Railway infrastructure pricing systems for freight in Europe: Analysis and evolution in the last decade

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ABSTRACT

The study aims to assess the different charging principles and levels in some of the most relevant European national and international routes and compare them with the results from 10 years ago. Another goal is to compare road and rail freight transport.

In the Qualitative analysis the infrastructure pricing systems for rail freight transport were described and compared. It was observed that within the last ten years many systems were simplified.

The Quantitative analysis contains: interval variation of charge levels, charges levels of the National and EFC OD pairs and the train weight impact on the charge levels.

Only Italian and German pricing systems charge per km for a 500-tonne train is bigger than 2 euros. An enormous part of their charges is taken by the mark-up. In other countries the mark-up is very low or even 0. That results in heterogeneity within the European Freight Corridors.

It was found that in 10 years in most of the pricing systems the level of charges decreased. The biggest relative change in price was observed for Italy – about 61%. On the other hand the biggest relative decrease of charge was observed for the Netherlands, France and Poland – from 44 to 47%. The charges for EFC for 500 tonnes trains decreased.

In comparison of freight pricing in road and rail transport it was found that in many countries and corridors the rail freight transport started to be competitive just for trains weighing at least 960 tonnes.

Keywords: Infrastructure pricing system; Rail freight transport ; Railway packages; International market

1. Introduction

Since the European Economic Community creation, one of its objectives was to establish common transport policy in the European space. One of today's concerns is a modal shift in freight transport. The target set from the EU Sustainable and Smart Mobility Strategy, released in 2011, is to shift away 30% of freight traffic from the road by 2030 and 50% by 2050 [1]. The aforementioned objective is driven by factors related to accessibility, sustainability, climate change, safety, resilience and economic development. Road freight transport mainly has advantages over other modes in terms of reliability, flexibility, accessibility and shipment size. It is said to be the cheapest mode over short distances [1] In long distance transport, rail transport is the biggest competition for road transport.

To oust discrimination from the pricing systems, increase the efficiency and competitiveness of the rail transport and its share in transport modes, European Union Commission published directives and regulations. It required the account separation of the infrastructure manager and operators (Directive 1991/440/EC). The infrastructure usage fee should be based on marginal cost, that is the cost that is directly incurred as a result of operating the train (Directive 2001/14/EC).

The regulations and directives, however, left some space for interpretation, which resulted in various ways of usage fee implementation, thus retention of the heterogeneity. That complexity and difference of the systems impede changes in traffic mode share.

The competition in transport modes is also hindered due to differences in charging of the road and rail infrastructure usage. Whereas there are regulations making railway undertakings cover the costs of rail deterioration, there is no such thing for road transport. Truck toll payments often do not cover the damage caused [1]. Moreover, there are many roads with free access, whose deterioration is to be paid for by public entities.

2. State of Art on railway infrastructure pricing

This chapter provided knowledge on many subjects related with rail infrastructure pricing systems. The reviewed analysis came from various sources. They did not always have the same conclusions. Those divergences raise some questions and discussion.

The legislations were met with objections and the member states not always fully aligned with them. Complete separation of infrastructure and operations was opposed of some member states, what postponed its full introduction. Most of IMs didn´t divide rail services on demanded amount of segments [2]. The marginal cost calculation was not provided by great majority of IMs [2]. It would be of interest to assess if that still applies today.

The impact of directives has been also analysed. In the 2007 – 2012 period an increase of dispersion in tariff system has been observed.

The studies, concerning calculation of cost directly incurred, applied various approaches, which resulted in different marginal costs.

- In CATRIN study [3] the marginal cost fluctuates from 0.32 to 1,73 € per 1000 gross tone-km, while charges for freight trains are quite lower (from 1,4 to 7,6 times) than charges for passenger transport.
- In the report of EC [4] the average marginal cost for freight trains in the European countries is equal about 5,5 € per 1000 gross tone-km.
- In the study of Smith et al. [5] the average marginal cost is equal 1,45 € per 1000 tonnes-km, whereas the charges of freight and passenger vehicles are similar.

The results from report of EC [4] stands out significantly from the other studies. The other studies obtained similar results, however they differ in terms of distinction between freight and passenger transport costs. The first and last mentioned studies are done by same authors. In the first one they put an accent on relation between marginal cost and traffic density and track quality. It was also noted that it is beneficial to favour less damaging vehicles. In the last one no more traffic density had relevance. It showed that the marginal cost is driven by infrastructure characteristics and vehicle features such as: number and mass of axles, maximum speed, stiffness of wheelset guidance.

The studies that use econometric approach are sensitive to traffic density. The marginal cost on track sections with low occupancy was higher than the track sections with high traffic density. That may mean

that the marginal cost in this method may include the maintenance works that are undertaken regularly notwithstanding the damages occurring on the track.

On the contrary, in the studies that use engineering approach the marginal cost results from the damage caused by the train with regards to characteristics of infrastructure and of train.

In terms of marginal cost comparison due to traffic mode, the road freight transport turned out to be more expensive than rail freight transport. However, the results from the report of EC [4] seem to be inflated, thus it is hard to the relevance of that statement.

The issues as heterogeneity and disparity of pricing system structure and charge levels and system complexity are related with problems existing in international corridors. Train operators have to deal with totally different systems even in neighbouring countries. They differ with number of variables, charge levels, charge types which provide an “invisible barrier” for TO. Moreover, in the Network Statements charging systems were often described in complex and unfriendly way. Many studies agreed on tariff systems simplification and stabilization over time.

On the other hand the study on calculation of cost directly incurred showed that it depends of multitude of variables regarding infrastructure and rolling stock characteristics. Maybe the resolution to that problem is not system simplification but rather improving its description. Stabilization of the systems not always is possible when the directive impose new limits and rules.

The shift from road to rail is supposed to be achieved by increasing of competition by mean of lines liberalization. However, the impact of liberalization have been noticed and the competition has introduced, the shift from road to rail is negligible. Interestingly, in the Crozets’ [6] word choice: “[…] the relation between liberalisation (RLI) and traffic growth is not easy to establish” can be found a shadow of prejudice, as instead of finding the relation, it is tried to establish it.

This chapter showed that there is a number of issues of interest to be worked on. This thesis will focus on pricing systems for freight rail transport. It will involve analysis of charging systems structure, evolution of charge levels and alignment with directives. At the end the modes of rail and road freight transports will be compared.

3. State of the practice on railway infrastructure pricing

3.1. Methodology

The methodology applied in this study corresponds with one in the study UIC STUDY of European Railway Infrastructure Charges for Freight [7], as its results are used in the chapter 4 to observe evolution of railway infrastructure pricing systems.

This study concerns the current state of practice on pricing systems in 10 selected European countries, taking part in one of most relevant European Freight Corridors. It is based on Network Statements for 2023 provided by each IM.

3.2. Qualitative Analysis of Charging Systems

In the qualitative analysis infrastructure pricing systems for rail freight transport of selected countries were described and compared. It focused on the components of the charge for the minimum access package. It was observed that within the last ten years many systems were simplified.

The Swiss IM is found as a benchmark, as it involved variables relevant from the direct cost point of view and adequate to directives’ recommendations. They included in the charge calculation number and of axles, infrastructure characteristics, Discount For Long Train, Environmental Surcharge, Noise fee/discount and ETCS fee/discount. For each variable clear description and example of calculation were provided. The simplification may be achieved not only by reducing the number of variables.

3.3. Quantitative Analysis of Charging Systems

In this part charges for chosen origin destination pairs in each of selected countries are compared.

Figure 1 presents comparison between charges per km. Additionally, a direct cost part of the charge was added.

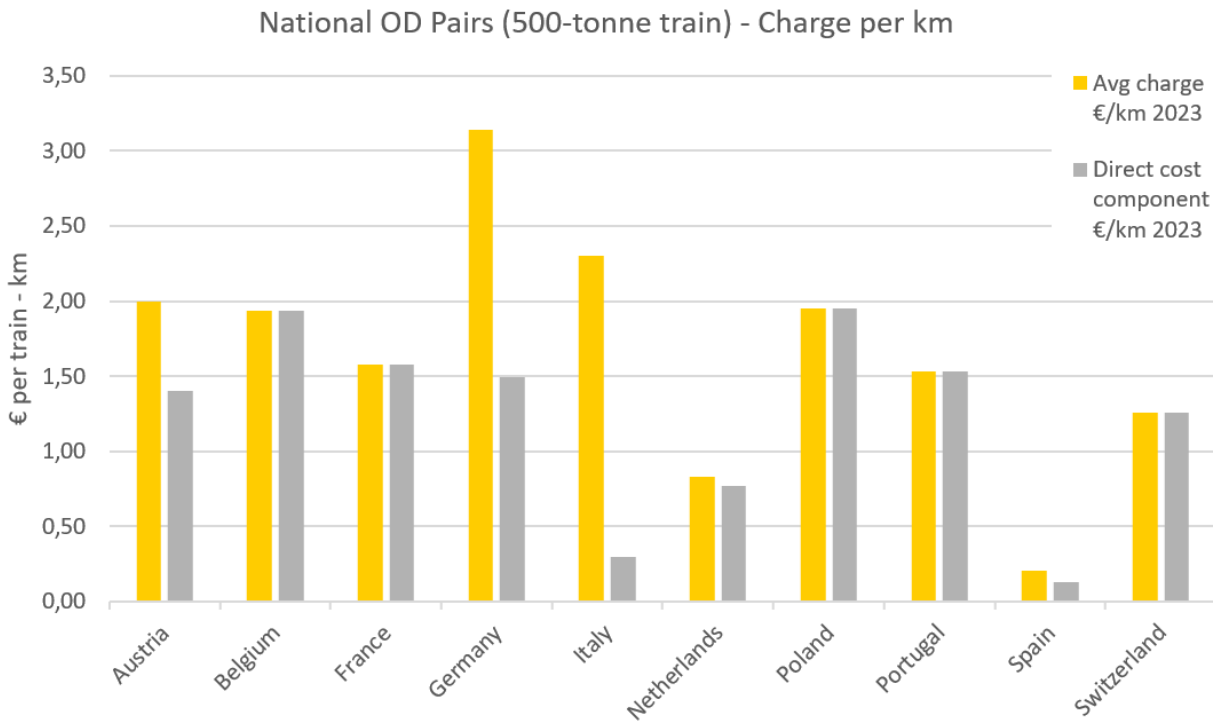

Figure 1 National OD Pairs (500-tonne train) - charge per km

Most of the prices are below 2 euros. Only the Italian and German price system charge per km for a 500-tonne train is bigger than 2 euros. An enormous part of their charges is taken by the mark-up. For both countries it is over half of the charge value. Interestingly, Italy has the second lowest direct cost, but also the highest mark-up. In other countries there is no or small mark-up. In Poland there is a mark-up, but only for trains heavier than 660 tonnes that are not intermodal. On the other hand, only Spain and the Netherlands have prices below 1 euro. Even though total charge for the Belgian path was one of the lowest, value of charge per km does not outstand from other countries.

The charges for European Freight Corridors are often different from charges for National OD pairs, as market segments and lines category may be charged differently. The figures 2 to 5 shows how the charges change from country to country within corridors. The black lines represent average rate per-kilometre.

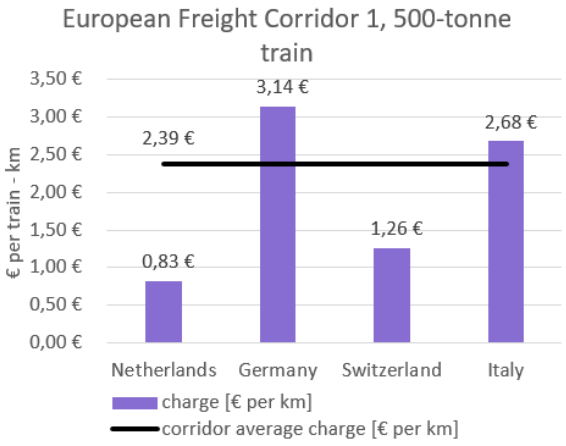

Figure 2 Cross-border Comparison: EFC 1, 500-tonne train

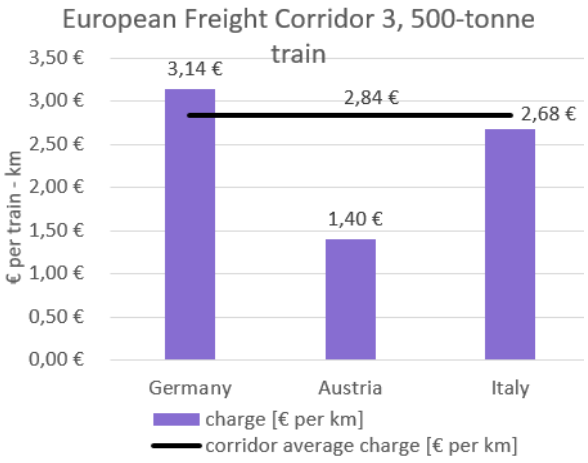

Figure 3 Cross-border Comparison: EFC 3, 500-tonne train

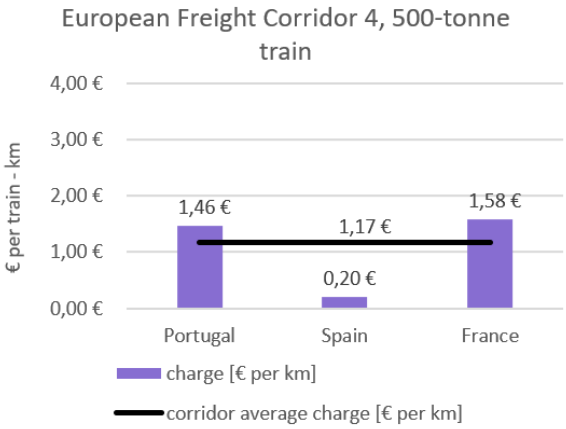

Figure 4 Cross-border Comparison: EFC 4, 500-tonne train

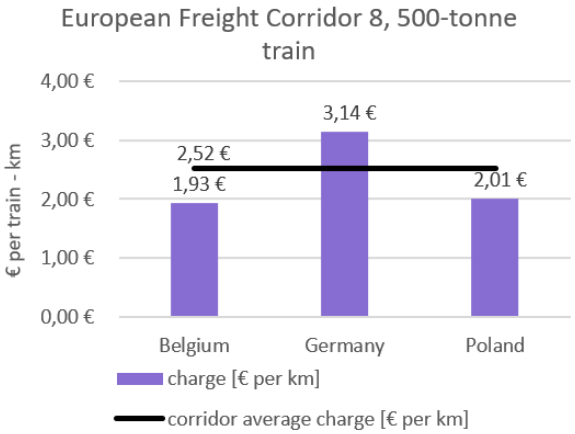

Figure 5 Cross-border Comparison: EFC 8, 500-tonne train

In EFC1 German and Italian sections increase the average charge significantly. It is important to point out, that charges of those countries are highly impacted by the mark-up, whereas Dutch and Swiss systems provide very small or no mark-up.

Similarly as in previous situation in EFC 3 German and Italian sections increase the average charge. In case of international corridors Austrian IM do not involve mark-up.

In case of EFC 4, Spain is the only country that involve a mark-up in its charge. However the Spanish charge is the lowest and it stands out significantly. The charges in Portugal and France are also very low, however that differences raise a question on the direct cost calculation methodology.

The EFC 8 is the most balanced in terms of charge levels. The high charge in Germany increase the average charge. It´s above 1 €/km higher than in other countries. The Belgian and Polish level of charges are similar. For 500 tonnes freight trains both of the systems do not levy the mark-up.

3.4. Comparison of freight pricing in road and rail transport

Comparison of freight pricing in road and rail transport was done by using the paths and charges from quantitative analysis were used for rail and compared with representative road routes and their charges between the same origins and destinations.

The charge for trains was calculated by dividing charge for 500 tonnes trains by 500 and for lorries by dividing charge per km by the maximum permissible weights for each country. The results are presented on the figure 6. To enrich the analysis, the diagram additionally includes a charge for 960 tonnes train and a marginal cost threshold imposed by EC for the rail transport. The additional bar in the graph for 960 tonnes is to consider the possibility of the rail freight market starting to be competitive just after some weight threshold. The marginal cost thresholds' unit was transformed from € per 1000 tonnes-km to eurocents per tonne-km (2,67 € per tonne-km = 0,267 eurocents per tonne-km). It is important to emphasize that the marginal cost for road transport is higher than for rail transport [4] (as it was mentioned in chapter 2).

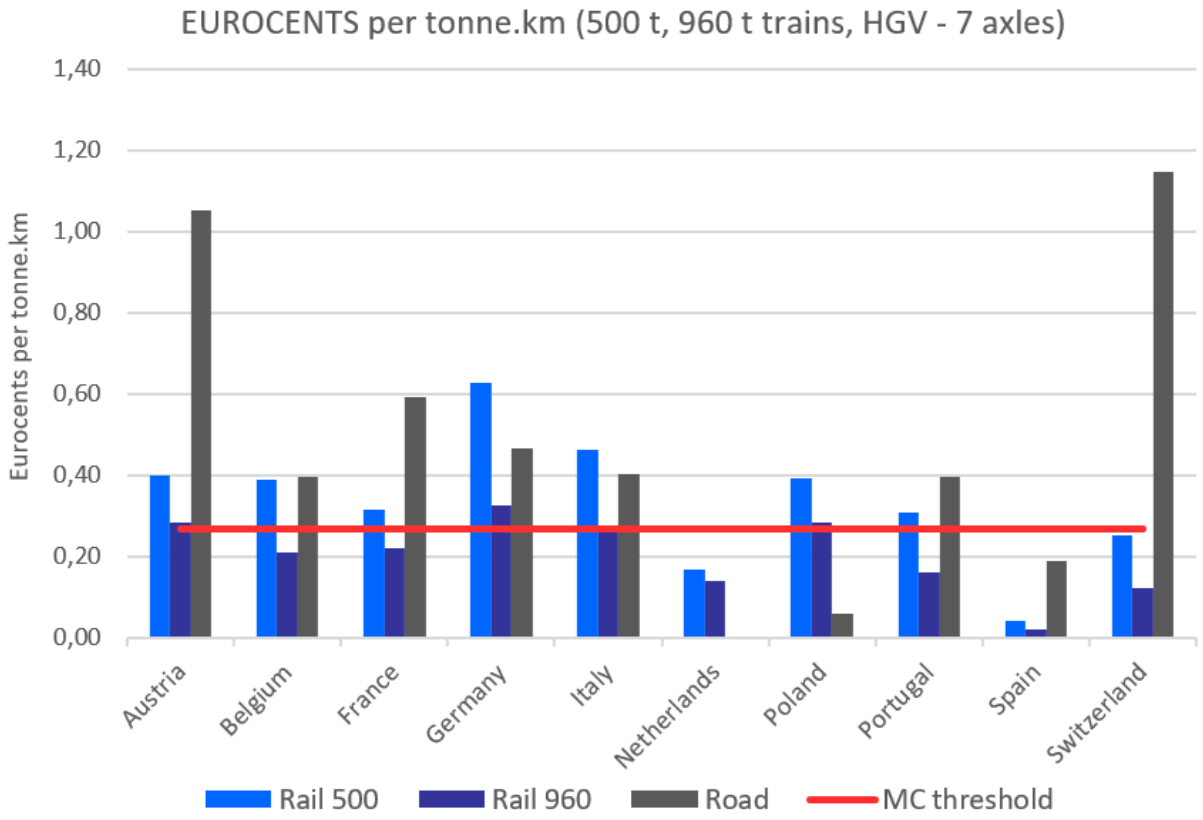

Figure 6 Comparison between rail and road transport for National OD Pairs - running charges in eurocents per tonne.km

It was found that in many countries and corridors the rail freight transport started to be competitive just for 960 t, as the charge per tonne-km started to be lower than for road freight transport. It is important to point out that, there is no regulation imposing on road transport to base its infrastructure charge on maintenance costs and there often exist other alternative highways without tariffs.

3.5. Critical analysis of Network Statements

Generally, the Network Statements presented for 2023 are comprehensive and don't impede its use in order to calculate the infrastructure charges. However, the calculation of the charge per km was always possible, often the Network Statement did not contain information on segmentation (or it was incomplete

or hard to find), which is an important part for the Railway Undertaking to calculate the distance and time of the transport.

All of the analysed pricing systems fulfil the demands to be based on the marginal cost and to have MC lower than 2,67 €. The full separation between managing a network and operating is slightly less popular than separation through a holding company.

4. Analysis of the evolution of railway infrastructure pricing systems for freight in the last 10 years

4.1. Methodology

The methodology applied in this chapter corresponds with the previous chapter. The analysis from chapter 3 is expanded by the results from UIC report [7] concerning 2013 pricing systems. The assumptions made are exactly the same in order to maintain consistency and relevance.

4.2. Evolution of systems structure

It was observed that the least changes occurred in Portugal, whereas the rest changed a lot. The most changes occurred in France, Italy, Poland and Spain. In France the number of new variables is similar to removed ones. Switzerland added quite many new variables and didn't remove any.

Even though Italy added more variables than removed, its system is not very complicated anymore. The charging rules are explained briefly and clearly. No more node fee nor fee per minute is applied, which facilitates calculations substantially.

Belgium, Germany and Spain simplified their systems significantly. They removed many variables from the first category (What is charged). Poland substituted charges per tonne-km and per axle load with weight categories, which also may be perceived as simplification.

4.3. Evolution of tariff levels

To notice the significance of the price increases, figure 7 presents percentage change of charges.

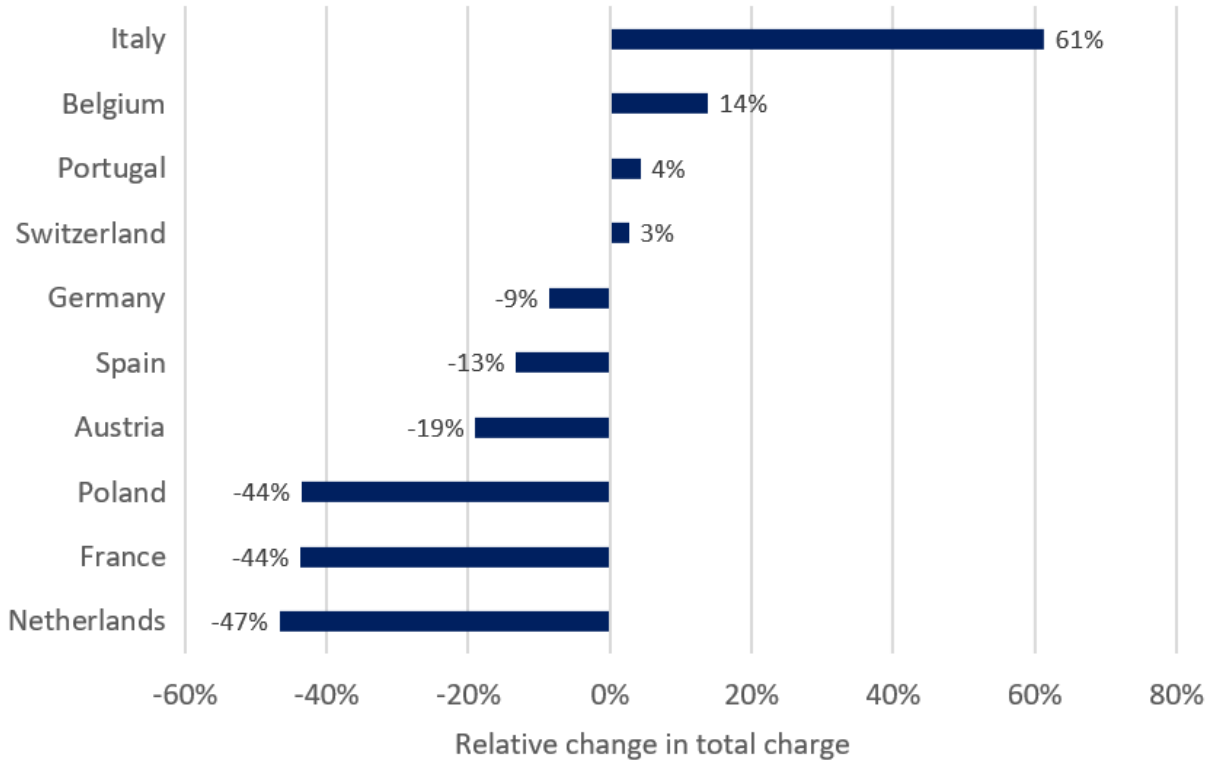

Figure 7 Relative change in total charge [%] for National OD pairs, 500 t train

The biggest relative change in price was observed for Italy – about 61%. On the other hand the biggest relative decrease of charge was observed for the Netherlands, France and Poland – from 44 to 47%.

The following analysis expands the previous section by adding results for 2013. The figure 8 shows box plots containing charges from all the selected countries and corridors.

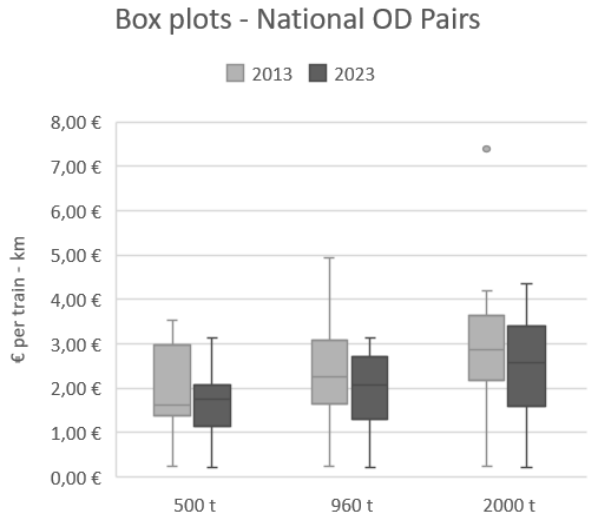

Figure 8 Sensitivity analysis. Box plots - range of prices for selected National OD Pairs for 2013 and 2023

It was observed that the dependency on weight in 2013 used to be bigger than now. However, the median values for all of the weights remained similar. Now the median is slightly higher for a 500 tonnes train and slightly lower for 960 and 2000 tonnes trains. The charges got more concentrated now for a 500 tonnes train, keeping similar maximum and minimum values. For a 960 tonnes train the majority of prices retained similar concentration of majority of prices, similar minimum. The maximum price is now much lower. It dropped almost 2 euro.

For a 2000 tonnes train there is a higher disparity in the interquartile range. The minimum price remained similar, but a big difference was observed between maximum values. In 2013 the maximum charge was obtained by Poland and equal 7,40 €/km, which significantly stood out from the array.

5. Conclusions

The study aims to assess the different charging principles and levels in some of the most relevant European national and international routes and compare them with the results from 10 years ago. Another goal is to compare road and rail freight transport.

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