²⁰ Removing all obstacles to

18 H.P.H. Nusteling, *De Rijnvaart in het tijdperk van stoom en steenkool 1831-1914. Een studie van het goederenvervoer en de verkeerspolitiek in de Rijndelta en het achterland, mede in verband met de opkomst van de spoorwegen en de concurrentie van vreemde zeehavens* (Amsterdam 1974) 85-103; Jan Luiten van Zanden and Arthur van Riel, *Nederland 1870-1914 Staat, instituties en economische ontwikkeling* (Amsterdam 2000) 218.

19 Klemann and Schenk, 'Competition in the Rhine delta', 832.

20 Hein A.M. Klemann and Joep Schenk, 'The Rine in the long 19th century. Creating the Lower Rhine Region', in: Marten Boon, Hein A.M. Klemann and Ben Wubs, *Transnational regions in historical perspective* (London 2019) 18-56.

navigation and deepening the Rhine was directly related to improving the possibilities for modern steam navigation on the river.

In freight transport, steam power was only profitable if the scale was large. However, large ships had more draft than was possible on the river, which was shallow in many places, especially before normalization. In other words, the condition of the waterway hindered the transition to steam. In the 1840s, however, the Cologne entrepreneur L. Camphausen and his Rotterdam competitor G.M. Röntgen came up with a solution more or less simultaneously by developing uniform iron ships, towed by small paddle steamers, with a shallow draft but a strong engine. Such steamboats were used to tow a train of long iron ships, each with a relatively high deadweight but, again, a shallow draft. In the past, steamboat companies primarily provided passenger and mail services. For these steamships, it was hardly interesting to tow all kinds of small sailing ships against the current. In any case, the Dutch skippers who were dominant in the Lower Rhine area avoided using steam tugs because they feared that steamboat companies were trying to undermine their position. Therefore, these new steam shipping companies had to use their own ships.

The introduction of iron and later steel ships was in itself an innovation and partly a reaction to other innovations. Not only did iron offer less resistance in water, but iron ships were also better suited to be loaded with bulk by the shipload. Traditionally, a barge was loaded with a large variety of goods, packed in barrels, bags, or boxes. Such goods were therefore treated as general cargo and loaded onto the barge using manpower, which led to enormous transshipment costs.²¹ With the increasing scale of transportation and the growing need of bulk transport, it gradually became cheaper to fill the entire barge with just one type of cargo, especially when transporting bulk goods such as iron ore, coal, and grain. At the end of the nineteenth century, though especially in the first years of the twentieth century, transshipment became much cheaper because these goods were simply dumped into a barge using cranes, coal tips, or elevators. Wooden ships were not strong enough for this type of shipping. In the first half of the nineteenth century, the transport volume was not yet that large, and traditional wooden ships could still compete.²² Nevertheless, already in the 1850s

21 H. van Driel and J.W. Schot, 'Het ontstaan van een gemechaniseerde massagoedhaven in Rotterdam', in: A.A. de la Bruhèze, H.W. Lintsen, A. Rip, J.W. Schot, *Techniek in Nederland in de twintigste eeuw* (Zutphen 2002) 5. *Transport, communicatie*, 75-95, there 75-76.

22 P.J. Bouman, *Rotterdam en het Duitse achterland, 1831-1851* (Amsterdam 1931) 96-97.

two major German entrepreneurs started to use the newly invented mastless iron ships for their coal transports. As there were no masts or sails, these barges had to use the service of a steam tugboat. These two services, two entrepreneurs were Mathias Stinnes, a coal merchant who owned a growing number of Ruhr and Rhine ships for his company and gradually became a major entrepreneur in inland shipping, and Franz Haniel, an industrialist who had started in the iron and steel industry. By utilizing ships along with mining, German major industry penetrated Rhine navigation.²³

With the introduction of steam tugs and iron ships, horses were replaced by steam engines, but the wind and current were not. Of the 342,000 tons that passed the Dutch-Prussian border upstream, 306,000 tons – 90 percent – were driven by steam in 1867. However, of the 1,575,000 tons (i.e., five times as much downstream transport) only 154,000 tons (less than 10 percent) used steam power.²⁴ Some large shipowners used steam tugs both upstream and downstream, but even in 1882, fifteen years later, the hundreds of small, independent, often Dutch skippers still used the wind and current for downstream transport, as they had already for centuries.²⁵ Another 25 years later, in 1906, 8,281 tugboats crossed the Dutch-German border upstream and 8,399 downstream. Their activity ensured that a total of 218,000 *Segelschiffe* (sailing ships) – also called *Segel- und Schleppkähnen* (sailing and tugging barges) – crossed the border.²⁶ These barges were towed upstream, but downstream the boats of the many small self-employed, often Dutch skippers, made use of the wind and current. Downstream sailing was still common until the early twentieth century.

The question must be asked, then, why independent skippers started using steam tugboats upstream as early as the 1860s, while they continued to sail downstream until the twentieth century. Graph 1 shows the average load per ship. Its size increased significantly in the early 1860s but remained below 150 tons. Technically, in other words, towing was still quite possible. The average freight per ship remained below or around 150 tons until the 1880s. Nevertheless, in the 1860s all draft horses disappeared from Rhine transport. Only in the last years of

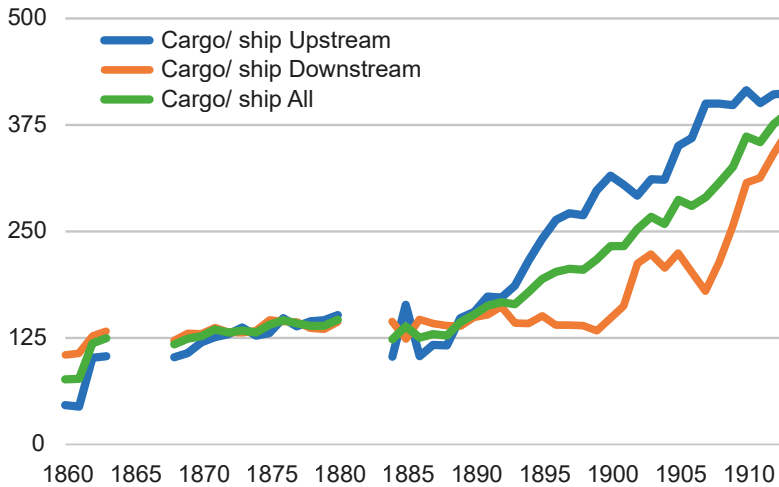
23 Andreas Kunz (ed.), *Statistik der Binnenschifffahrt in Deutschland 1835-1989* (St. Katharinen 1999) 12.

24 Zentral-Kommission für die Rheinschifffahrt, *Statistischer Jahres-Bericht*, 1867 and 1868 (Mannheim 1869) XXI-XXII.

25 Nusteling, *De Rijnvaart in het tijdperk van stoom*, 264.

26 Erich Petersilie, *Schifffahrt und Güterverkehr auf dem Rheine während der Jahre 1891 bis 1906. Auf Veranlassung der Zentralkommission für die Rheinschifffahrt* (Mannheim 1908) 176.

Graph 1 Average cargo per ship in ton crossing the border near Emmerich, 1860-1913



Sources: Zentralkommission für die Rheinschifffahrt, *Statistischer Jahres-Bericht, 1860-1914* (Mannheim s.a.)

the 1880s, when the normalization of the river was nearing completion, did the volume of Rhine navigation increase further, upstream even to more than 400 tons at the beginning of the twentieth century. Only then was the use of draft horses no longer possible for physical reasons. In 1875, a skipper from near Amsterdam paid 7.5 guilders – almost two weeks wages for his servant – to be towed for ten hours.²⁷ Steam tugging was expensive. As the old technique of towing still functioned, the question therefore is what led to a turnaround in the 1850s. During this period, the only major change was the appearance of the first permanent railway bridges crossing the Rhine.

Until the 1850s, downstream from the medieval bridge in Basel, Switzerland, the Rhine could only be crossed by ferries or floating pontoon bridges, which gave free passage to Rhine barges by dragging away parts of the bridge. This method had to change with the arrival of the train. Although train ferries were experimented with, permanent bridges proved to be the only solution when railway lines had to cross waterways. In the 1850s, a Prussian railway company in Cologne, on the site of the current Hohenzollern railway bridge, began the construction of the *Dombrücke* (Cathedral Bridge), the first of several Rhine bridges.

²⁷ Ruud Filarski, *Tegen de stroom in. Binnenvaart en vaarwegen vanaf 1800* (Utrecht 2014) 153-155.

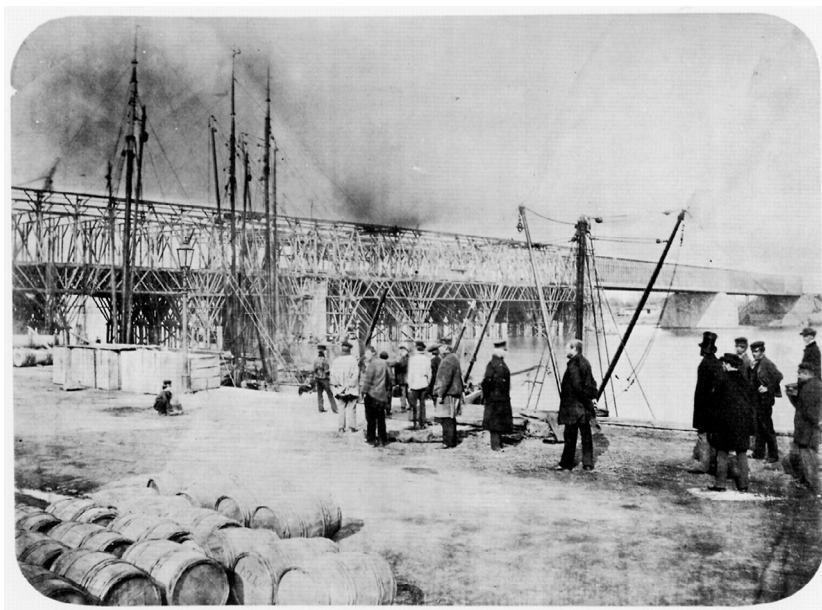


Illustration 2 Building the Dombrücke in Cologne. Railways made it necessary to build permanent bridges crossing the Rhine, with huge consequences for shipping by barge (source: Johann Burbach, 1859, Historische Museen, Kölnisches Stadtmuseum.)

Because the initiative came from a railway company, the original design posed a serious threat to shipping. Skippers, steamboat companies, various chambers of commerce and several Rhine states objected to the bridge. Therefore, the subject was discussed at an additional meeting of the CCNR in 1858, which resulted in a committee of experts to answer the question of whether it was possible to make the bridge higher than the proposed 15 meters (48 feet) or whether a movable part could be included in the construction. The committee members quickly agreed that a movable part was not an option. Whether the bridge could be higher was disputed. Prussia then offered to increase the height by 1.57 meters. While this option was still being discussed, construction of the Bonn-Bingen railway line across the Rhine had already begun.²⁸ The rapid development of the railways meant that bridges were needed everywhere. After lengthy negotiations, an agreement was reached within the CCNR. *Dombrücke* was built according to the proposal of the Prussian government, and the skippers who had to adjust their masts or

²⁸ Notizen über die neue Rhein-Brücke bei Köln, 3-17 'Berlijn, 28 Maart.' *Opregte Haarlemsche Courant*, 31-03-1858, Dag: 'Haarlem, 7 April.' *Opregte Haarlemsche Courant*, 08-04-1858.

chimneys were compensated by Prussia. In the years that followed, other bridges were discussed, and plans were regularly adapted to the needs of shipping. After 1875, this deliberation was no longer necessary. Builders knew the rules and permission from the CCNR took the form of a building permit.²⁹ It is possible that these new bridges were an insurmountable obstacle to towing, but to be sure, further research is needed.

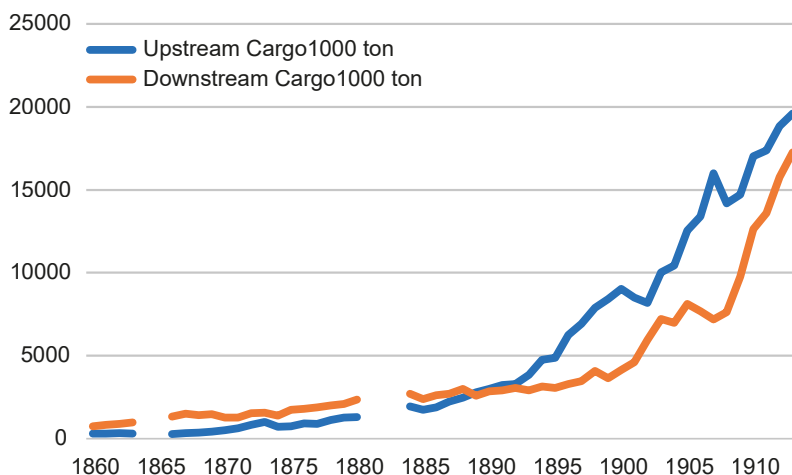
The big jump

Hydraulic construction activities to adapt the Rhine to large-scale steam towage started slowly. In the mid-nineteenth century, not all Rhine states agreed that such expensive projects were really necessary. It was not until the 1880s that the river turned into a straight, deep, and virtually dead shipping channel. Now the scale of Rhine navigation could grow exponentially. Graph 1 shows that this growth only happened from the mid-1880s and for the time being only in the upstream direction. Naturally, a growing amount of cargo per Rhine barge can partly be achieved by making better use of the loading capacity of the ships. However, the average cargo per upstream sailing barge measured at the Dutch-German border grew from 104 tons in 1886 to 213 tons in 1894, in just eight years. It seems unlikely that the ships in 1886 were only half full on average. A new generation of inland vessels was needed on the Rhine, at least on the Lower Rhine.

Looking at a longer period, in the thirty years between 1885 and 1913, the scale of Rhine navigation quadrupled in the upstream direction. Therefore, more than one new generation of barges was needed. Because only such an increase in scale could lead to the enormous drop in freight prices which was necessary to become competitive again with the railways, large German shipping companies took advantage of the opportunities offered by the new infrastructure. In order to survive, independent skippers had to go along with this change. Because the lion's share of the transport between Rotterdam and the German Rhine port Ruhrort – itself the lion's share of all Rhine transport – was provided by independent Dutch skippers, the question must be asked as to how they managed to adapt to the new competitive conditions.

²⁹ W.J.M. Van Eysinga, *Geschichte der Zentralkommission für die Rheinschiffahrt 1816 bis 1969* (Strasbourg 1994²) 80-81.

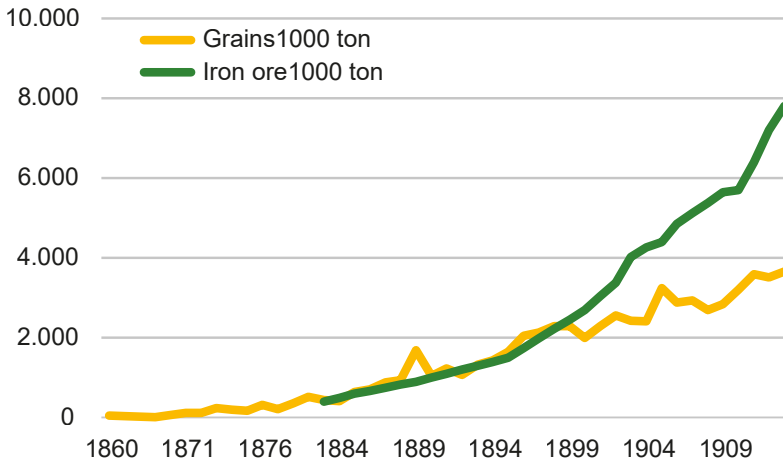
Graph 2 Total cargo (1000 ton) crossing the border near Emmerich, 1860-1913



Sources: Zentralkommission für die Rheinschifffahrt, *Statistischer Jahres-Bericht, 1860-1914* (Mannheim s.a.)

On the Rotterdam-Ruhr route, 80 percent of the Rhine barges sailed under the Dutch flag. In 1900, almost all of those Dutch ships were still relatively small sailing ships, owned by small, independent skippers. In the years 1903-1913, these small skippers had to adapt to a huge increase in scale, a transformation process that had been initiated and kept going by several large German shipowners. To adapt to the new situation, the small skippers had to give up sailing and use tugs not just upstream, but also downstream. Tugboats not only made a greater scale possible, but also ensured the more regular supply with raw materials that the modern German industry needed. In addition, new transshipment facilities – such as the grain elevators, coal tips, cranes, and bucket ladders that appeared in the ports at the estuary – required barges to no longer be made of wood, but of iron or steel. Therefore, apart from the larger scale, ships made of iron or steel became the norm. These innovations were stimulated by changes in the cost ratios between wood and metal. Gone were the days when huge timber rafts floated down the Rhine to the Dutch port city of Dordrecht to be sawn by windmills and used in shipbuilding. In the 1870s, 75,000 to 120,000 square meters of wood floated down the river every year in colossal rafts. After 1892, 40,000 square meters per year was the maximum; and at the beginning of the twentieth century, 20,000 square meters was

Graph 3 Most important upstream cargo (1000 ton) crossing the border near Emmerich, 1860-1913



Sources: Zentralkommission für die Rheinschifffahrt, *Statistischer Jahres-Bericht, 1860-1914* (Mannheim s.a.)

reached in only a few exceptional years.³⁰ Germany itself needed the wood. In addition, technical developments stimulated German iron and steel production, resulting in much lower prices for these products.³¹

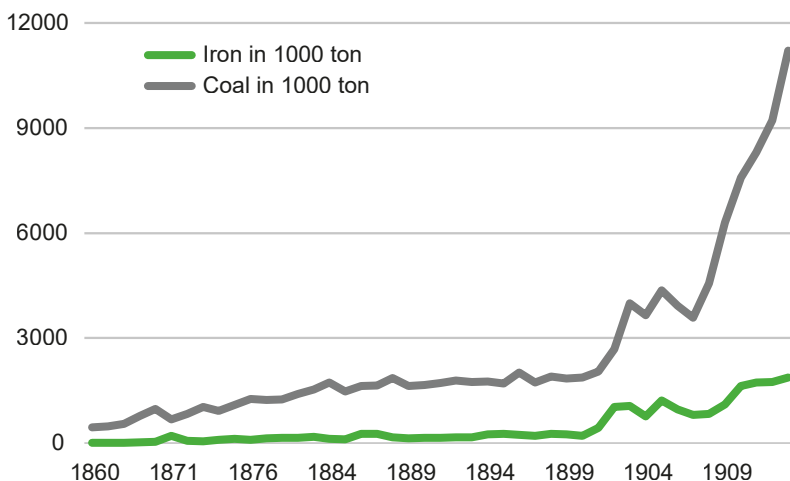
In the Netherlands, which had only a few small coal mines in a remote area and no iron ore at all, there was no iron or steel industry. At the same time, German cartels, in collaboration with international cartels, kept domestic iron and steel prices high in the home market. To this end, surpluses, which would undermine domestic price levels, were dumped in countries without their own production, such as the Netherlands. As a result, iron and steel became relatively cheap in that country.³² Because labor costs in the Netherlands were also favorable, Rhine ships were often built in that country, also for the German market. The price of a new iron or steel ship was higher than that of a wooden ship, but their higher durability and lower resistance in water

30 Zentralkommission für die Rheinschifffahrt, *Statistischer Jahres-Bericht, 1860-1914*, author's own calculations.

31 Arthur van Riel, *Trials of convergence. Prices, markets and industrialization in the Netherlands, 1800-1913* (Unpublished PhD thesis Universiteit Utrecht 2018) 730-734.

32 Hein Klemann, 'Ontwikkeling door isolement. De Nederlandse economie 1914-1918', in: Martin Kraaijestein and Paul Schulten, *Wankel evenwicht. Neutraal Nederland en de Eerste Wereldoorlog* (Soesterberg 2007) 271-309; Hugo Bonikowsky, *Der Einfluß der industriellen Kartelle auf den Handel in Deutschland* (Jena 1907) 42.

Graph 4 Most important downstream cargo (1000 ton) passing the border near Emmerich, 1860-1913



Sources: Zentralkommission für die Rheinschifffahrt, *Statistischer Jahres-Bericht, 1860-1914* (Mannheim s.a.)

made them cheaper to operate. Above all, in order to meet the demands of industry in the Ruhr area, the volume of Rhine navigation had to increase sharply during this period. The growing supply of iron ore for the German blast furnaces, more and more grain to feed the workers in the Ruhr area, and wood to build new industrial cities and to use as pit wood in the mines required an increase in scale in Rhine navigation.

The transition from small wooden sailing barges to large iron ships required significant investments. Nevertheless, this transition went smoothly and quickly. In 1882, the Dutch Rhine fleet consisted of 2,720 mainly wooden sailing ships with an average capacity of 154 tons. This capacity was little more than the average cargo of 124 tons.³³ German shipowners already had iron barges without masts, which could therefore only be used in a train pulled by a steam tug. From the 1890s onward, Dutch skippers also switched to such barges, a process that gained momentum after 1900. With the completion of the standardization process and the enormous expansion of the German steel industry, Rhine transport experienced explosive growth rates (graph 2). Just as Rhine navigation won the battle for bulk transport over rail, Rotterdam won over Antwerp. As a result, the Dutch Rhine fleet

33 Nusteling, *De Rijnvaart in het tijdperk van stoom*, 242.

grew in number and size. Between 1882 and 1900, the number of Dutch Rhine ships increased from 2,713 to 4,260, or by 57 percent (2.5 percent annually), while the average loading capacity grew by 43 percent from 155 to 221 tons (2.0 percent annually). In 18 years, the capacity of the Dutch Rhine fleet grew in total by 124 percent (4.6 percent on an annual basis) from 421,000 to 942,000 tons.³⁴ In addition to the growing demand for ore and grain, the increased competitiveness relative to rail was the driving force behind this development.

By the 1880s, the Rhine waterway had already been almost completely adapted to the requirements of the time, allowing barges with a much greater draft to be used. Not only the average ship, but especially the maximum size of such a ship increased enormously: from 800 tons around 1880 to 1075 tons in 1885, 1400 tons in 1890, and 2,100 tons around 1900, or by 162.5 percent in twenty years time, an average of 4.9 percent per year.³⁵ Such gigantic ships of 2,100 tons were rarely owned by independent skippers. They belonged to German shipping companies that had ties to the industrial conglomerates in the Ruhr area. In the 1850s, Mathias Stinnes and Franz Haniel were the first to establish such industrial Rhine shipping companies, and even then there was a close link with coal mining and iron and steel production. The economies of scale in Rhine navigation pursued by these shipowners resulted in a significant reduction in transport costs for the industrial companies with which they were associated. Because this was a period of rapid growth for German heavy industry, and since Rotterdam increasingly became the hub for overseas transport, especially bulk transport, the demand for loading space on the Rhine increased sharply, provided it was offered at the low freight rates of the major ship-owners linked with the German industry. These rates forced private skippers to adapt, also in terms of scale, because only a larger scale could make their inland vessels competitive again.

In addition to the new scale, which required an average loading capacity of more than 400 tons upstream (graph 1), a level of reliability and efficiency were required that self-employed skippers with small sailing barges could hardly guarantee. Although the actual decrease in freight rates of 81 percent between 1870 and 1913 had to be compensated by higher efficiency and savings, the capacity of the Dutch fleet increased by 87 percent between 1900 and 1914 (4.6 percent annually). In these years, the average capacity per ship doubled, but the

34 Idem.

35 Hermann Schwabe, *Die Entwicklung der deutschen Binnenschifffahrt bis zum Ende des 19. Jahrhunderts* (Berlin 1899) 13.

number of inland vessels decreased by 6.1 percent, from 4,260 to 4,000.³⁶ It meant that most skippers tried to keep up and only a small proportion dropped out. Bulk transport explains the growth, both upstream and downstream. Traditionally, luxury goods (such as Dutch colonial coffee or sugar) were important in upstream transport; but between 1871-1875 and 1911-1913, their share fell from 60 to 15 percent.³⁷ Graph 1 shows how the load per ship in upstream transport grew exponentially from the 1880s onward. Downstream this development only started in the new century. The reason was that upstream transport reflected the growing demand for bulk in the Ruhr area, a result of the increase in scale in the iron and steel industry. Graph 3 shows how iron ore and grain alone account for 60 percent of the increase in upstream transport. Downstream there was only one relevant bulk commodity: coal. Because the German coal market was initially organized in close cooperation between the German mining cartels and the railway companies, coal only became important in Rhine transport in the new century. From then on, it immediately started growing exponentially (graph 4).³⁸ Between 1900 and 1913, coal alone was responsible for 69 percent of the increase in transport downstream on the Rhine. Rhine transport was bulk transport, and therefore freight prices were supposed to be low.

German industry and Dutch self-employed skippers

Around 1880, the Rhine was adapted to large-scale steam navigation. From that moment on, German industrialists founded Rhine shipping companies, some of which sailed under the Dutch flag. In the Netherlands, wages were relatively low and there were hardly any social welfare costs, while in Germany these programs became a substantial part of labor costs.³⁹ In 1911, the gigantic German iron, steel, and coal conglomerate Thyssen founded the legally Dutch, but 100 percent German-owned Rhine shipping company *Vulcaan NV*.⁴⁰ Such large

36 Nusteling, *De Rijnvaart in het tijdperk van stoom*, 242.

37 Idem 464-498.

38 See: Joep Schenk, *Havenbaronnen en Ruhrbonzen. Oorsprong van een wederzijdse afhankelijkheidsrelatie tussen Rotterdam en het Ruhrgebied 1870-1914* (Unpublished PhD Thesis Erasmus University Rotterdam 2015) Passim.

39 Clapp, *The navigable Rhine*, 46.

40 Van Driel and Schot, 'Het ontstaan van een gemechaniseerde massagoedhaven', 86 noot 41; Joh. de Vries, *Herinneringen en dagboek van Ernst Heldring (1871-1954)* (Groningen 1970) *Deel 1*, 186 footnote 1.

shipowners, often affiliated with one of the major industrial Ruhr companies, had the money to invest in their fleet again and again, as soon as the canalization process made sailing with larger ships possible. Around 1840, a tow was a maximum of 40 meters long, consisted of four ships, and the total tonnage was 400 tons. At the beginning of the twentieth century, such a tow could consist of four to six ships, was up to 400 meters long, and had a maximum capacity of 6,000 tons. Nonetheless, fuel consumption hardly increased due to streamlining, the use of compression steam engines, and an improved ship's propeller.⁴¹ This was of course only possible in the optimal case, and the circumstances for Dutch private skippers were often less favorable.

In 1914, the carrying capacity of the average German Rhine barge was 726 tons. That was 65 percent more than that of the average Dutch ship, which had a capacity of only 440 tons. Nevertheless, the capacity of the typical Dutch barge had increased by 186 percent since 1882, while that of the typical German barge grew by 233 percent.⁴² When the Rhine normalization was more or less completed in 1880, Rotterdam quickly developed into the port that supplied the Ruhr area with iron ore, grain, and pit wood and, after the turn of the century, into the export port for German coal. These four bulk goods increasingly dominated Rotterdam transshipment and transport.⁴³ In 1903, a steam tugboat, built in a Dutch shipyard for a German shipowner, was given the resoundingly nationalistic name *Wacht-am-Rhein VIII* (Watch-on-the-Rhine 8). The ship was 30 meters long and had a 300 hp steam engine. This was a huge increase over the small steam tugs of the 1850s, but ten years later a new 800 hp steam tug was already built. By this time, the *Wacht-am-Rhein* was outdated for transport on the Lower Rhine, and the ship was sold to a shipowner further upstream, where the condition of the waterway forced the use of smaller ships.⁴⁴ As a result of such investments, the share of Rhine transport in Germany's total imports and exports increased substantially.

Just before 1914, 25 percent of all imports from the German *Kaiserreich*, measured by weight, entered this empire on a Rhine ship at Emmerich. About 22 percent of all its exports left this *Reich*

41 Clapp, *The navigable Rhine*, 93-100.

42 Nusteling, *De Rijnvaart in het tijdperk van stoom*, 242.

43 Schenk, *Havenbaronnen en Ruhrbonzen*, 310 a.f.; Klemann, Schenk, 'Competition in the Rhine delta.'

44 Hein Klemann, 'Utgard', in: *Rotterdamse havenschatten. Topstukken van het Maritiem Museum Rotterdam* (Rotterdam 2020) 58-61.

(which was a third larger than today's Germany) in this way.⁴⁵ As the competitive position of Rhine navigation improved, that of Rotterdam also improved. However, tariffs and similar incomes in Rhine navigation were low. In order to keep up with the competition, self-employed Rhine skippers had to invest in larger vessels and to do so had to borrow money from family, friends, the bank, or a shipyard.⁴⁶ Although some German shipowners moved their activities to the Netherlands, the number of barges under the Dutch flag decreased. On balance, 10 percent of Dutch Rhine skippers gave up, but some of them probably left for other inland waterways where they could better compete with their ships, which were then too small on the Rhine, but which still fell in the highest category of ships on these waters.

The impression that Dutch Rhine ships were owned by small independent skippers and that the German ships were owned by shipowners with close ties to big business is confirmed by other sources. In 1913, approximately 35 percent of the engine power of the steam tugboats on the Rhine was Dutch. Of this, 58 percent was owned by independent private skippers and 42 percent by shipping companies. Germany had 59 percent of the towing power, 90 percent of which was owned by shipping companies, most of which had strong relationships with one of the industrial conglomerates in the Ruhr area. As these financially powerful groups continued to invest in the newest, most powerful tugboats, Dutch tugs were overrepresented in the less than 600 hp category and underrepresented in the over 1000 hp category. The situation was similar among the barges. In 1913, 35 percent of the tonnage of barges on the entire Rhine, including the upstream part, was Dutch. Of these Dutch barges, 85 percent was owned by private skippers. Only half of the German ships were owned by small skippers. Due to the large share of such skippers among Dutch shipowners, 53 percent of Dutch inland vessels belonged to the smallest category, then up to 600 tons. On the Rhine as a whole, this category was 40 percent, but it should be noted that Dutch barges rarely sailed to the upper reaches of the river, where only smaller ships could be deployed. Strangely enough, 71 percent of the ships in the category of over 2,000 tons, the largest among the Rhine barges, were also Dutch. However,

45 Kaiserliches Statistisches Amt, *Statistisches Jahrbuch für das Deutsche Reich* (Berlin 1880-1917); Author's own calculations.

46 Filarski, *Tegen de stroom in*, 161.

they were probably the property of German industrial groups flying the Dutch flag.⁴⁷

How did Dutch skippers adapt?

Most Dutch Rhine ships were owned by small independent skippers who sailed back and forth between Rotterdam and Ruhrort, the gigantic Rhine port of the Ruhr area near Duisburg. For these skippers, the first two steps in modernization were probably not a problem. They themselves initiated the improved organization of the horse stations in the 1830s, as a direct response to the emergence of much faster steamboats. This move reduced their costs significantly. The second step was taken in the 1850s and 1860s, when major shipowners associated with the Ruhr industry already started using steam tugs in both directions. It is still unclear why small Dutch skippers started using tugs going upstream from the 1850s onward to replace towing by horses. A tug was expensive, but of course towing by horse also had to be paid for. An exact comparison cannot be made. Nevertheless, the relatively high costs of towing seem to indicate that these costs did not explain the transition. The only other explanation could be that towing was hampered too much by the new permanent railway bridges over the Rhine. Sailing in a downstream direction remained common for the time being.

These first two steps were relatively minor adjustments. Only after the normalization of the river enabled German shipping companies to deploy increasingly larger tows did a much larger transition become necessary. As a result, freight rates collapsed completely. This drop was beneficial for the port of Rotterdam and its competitive position, as well as for the German industry, which received cheap transport. It was, however, disastrous for small independent skippers. They had to accept a reduction in their freight rates, corrected for the general price index, of more than 80 percent. Expensive investments with borrowed money could only partially solve this problem. In 1882 their turnover per shipload-kilometer was 4.93 guilders in 1913 prices with an average ship of 154 tons and an average freight rate of 3.20 cents per ton-kilometer. In 1900, it was only 3.49 guilders for a much larger ship

⁴⁷ Bernhard Harms, Bruno Kuske, Otto Most and Andreas Predöhl, *Die deutsche Rheinschiffahrt. Gutachten der Rhein-Kommission über die Lage der Rheinschiffahrt und der in ihr beschäftigten Arbeitnehmer* (Berlin 1930) 184-185; Author's own calculations.

and in 1913 only 3.08 guilders.⁴⁸ The increase in scale was insufficient to compensate for the collapse in freight prices, and between 1882 and 1913 the income per voyage of a skipper who invested again and again in an average ship fell by 37.5 percent, or almost one percent per year. Their position crumbled. In addition, they had new costs due to the interest on their investments and the costs of tugging. The only conceivable solution was to cut back on other costs or leave the Rhine completely and become active in other parts of Dutch inland shipping.

To save on costs, Rhine skippers, but also skippers on other inland waterways who had to deal with the new competition from the railways to which they, like Rhine skippers, responded by purchasing larger ships, gave up their houses on shore. Until the middle of the nineteenth century, a Rhine ship only had a wooden shed on deck. There, the skippers and their servants found just some shelter for cold and rain. Dutch Rhine skippers almost always travelled back and forth between Rotterdam and Cologne and later Ruhrort. Such skippers often owned a home for their family near the Dutch port, where they were considered respectable small business owners. By cutting back on that house on the shore, they lost that status. However, such a house became too expensive, and their family moved on board. As a result, their wife and children also lost their home and thus their social environment. Moreover, they became a source of cheap labor. If they were not too young, their sons could help the skippers with all kinds of jobs on board: loading, unloading, sanding, painting, hoisting sails, or operating the rudder. The wife and daughters then did the housework, which was much more laborious than on shore, because everything quickly became dirty on iron barges. The family quarters on a ship were small, but on a Rhine ship not too cramped. Moreover, they grew with the ship. When the Rhine ships became larger in the mid-nineteenth century, the wooden shed thus developed into reasonable housing.⁴⁹

Nevertheless, the low freight rates meant that savings had to be made on the costs of living and comfort of the skippers and their families. For religious reasons, but probably also because children already could be deployed at a tender age, skippers often had large families. They

48 Jan-Pieter Smits, Edwin Horlings, Jan Luiten van Zanden, *Dutch GNP and its components, 1800-1913* (Groningen 2000) 142-147; CBS, *Statline*; CBS, *70 jaren statistiek in tijdreeksen, 1899-1969* (Den Haag 1970); CBS, *Tweehonderd jaar statistiek in tijdreeksen, 1800-1999* (Voorburg 2001); CBS, *Jaarcijfers voor Nederland*; Author's own calculations.

49 Stephanie Steppart, *Schifferfrauen auf dem Rhein. Die familiäre und soziale Lage der Frauen von Binnenschiffen* (Mainz 1987) 37.

and their families often wore old and dirty clothes on an always dirty ship. Only on Sundays, when they went to church, were they properly dressed and washed. Bystanders, who noticed the skippers and their families at a bridge or lock, saw people without a permanent place of residence, in dirty clothes and categorized them as vagabonds.⁵⁰ This increased the skippers' distrust of the outside world. The fact that skippers and fairground children were exempted from compulsory education when it was introduced for six- to twelve-year-olds in 1901, reinforced their isolation.⁵¹ In a society in which formal education became increasingly important, many skipper's children remained illiterate. Initially, skippers thought that their children needed little formal education, because they themselves also had learned the trade from their parents, but the development of technology and all kinds of government regulations required more education and training, even for skippers. Moreover, without primary education, it became increasingly difficult for their children to earn a living on shore.

Some Dutch Rhine skippers found another solution: they left the Rhine with their ship and continued their activities in other waters. Freight rates in the many Dutch canals and rivers were always at a higher level per ton-kilometer than on the Rhine. In 1890, only Limburg (the extreme southeast of the country) had inland vessels with an average capacity of more than 100 tons. Presumably these sailed the Meuse. Nationally, the average inland vessel did not exceed 35 tons (with the exception of Rhine vessels). However, competition became threatening in those waters, too, especially because the Railway Act of 1860 promoted the construction of many new lines. That is why Johannes Tak van Poortvliet (1839-1904) – the progressive-liberal minister for infrastructure and water management – also wanted to tackle the waterway network in 1878 with a Canal Act. He proposed a program with, for example, an Amsterdam-Waal Canal, an Amsterdam-Rotterdam canal, and a far-reaching improvement of the Zuiderzee-Meppel waterway.⁵²

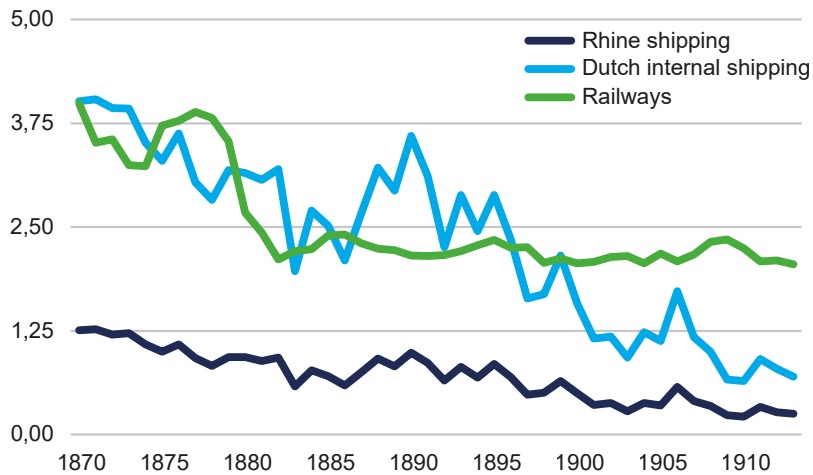
The fact that the Limburg regional government got the impression that their province had not received what it needed meant that the proposed law was rejected in the House of Representatives (*Tweede*

50 Désirée Langius, *De Rijn- en binnenvaartschippers 1850-1945* (Unpublished MA-thesis Leiden University 2015) 29-31.

51 Filarski, *Tegen de stroom in*, 162.

52 H.A. Kamphuis, 'Tussen algemeen en plaatselijk belang. De verwerping van Tak van Poortvliets ontwerp-Kanalenwet in 1879', *Tijdschrift voor Waterstaatsgeschiedenis* 9 (2000) 34-47, 37-39.

Graph 5 Rail, Rhine, and inland shipping tariffs in guilder cents per ton-kilometer, adjusted for price development (GDP deflator) 1870-1913. Prices 1913 = 100



Sources: Jan-Pieter Smits, Edwin Horlings, Jan Luiten van Zanden, *Dutch GNP and its components, 1800-1913* (Groningen 2000) 142-147; CBS, *Statline*; CBS, *170 jaren statistiek in tijdreeksen, 1899-1969* (Den Haag 1970); CBS, *Tweehonderd jaar statistiek in tijdreeksen, 1800-1999* (Voorburg 2001); CBS, *Jaarcijfers voor Nederland*; Eigen berekeningen.

Kamer). Nevertheless, Tak's principles were adopted by various ministers in the following decades. Thus, between 1850 and 1900, both a railway and a waterway network emerged, creating two competing transport networks. As a result, lower rates per ton-kilometer also had to be accepted on inland waterways. To compensate for the slowness, the extra transshipments, and the unreliable supply (given shipping was more dependent on the weather), the difference between inland shipping and train rates had to be significant. Only then would inland shipping prove competitive. In the mid-nineteenth century, freight rates on the Rhine per ton-kilometer were less than half of those on rail, but it was not enough to make Rhine transport competitive. Only when rates fell even further and freight rates for rail transport became more than three times higher than those for Rhine transport did the competitiveness of shipping by barge on the Rhine increase sufficiently to result in a shift from rail to the Rhine and from Antwerp to Rotterdam (graph 5).⁵³ The new competition from the railways led to similar developments in inland shipping in other waters than the Rhine.

53 Klemann and Schenk, 'Competition in the Rhine delta', *passim*.

The ships got bigger, the skippers' families moved on board, and paid servants gave way to family labor. It all just happened a little slower. In 1890, the smallest barges on the Rhine were already 300 tons. However, in 1906, 16 years later, the national average (excluding the Rhine) had increased by 142 percent to 85 tons. As on the Rhine, this shift was only possible because waterways were improved. Consequently, in large parts of the country waterways were now accessible to small, old-fashioned Rhine vessels. For Rhine skippers with barges too small for that river, a new market was opened.

In 1870, the average price per ton-kilometer in inland shipping on other waters than the Rhine was 3.99 cents (in 1913 prices). In 1913, it was only 0.70. It shows that on these waters the decrease of freight rates was as dramatic as on the Rhine – 82 percent – although the absolute level of the tariffs remained higher than on the Rhine (graph 5). The 1870 Rhine freight rate of 1.27 cents per ton-kilometer was only 31 percent of the freight rate in other waters, but in both modes of transport the decline was enormous. Nonetheless, by leaving the Rhine for other waters, Rhine skippers could limit their decrease in freight rates between 1870 and 1913 from 81 to 45 percent. As a result, they lost their social position as Rhine skipper, the highest possible in the skippering world. Thus, they could however also limit their investments and keep their costs relatively low. Given the rapid growth of inland vessels on other waterways than the Rhine, it seems likely that some former Rhine skippers, or at least their barges, found a new life on other waterways.⁵⁴

Conclusions

The average size of the Dutch Rhine barges increased from 154 tons in 1882 to 221 tons in 1900 and 440 tons in 1914.⁵⁵ Since the standard deviation is unknown, the minimum size for a profitable Rhine vessel cannot be calculated, but it is clear that Rhine vessels of 100 to 300 tons had to be replaced by considerably larger ones in a short time. Modernization also required iron or steel barges and the use of tugs, not only upstream but also downstream. This change meant that the

⁵⁴ J.P. Smits, *Economische groei en structuurveranderingen in de Nederlandse dienstensector, 1850-1913. De bijdrage van handel en transport aan het proces van moderne economische groei* (Unpublished PhD-thesis VU Amsterdam 1995) 178.

⁵⁵ Nusteling, *De Rijnvaart in het tijdperk van stoom*, 242.

skippers had to invest heavily and borrow money to do so. In order to survive, they ran into debt while their income fell. Their prosperity clearly declined. Large German shipowners, often directly linked to Ruhr conglomerates, scaled up to reduce the cost of freight transport and forced their small Dutch competitors to keep up. Even if they managed to find money to invest, sales per shipload-kilometer fell. As a result, the small, self-employed skippers and their families became impoverished, and family labor had to be used as a cheap solution. They also cut back on their personal expenses. Most of them sold their houses ashore and took their families on board. These measures saved on household costs but also made it possible to use the labor of their wives and children in the company. Some of the old, overly small Rhine barges found a second life in inland shipping. On almost all other Dutch waterways, however, the size of the ship also increased sharply in order to compete with rail. Even so, the size of these barges remained considerably smaller than on the Rhine and differed widely locally, as it depended on the local waterways. Sometimes Rhine skippers sold their ships. Sometimes skippers themselves made the switch to local shipping. It eased their problems, but was no real solution, because even if they switched, their freight rates fell by 45 percent between 1870 and 1913.

About the author

Hein Klemann (1957) studied history at the Free University Amsterdam (VU) as well as economics both at this university and the University of Amsterdam, obtaining his PhD from the VU. He then worked at various universities and institutes and published on economics and the Second World War, Dutch-German economic relations, Rhine navigation, and on the city of Haarlem. Since 2005, Klemann has been a professor of economic history at Erasmus University Rotterdam.

E-mail: klemann@eshcc.eur.nl

