

# IMPACT OF THE COVID-19 EPIDEMIC ON RAIL TRANSPORT IN EUROPE

WPLÝW EPIDEMII COVID-19 NA TRANSPORT KOLEJOWY W EUROPIE

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**Abstract:** The aim of the study is to assess the scope of the impact of the COVID-19 epidemic on the rail transport market in Europe. To this end, both the passenger and freight transport market were analysed. The period under study covers the years 2019-2022. The COVID-19 epidemic has affected all European countries; and this extends to the demand and supply side of all modes of transport, including rail transport. Restrictions implemented in various areas of economic activity caused Railways to lose a significant part of their passengers. In 2020, the number of passenger-kilometres decreased by an average of 48% compared to 2019. Countries such as Ireland and the United Kingdom saw the biggest change (a decrease of 65%). With regard to the transport of cargo by rail, the scale of the restrictions was already significantly smaller. As a result, the volume of transport performance expressed in tonne-kilometres decreased in 2020 by 7% compared to 2019. The years 2021-2022 represent the end of the reconstruction of the railway market, where the number of passengers transported by rail and the rate of rail use increased significantly and widely. Countries such as Germany, Spain and France have taken initiatives to promote public transport, mainly railways. For the further development of rail transport, it is necessary to continuously improve the quality of services, reduce journey times, improve the accessibility of modern rolling stock and integrate rail with other regional, urban and suburban rail networks and other modes of transport.

**Keywords:** COVID-19 epidemic, rail transport, epidemiological restrictions, passenger transport, ecological aspects, supply chain

**Streszczenie:** Celem opracowania jest ukazanie zakresu oddziaływania epidemii COVID-19 na rynek przewozów kolejowych w Europie. Analizie poddano rynek przewozów pasażerskich i towarowych. Badany okres obejmuje lata 2019-2022. Epidemia COVID-19 dotknęła wszystkie kraje europejskie, wpłynęła na stronę popytową i podaźową wszystkich rodzajów transportu, w tym także transport kolejowy. Ograniczenia wdrożone w różnych obszarach działalności gospodarczej spowodowały, że kolej utraciła znaczną część pasażerów. W 2020 r. ilość pasażerokilometrów w porównaniu do 2019 r. zmniejszyła się średnio o 48%. Największa zmiana dotyczyła takich krajów jak Irlandia i Wielka Brytania (spadek o 65%). W odniesieniu do transportu ładunków koleją skala oddziaływania obostrzeń była już znacząco mniejsza. W rezultacie ilość pracy przewozowej wyrażona liczbą tonokilometrów zmniejszyła się w 2020 r. o 7% w porównaniu z rokiem 2019. Lata 2021-2022 to okres odbudowy rynku kolejowego. W sposób znaczący i powszechny wzrosła wówczas liczba pasażerów przewożonych koleją oraz wskaźnik wykorzystania kolei. Takie kraje jak Niemcy, Hiszpania czy Francja, podjęły inicjatywy mające na celu promowanie publicznych środków transportu, w tym głównie kolei. Dla dalszego rozwoju transportu kolejowego konieczne jest stałe podnoszenie jakości usług, skracanie czasu podróży, poprawa dostępności nowoczesnego taboru oraz integracja kolei z pozostałymi regionalnymi, miejskimi i podmiejskimi sieciami kolejowymi, a także z innymi rodzajami transportu.

**Słowa kluczowe:** epidemia COVID-19, transport kolejowy, obostrzenia epidemiologiczne, przewóz pasażerów, aspekty ekologiczne, łańcuch dostaw.

## Introduction

The effects of the COVID-19 outbreak continue to be felt across Europe. But they have had different impacts in different countries. In the second

quarter of 2020, most countries, taking up the fight against the epidemic, implemented strict restrictions on movement within internal and international traffic. This resulted in a significant reduction in mobility both in the area of social activity of the

population and the movement of goods (Kusto, Klepacki, 2022).

The scope of epidemiological restrictions throughout 2020 showed high variability. Strict restrictions on movement persisted until the summer months, when their scope was relaxed in Poland and other countries. This situation continued until the fourth quarter. At that time, restrictions were reintroduced in many countries in connection with the second wave (Nikolaidou, Kopsacheilis, Georgiadis et al., 2023).

With the introduction of pandemic-related restrictions, the demand for passenger travel by rail dropped significantly. Concerns about the risk of infection and the introduction of quarantine in many countries caused people to avoid travel, which negatively affected the number of passengers using the rail (Tarkovsky et al., 2022). In order to adapt to reduced demand, many railway lines in Europe made changes to timetables. Some connections were suspended and the frequency of trains was curtailed.

The fall in passenger numbers and the introduction of safety measures caused financial difficulties for rail carriers. Many companies had to reduce operating costs, and some received financial support from governments. The pandemic has also had an impact on the transport of goods by rail. In some regions, especially at the beginning of the pandemic, restrictions on production and demand for goods may have affected the movement of goods. In international trade, border closures and travel restrictions affected the movement of goods (Magriço et al., 2023).

The impact of COVID-19 on rail transport in Europe has not been uniform and has varied from country to country. Governments and transport companies have taken various measures to address the challenges and maintain the continued operation of the rail network (Jenelius, 2022).

### Literature review

The reduction of transport needs concerned each mode of transport, including rail transport. (Malik et al., 2022). Rail transport is characterised by features that determine, on the one hand, its strengths and competitive advantages, and on the other hand, affect restrictions in development and accessibility (Turkova et al., 2022). The factor determining the development of railways is the possibility of transporting a large number of passengers, or significant loads of cargo, at one time (Mendyk, 2009). Transport in this branch is characterised by relatively lower energy consumption and the low emission of harmful

compounds into the environment (Dedik et al., 2020). The railway is also characterised by a low degree of land occupancy (Platje et al., 2018).

An important aspect of this branch of transport is safety, wherein the high level of safety can be put down to the way rail traffic is managed, coupled with the organisation of the driving path. This is reflected in the low accident rate. Reliability, in turn, is combined with resistance to adverse weather conditions. The answer to the search for new, more efficient, less cost-intensive and more environmentally friendly modes of transport has been the development of intermodal transport (Ambra et al., 2021), which makes extensive use of rail transport, being safer, greener and potentially more efficient on long-distance routes (Wojewódzka-Król, Crew, 2022). The advantage of intermodal transport is that it allows for the creation of modern supply chains combining two or more modes of transport into one system (Rosa, 2022).

There are also barriers to rail transport, as it does not allow for door-to-door deliveries. Therefore, it is connected with the necessity of almost every support from road transport in the transport of goods. The possibility of using replacement infrastructure is also limited, which makes the railway susceptible to difficulties occurring during renovation and modernisation works (Caramuta et al., 2023).

In the market context, a certain barrier to the development of railways is the difficulty of new carriers entering the market – high cost, licenses, access rights to infrastructure, low level of rolling stock availability. Although the railway is characterised by high transport capacity, it is often treated mainly as a substitution branch for road transport (Abramov et al., 2022).

Rail transport generates significantly lower carbon dioxide emissions compared to road and air transport (Kramarz et al., 2022). Most trains, especially those operating on electricity, emit minimal amounts of greenhouse gases, which helps in the fight against global warming (Dolinayova et al., 2016). Indeed, more and more railway lines around the world are electrified, which reduces pollutant emissions and dependence on fossil fuels (Reis et al., 2013).

Rail transport is one of the most efficient means of transport in terms of its energy use (Costa et al., 2017). Compared to road vehicles, trains have a lower energy requirement per unit weight transported, which translates into lower operating costs and lower energy consumption. Promoting this mode of transport also reduces congestion (Abdelatif et al., 2015).

Rail is particularly efficient in transporting goods over long distances. Thanks to larger wagon capacities and more goods transported at the same time, energy consumption per unit load is lower compared to road transport (Markiewicz, 2021). The beneficial effects on the environment are also expressed in noise emissions. Trains are usually quieter than cars and planes, which makes them less burdensome in cities and in densely populated areas (Markiewicz, Niedzielski, 2022).

Thanks to its ecological advantages, rail transport plays an important role in the pursuit of sustainable development and reduction of negative impact on the natural environment (Pomykała, Engelhardt, 2023). Promoting and investing in the development of rail transport can contribute to achieving climate protection and sustainability goals in the transport sector (Gandhi, Kant, 2023).

### Material and methodology

The aim of the study is to show the scope of the impact of the COVID-19 epidemic on the rail transport market in Europe. Both the passenger and freight transport market were analysed. The material used in the analysis is data from the Independent Regulators Group – Rail (IRG-Rail) and the Office of Rail Transport (UTK). IRG-Rail is a platform for cooperation and the exchange of information and best practices between national railway regulatory authorities; and aims to facilitate the creation of a single, competitive, efficient and sustainable internal rail market in Europe.

The period under study covers the years 2019-2022. The subject of the analysis, carried out horizontally and vertically, was the number of passengers and tonne-kilometres, the number of trains running in passenger and freight transport and the railway utilisation rate.

### Results and discussion

The COVID-19 crisis has significantly affected the European transport system in 2020. The spread of the virus led to a reduction in international and domestic travel and caused a global decline in demand for transport. At the same time, however, rail transport continued to provide key services (Surmařová, Vrána, Ilík, 2022).

The COVID-19 outbreak has affected all European countries. Most countries have introduced strict lockdown measures or restrictions on internal movement. Some internal restrictions on movement differed at regional level as well as for domestic and international travel (Tori et al.,

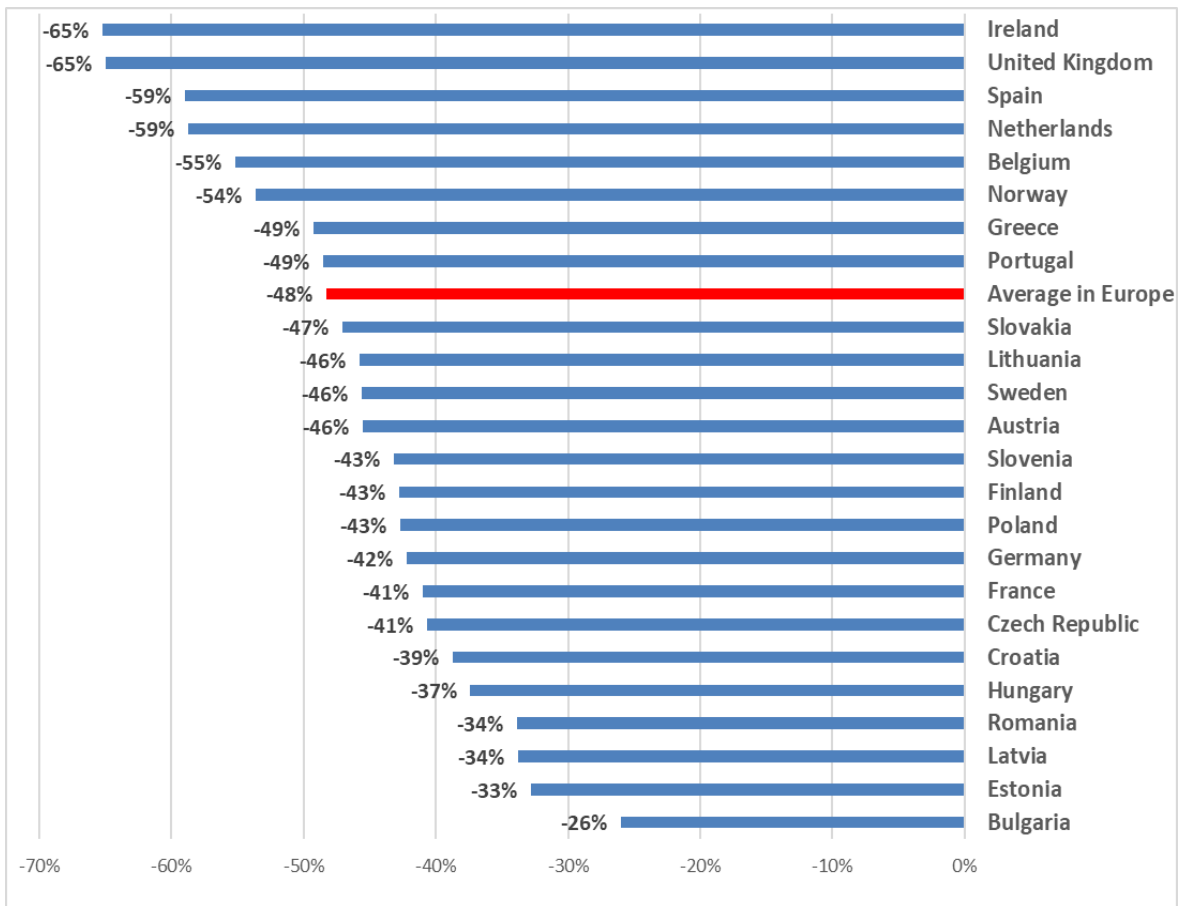
2023). This was the case, for example, in Italy, Great Britain and Germany (Grechi, Ceron, 2022). There were recommendations or recommendations to stay at home temporarily. At the same time, 16 countries reintroduced controls at land borders, banning or at least restricting international traffic (Fridrisek, Janos, 2022).

As a result of the epidemic, railway undertakings or infrastructure managers introduced legislation reducing passenger train capacity by 40% or 50% (e.g., Croatia, Italy, France, Portugal, Spain), shortened timetables (e.g., Austria, Belgium, Finland, Italy, Norway, Slovakia, United Kingdom).

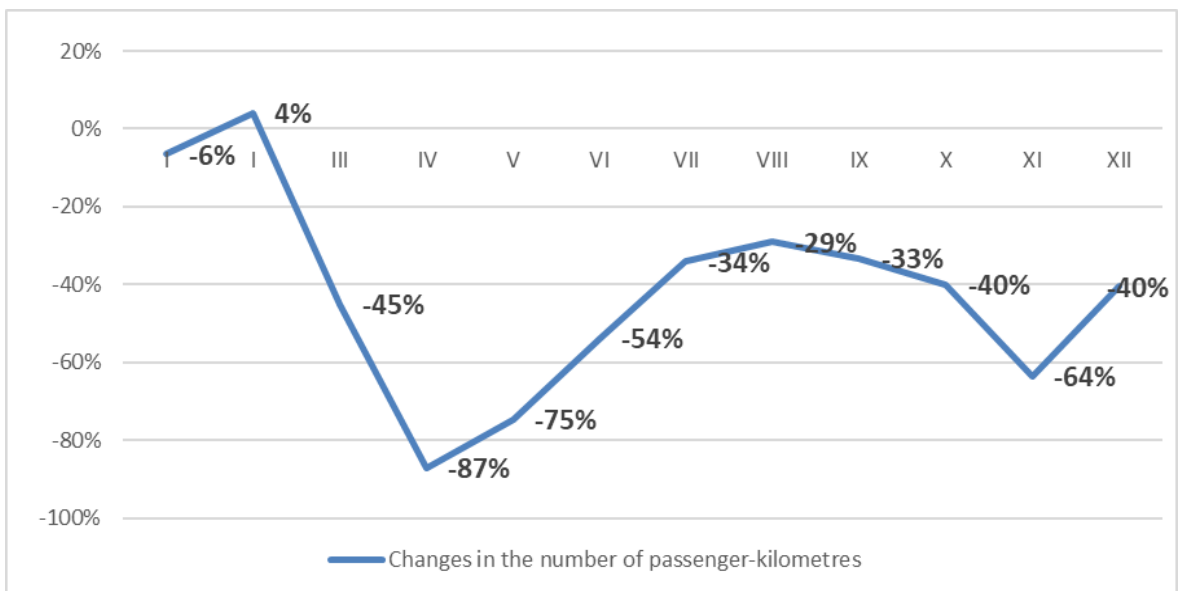
The presented conditions did not remain indifferent to the volume of rail transport (Fig. 1). In 2020, passenger transport due to the COVID-19 epidemic recorded a significant decrease. The number of passenger-kilometres during the year decreased from 419 billion in 2019 to 217 billion, which accounted for -48%. Such a significant decrease occurred in each of the 24 countries providing data under IRG-Rail. The relatively largest change was seen in countries such as Ireland and the United Kingdom (-65% change). Significant reductions in train travel were also recorded in Spain and the Netherlands (-59%), Belgium (-55%) and Norway (-54). The smallest decrease took place in Bulgaria (change -26%).

Analysing the scope of changes throughout the year, it can be concluded that they were characterised by significant variation (Fig. 2). The most severe decrease in the number of passenger-kilometres took place in April 2020, when transport performance was lower by 87% than in the corresponding period of 2019. Along with the easing of covid restrictions, there was a gradual recovery of the passenger rail transport market. This situation lasted until September 2020. The next wave of the virus meant that in November transport was lower by 64% than in the same period of 2019.

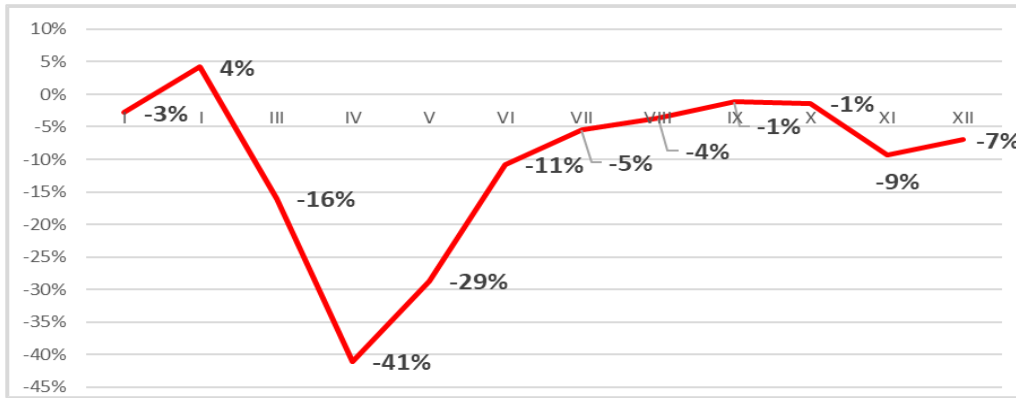
Following the reduction in demand for rail transport services, there was also a reduction in supply. The direction of change was similar. However, the difference concerned the scale of the phenomenon (Fig. 3). Throughout 2020, the number of passenger trains running decreased by an average of 9%. In April, a total of 41% fewer trains set off on routes in 24 countries in Europe, and in November 9% fewer trains. This was a consequence of the reduced demand for rail transport from passengers.



**Figure 1.** Changes in the number of passenger-kilometres in rail transport in Europe in relation to 2020/2019 in %  
 Source: own calculations based on: Impacts of the COVID-19 crisis and national responses on European railway markets in 2020. [www.irg-rail.eu](http://www.irg-rail.eu) (02.08.2023).



**Figure 2.** Changes in the number of passenger-kilometres in rail transport on average in 24 countries in Europe in individual months of 2020 compared to 2019 in %  
 Source: own calculations based on: Impacts of the COVID-19 crisis and national responses on European railway markets in 2020. [www.irg-rail.eu](http://www.irg-rail.eu) (28.07.2023).

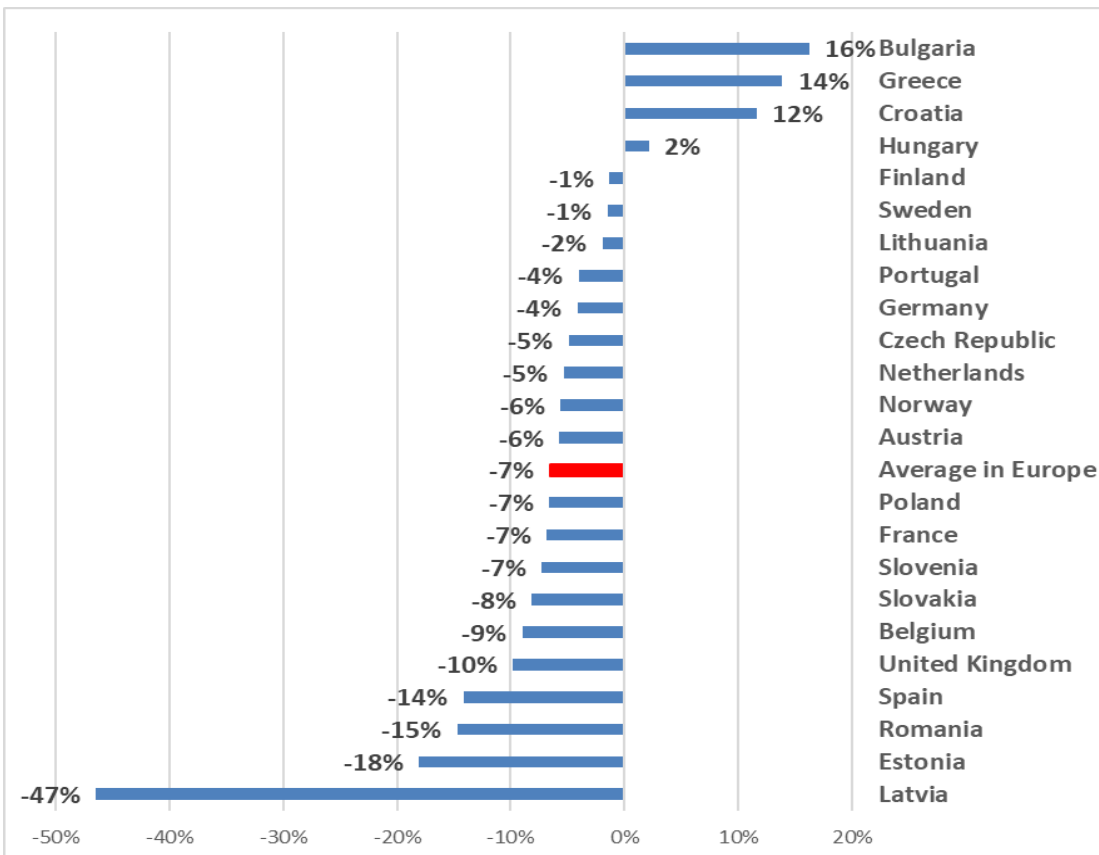


**Figure 3.** Changes in the number of passenger trains running in rail transport in individual months of 2020 compared to 2019 in %

Source: own calculations based on: Impacts of the COVID-19 crisis and national responses... (28.07.2023).

The situation in the transport of goods by rail was much more optimistic. In 2020, freight traffic was significantly less affected by the COVID-19 outbreak than passenger traffic (Shchepkina, Meshkova, Goigova, Maisigova, Tochiewa, 2022). In some countries, this type of service was prioritised in the face of shrinking passenger traffic (Fig. 4). In 2020, the 23 countries monitored by IRG Rail carried out a total of 386.6 billion tonne-kilometres of transport performance compared to

413.8 billion tonne-kilometres in 2019. This was a decrease of 7% compared to 2019. In Latvia, freight traffic decreased by 47% in tonne-kilometres during this period. Estonia also recorded a serious decrease (by 18%). Although most countries recorded a decrease in transport performance at that time, there were also those where the number of tonne-kilometres increased. These countries were Bulgaria, Greece, Croatia and Hungary.

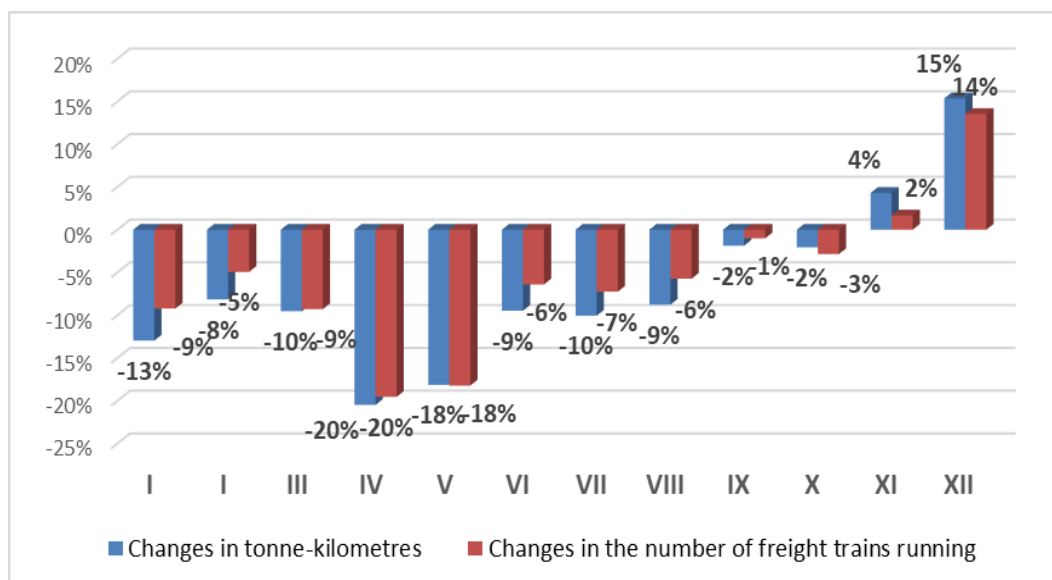


**Figure 4.** Changes in the number of tonne-kilometres in rail transport in 23 countries in Europe on average in 2020/2019 in %

Source: own calculations based on: Impacts of the COVID-19 crisis and national responses... (28.07.2023).

With regard to rail freight transport, tonne-kilometres and trains running throughout 2020 varied significantly (Fig. 5). In 2020, April turned out to be the month with the largest decreases in the volume of transport work and the number of

trains running. These rates fell by an average of 20% in 24 countries in Europe. It is optimistic that December 2020 has already brought increases in the analysed indicators by 15% and 14%, respectively.



**Figure 5.** Changes in the number of tonne-kilometres and freight trains running in rail transport in the average in 24 countries in Europe in individual months of 2020 compared to 2019 in %

Source: own calculations based on: Impacts of the COVID-19... (28.07.2023).

In 2021, the impact of the COVID-19 epidemic on rail passenger transport restrictions began to gradually decrease (Rothengatter, Zhang, Hayashi, Nosach, Wang, Oum, 2021). However, the restrictions still in place meant that it was not possible to rebuild the rail transport market to the pre-epidemic level (Fig. 6).

In 2021, the most similar level to the result of 2019 was achieved by the railways in Slovenia (88% of the result from 2019). Turkey (83%) came second, followed by Bulgaria (84%), Lithuania (79%) and Romania (77%). Next in line was Poland with the number of passengers at the level of 73% compared to pre-pandemic 2019. In 2021, the smallest percentage of the number of passengers from the period before the outbreak of the epidemic was recovered by rail in Ireland. It is the country whose railways suffered the most in 2020. The year 2022 brought changes both in the social and economic dimension. At the beginning of 2022, with the outbreak of the war in Ukraine, there was a sharp increase in fuel prices both in Poland and in Europe. This resulted in a noticeable increase in the cost of individual transport. A convenient alternative to commuting to work or further places has become railways. At the same time, many European countries have taken initiatives to promote public transport. This

particularly affected demand for rail passenger transport.

The analysis of UTK and Eurostat data available for the first half of 2022 for 26 countries shows that almost 75% of the number of rail passengers falls on 6 countries (Fig. 7). Among all the European countries, the largest share in passenger transport (32.2%) was held by German railways. In comparison with the first half of 2021, when epidemiological restrictions were still in force, the number of passengers on these railways increased by 411.4 million passengers (+57.5%). Introduced from 1 June 2022, the €9 ticket meant that in local and long-distance rail transport, passengers used German railways not only more often, but also over longer distances.

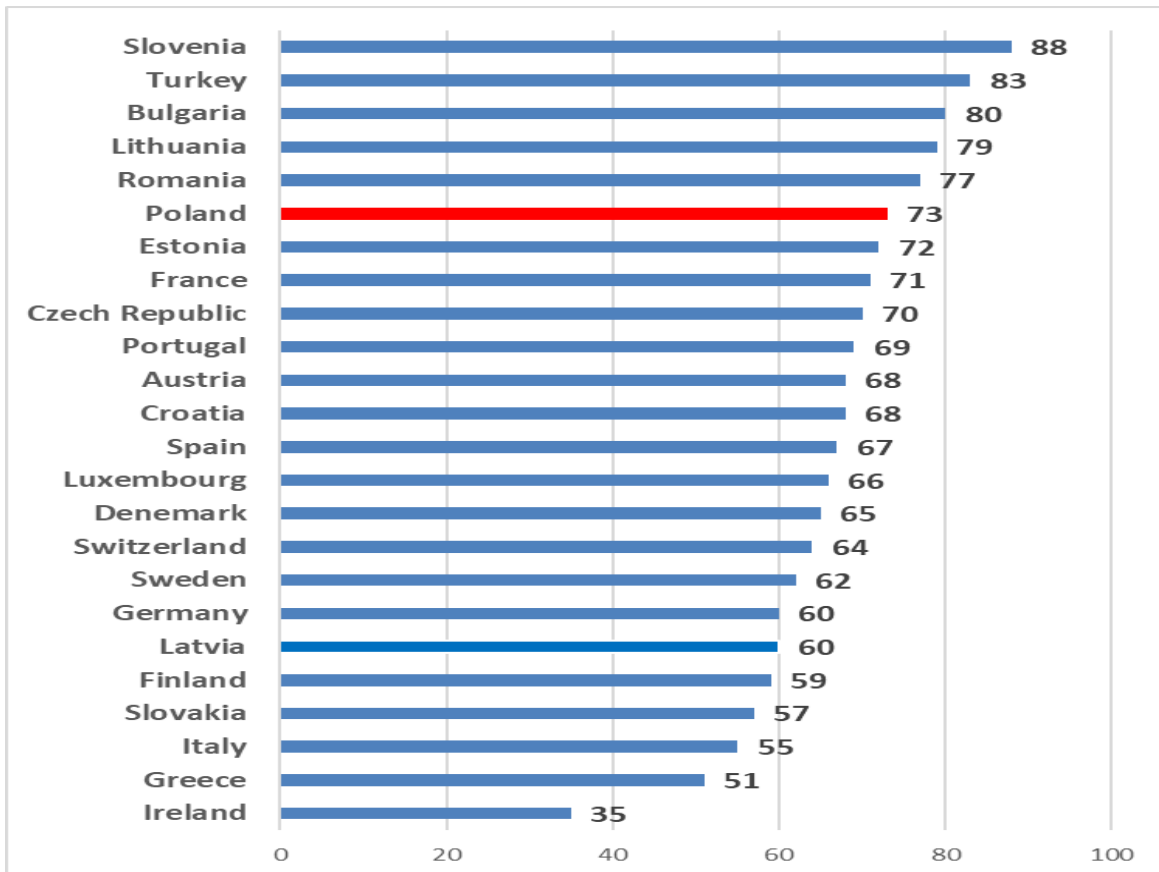
Second place in terms of the number of passengers among the analysed countries was taken by the railway in France. In the first half of 2022, the share of this railway was 15.7%. Compared to the first half of 2021, almost 160.3 million more people were transported by rail in France (+41.1%). Here, the ban on short domestic flights introduced in 2021 on distances that can be covered by train in no more than 150 minutes had a significant impact.

In third place was the railway in Italy with a 9.1% share in the number of passengers in the first

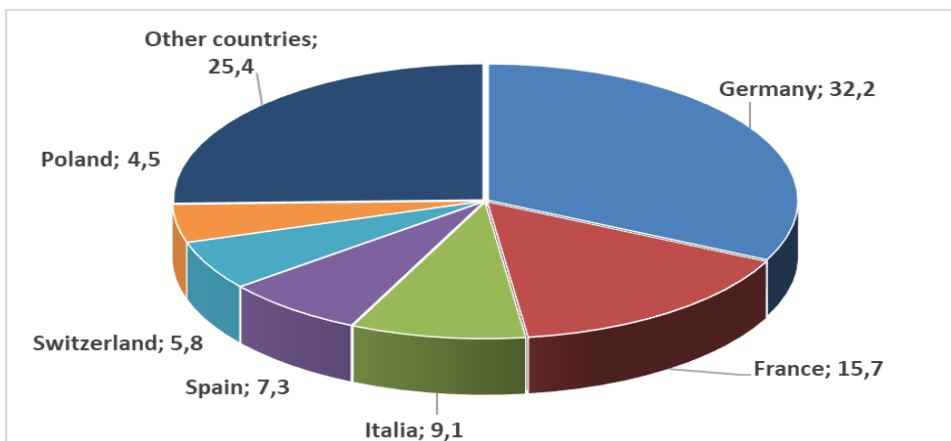
half of 2022. In comparison with the first quarter of 2021, this railway carried 123.5 million passengers more (+63.1%).

Spain has an interesting solution with a 7.3% market share. In response to inflation and high gasoline prices in 2022, it introduced a 100% discount on multi-journey tickets for all suburban trains and medium-distance regional lines covering journeys of less than 300 km, operated

by the state railway operator. The result of these activities was an increase in rail transport in the first half of 2022 by 73 million (+40%) compared to 2021. In the first half of 2022, the position, and a 5.8% share in the analysed countries, was claimed by Switzerland. Compared to the first half of 2021, there was an increase in the number of passengers by 38.3 million passengers (+23.1%).



**Figure 6.** Passenger volume ratio (% of number of passengers) in 2021 compared to 2019 in 24 European countries  
Source: Report: Passengers in Europe return to the railways. Office of Rail Transport Warsaw 2022.



**Figure 7.** Share of individual countries in the total number of rail transport passengers in 27 countries for the first half of 2022 in %

Source: Report Passengers in Europe return...

In Poland, which is in sixth position (4.5%) in terms of share in the number of passengers among the 27 analysed countries, the increase in the number of passengers amounted to 61.1 million (+62.9%) respectively in the first half of

2022 to the first half of 2021 and 53.9 million more (+51.7%) compared to the first half of 2020. A detailed breakdown of changes in the number of passengers in the years 2019-2022 on a monthly and annual basis is presented in Table 1.

**Table 1.** Changes in the number of passengers transported by rail in Poland in 2019-2022

Month	Number of passengers transported in million				% changes	
	2019	2020	2021	2022	2020/2019	2022/2019
January	26,5	28,5	13,6	21,4	107,5	80,8
February	25,2	27,5	14,3	21,2	109,2	84,2
March	28,2	17,8	15,2	28,4	63,1	100,7
April	26,5	6,1	14,0	26,9	23,0	101,5
May	28,5	9,8	18,9	30,4	34,4	106,7
June	27,4	14,6	21,1	29,8	53,3	108,8
July	28,1	18,9	23,5	30,4	67,3	108,2
August	28,3	20,1	24,9	30,7	71,0	108,5
September	28,8	21,6	24,9	29,6	75,0	102,8
October	31,2	18,5	27,0	32,8	59,3	105,1
October	29,4	12,4	25,1	31,3	42,2	106,5
December	27,9	13,5	22,6	29,5	48,4	105,7
Total	335,9	209,4	245,1	342,4	62,3	101,9

Source: Report on the functioning of the rail transport market in 2021 Office of Rail Transport 2022 and operating data of UTK, [www.utk.gov.pl](http://www.utk.gov.pl) (accessed 15.07.2023).

After a period of rapid collapse for rail transport in 2020, the following years brought a restoration of demand for this type of services. Full success in this sphere in Poland was seen in 2022. Although in January and February passenger transport was lower than in the corresponding months of 2019, in the following months it was possible to exceed the volumes from 2019. The summer months (June-August) proved to be particularly favourable in this respect. This situation meant that in the whole of 2022, 6.5 million more people were transported in rail transport than in 2019.

By comparing the data on the number of rail passengers with data on the number of people living in individual countries, the rail utilisation rate can be calculated. It gives the number of trips per 1 inhabitant of a given region.

In the first half of 2022, passenger rail services were most often used by residents of Switzerland. On average, a resident of this country in the first 6 months of 2022 used rail transport on average almost 24 times. For the statistical inhabitant of Luxembourg, the figure was 16, while for Denmark this figure was noted at almost 15. The Germany with the highest share in terms of passenger numbers achieved a rail utilisation rate of 13.5

journeys per 1 inhabitant. In the first half of 2022, residents of Sweden used it more than 10 times.

In Poland, the average inhabitant in the first half of 2022 used railway services on average 4.2 times (for the whole of 2021, this value was 6.4). In terms of the change in the dynamics of the rail utilisation rate compared to the first half of 2020 Poland, with a 52.4% increase, ranked seventh among 27 European countries. Turkey (+118.2%), followed by France (+68.2%), Italy (+64.4%), Slovenia (+61.8%), Portugal (+54.7%) and Spain (+53.2%). The lowest percentage increases were recorded for Latvia (+13.7%), Finland (+16.4%), Sweden (+18.1%), Switzerland (+22.1%), Ireland (+22.6%) and Germany (+23.15).

Such a high growth rate on the railway market in Turkey (by 150.5% compared to 2021 and by 120.2% compared to 2020, respectively) resulted from the reconstruction of a transport policy. The country has gone from a preference for road construction to a period of intensive railway investments. Currently, over 4,000 km of railway lines are under construction. In large part, they are aimed at developing urban railways in locations such as Istanbul, Izmir and Ankara.



## Summary

The COVID-19 outbreak affected all European countries. Its particularly adverse impact was evident for most of 2020. Since March 2020, most countries have introduced strict isolation measures or restrictions on internal movement. This has resulted in a significant decline in global mobility in all countries. Restrictions implemented in various areas of economic activity caused the railway to lose a significant part of its passengers. In 2020, the number of passenger-kilometres decreased by an average of 48% compared to 2019. Such a significant decrease occurred in each of the 24 countries providing data under IRG-Rail. Countries such as Ireland and the United Kingdom saw the biggest change (down -65%).

With regard to the transport of cargo by rail, the scale of the restrictions was already significantly smaller. As a result, the volume of transport performance expressed in tonne-kilometres decreased in 2020 by 7% compared to 2019. Although most European countries recorded a decrease in transport performance at that time, there were also four countries where the number of tonne-kilometres in the transport of cargo increased.

With the easing of restrictions caused by the COVID-19 epidemic, it has become crucial to regain the group of commuters who switched to using private cars during the pandemic. A number of factors contributed to the recovery of the rail transport market. With the outbreak of the war in Ukraine, there was a sharp increase in fuel prices both in Poland and in Europe. This resulted in a noticeable increase in the cost of individual transport. What is more, railways have become an advantageous alternative to commuting to work,

school, university or tourist trips. At the same time, many European countries, such as Germany, Spain and France, have taken initiatives to promote public transport. This has particularly affected the significant recovery in demand for rail passenger transport.

As a result of these solutions and changes in socio-economic conditions, in 2022 there was a sharp increase in demand for services provided by rail transport. This situation meant that for the whole of 2022 in Poland, 6.5 million people were transported in rail transport than in 2019. The summer months (June-August) proved to be particularly favourable in this respect. Among the 27 European countries, Poland in 2022, in terms of the change in the dynamics of the railway utilisation rate compared to the first half of 2020, with an increase of 52.4%, took the seventh position. Turkey (+118.2%), followed by France (+68.2%), Italy (+64.4%), Slovenia (+61.8%), Portugal (+54.7%) and Spain (+53.2%).

Such factors, as well as a growing environmental awareness in individual European countries, will see increased numbers of rail passengers in the future. At the same time, as the experience of some European countries shows, reducing the costs associated with rail transport is not a sufficient method of competing with travel by other means of transport. It is necessary to continuously improve the quality of services, reduce travel times, improve the accessibility of modern rolling stock and integrate rail with other regional, urban and suburban rail networks and other modes of transport.

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