CER
The Voice of European Railways

Position Paper

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Commission study results suggest greater role for European railways

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Commission study results suggest greater role for European railways

Summary

European railways comply with the principles of 'user pays' and 'polluter pays' better than any other motorised transport mode, both for passengers and freight. This is a key insight from the European Commission's recent study on transport cost internalisation. It shows that rail excels in covering its variable infrastructure costs and externalities like air pollution, CO_2 and noise through charges, with smaller cost-coverage gaps in € per passenger-km or ton-km than other modes. It also shows that rail's externalities are small in comparison with other modes, both for passengers and freight, suggesting a big role for rail in helping to reduce transport externalities. A shift to rail would benefit the environment and citizens in Europe. To achieve that, policymakers should create the right framework conditions for rail to flourish, including proper internalisation of transport's external costs, and help further develop the rail system itself, so that more persons and goods can move in a sustainable way.

1. Introduction

A study on "Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities" was published by the European Commission in June.[1] For each transport mode, each country and separately for passengers and freight, it analyses to what extent the principles of 'user pays' and 'polluter pays' are implemented across the EU.

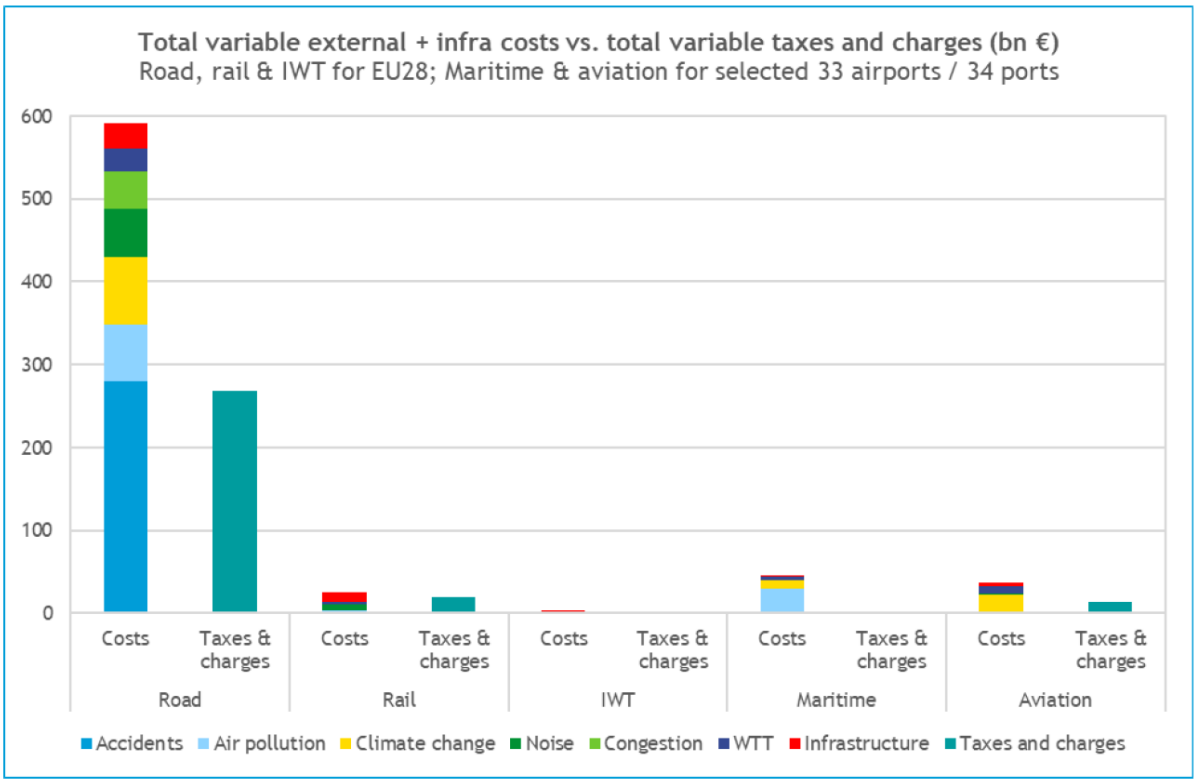
The study confirms rail's leading role in complying with these principles, and rail's very low carbon footprint and low externalities in general. Remaining external costs and the variable cost of infrastructure use are better covered by rail than by competing modes.

Section 2 of this paper highlights major insights from the study regarding cost coverage. To compare different transport modes with each other, it mostly looks at the *absolute gap in variable-cost coverage* per passenger-km (pkm) or ton-km (tkm). An annex explains why this is more appropriate than looking at full-cost coverage or coverage expressed in ratios. Section 3 sheds light on transport externalities and section 4 on some related issues. Section 5 concludes. An extra annex includes a 2-page factsheet with key insights from this paper.

2. Cost coverage by mode: major insights from the study

An overall picture, combining passenger and freight transport, is given in this chart[2]:

Figure 7 - Total variable external and infra costs vs. total variable taxes and charges



[1] All different parts and annexes of the study are accessible here.
[2] Charts in this section are taken as screenshots (incl. original captions) from the study's "State of play of Internalisation" part, p. 52-54. The ratios quoted in "Insight 1" come from related Excel annexes (specifically, file "Annex D Final_total_avg_Cross Modal Comparisons.xlsx", sheet "Variable_ext_infra_CC", area A3:K18).

When combining passenger and freight transport, no cost coverage gaps per pkm or tkm can be compared between modes. Still, the chart delivers an important insight:

INSIGHT 1: Rail leads transport in variable-cost coverage – 79%, against 45% for road, 37% for aviation and even less for water modes.[2]

Now, however, to compare modes with each other in line with the two preceding sections, let us turn to the *absolute gap in variable-cost coverage*, the best indicator of compliance with the principles of 'user pays' and 'polluter pays'.

Of the following two charts, the first one is on passenger transport, the second on freight.

Figure 8 - Average variable external and infrastructure costs vs. average variable taxes/charges for passenger transport

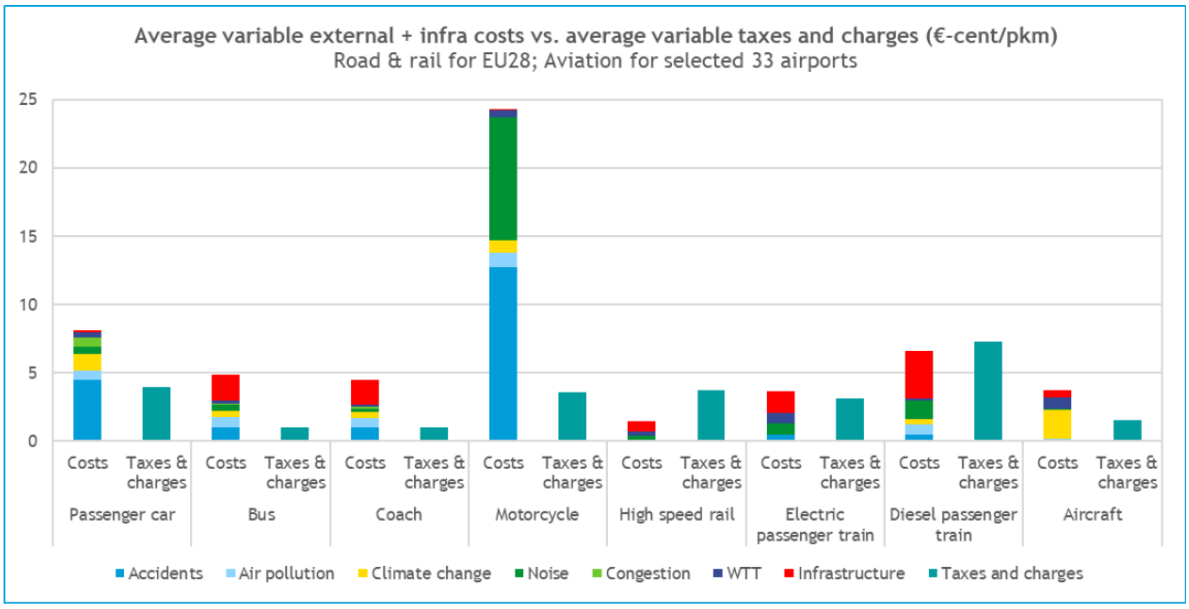
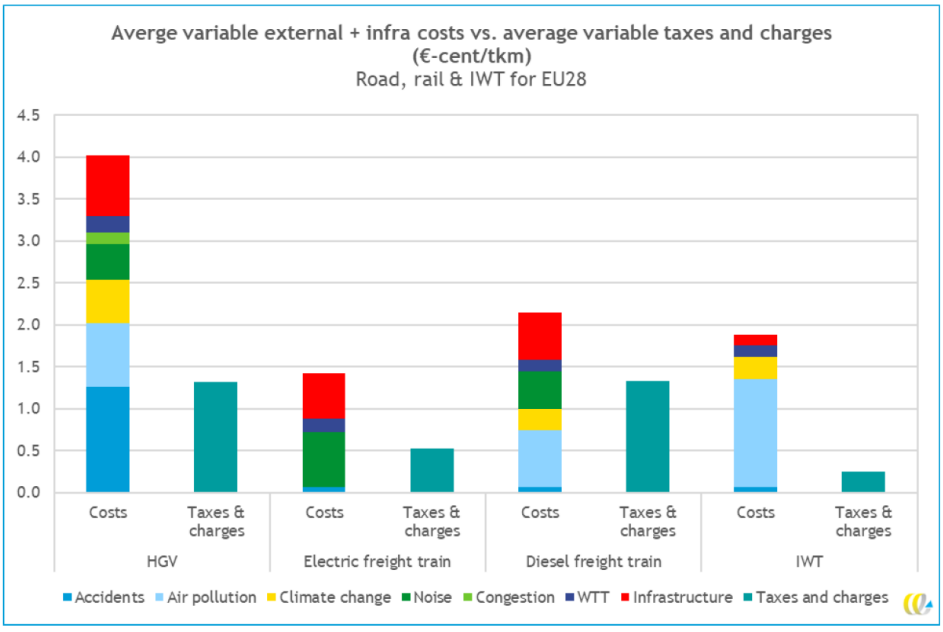


Figure 9 - Average variable external and infrastructure costs vs. average variable taxes/charges for freight transport



Taken together, these two charts deliver another important insight:

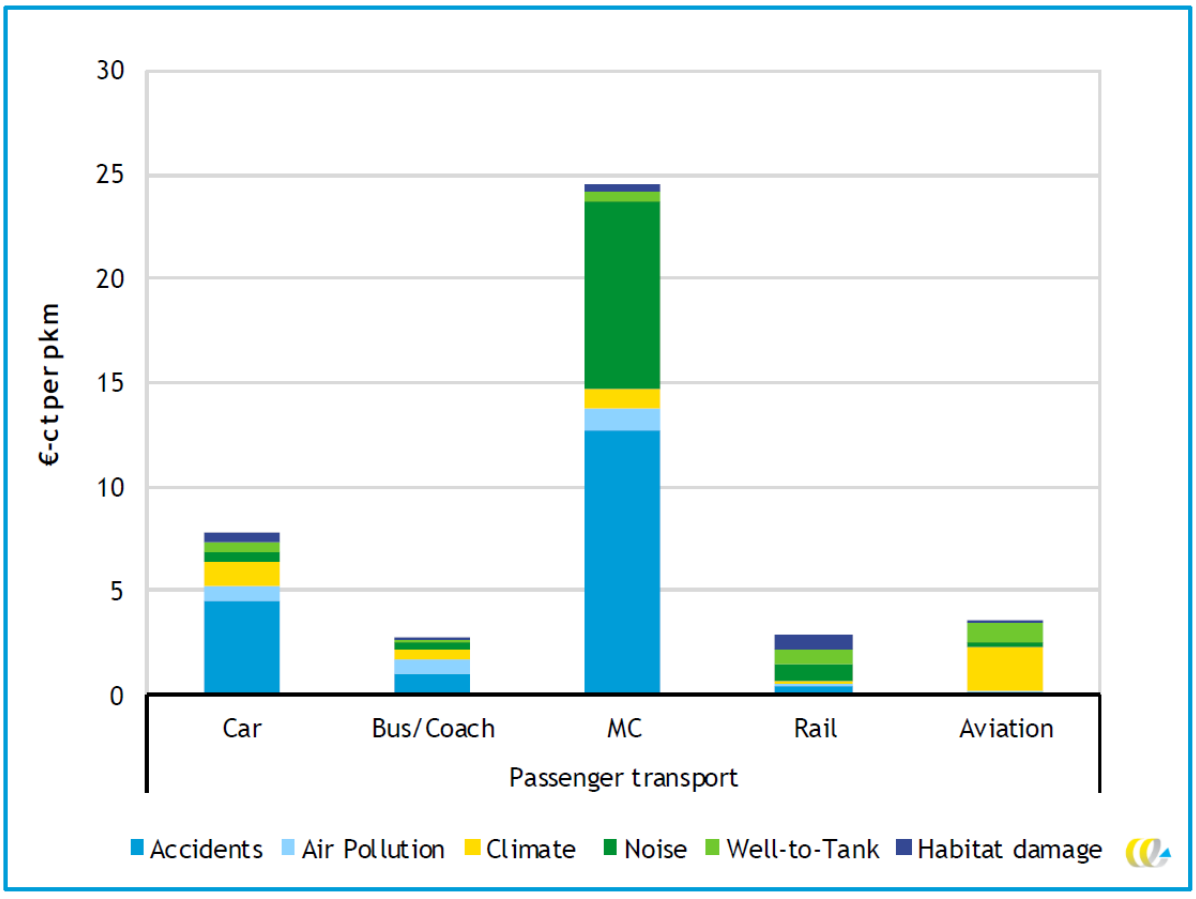
INSIGHT 2: Both for passengers and freight, cost-coverage gaps (i.e. variable costs minus taxes & charges) in € per pkm or tkm are smaller for rail than any other mode. High-speed rail even 'over-pays' to society.

In other words, rail complies better with the principles of 'user pays' and 'polluter pays' than the other modes, as it leaves a smaller gap of uncovered externalities to society.

3. Externalities: major insights from the study and some issues

Let us now look at externalities in isolation: accidents, air pollution, noise, climate plus well-to-tank emissions, habitat damage.[3] This perspective matters in transport policy, as it shows by which mode a given load would be carried so as to minimise externalities.

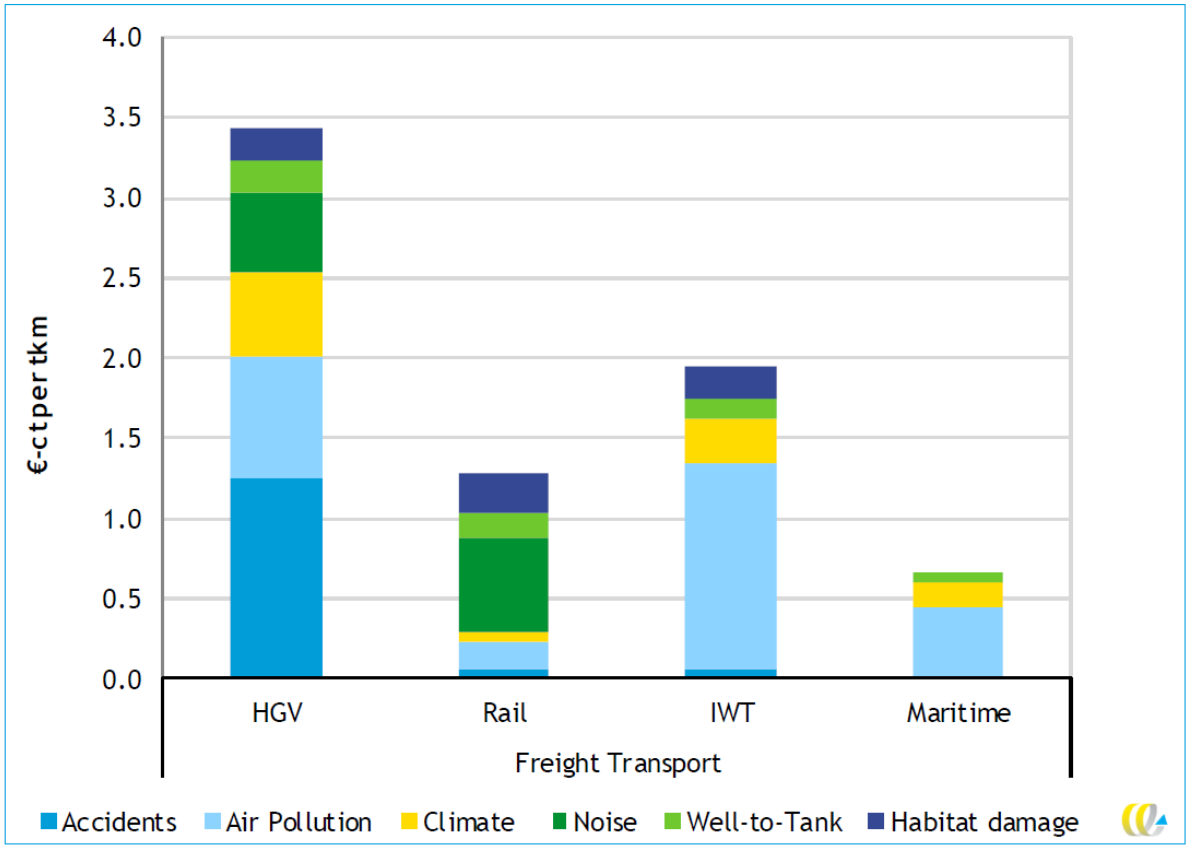
Figure 11 - Average external costs 2016 for EU28: passenger transport (excluding congestion)



Note: The figures for aviation are averages for selected EU28 airports.

[3] Charts in this section are taken as screenshots (incl. original captions) from the study's "Main findings" part, p. 52-53.

Figure 12 - Average external costs 2016 for EU28: freight transport (excluding congestion)



Note: The figures for maritime transport are averages for selected EU28 ports.

These charts suggest a third important insight from the study:

INSIGHT 3: Rail's externalities, both for passengers and freight, are among the lowest, with a particularly low climate impact.

So whenever the objective is to minimise environmental externalities, or specifically climate impacts, a given transport load generally should be carried by rail.

The following **comments** highlight a few particular points and issues.

*Comment on passengers chart: **well-to-tank emissions** relate to the climate*

In comparing the climate impact of aviation versus rail, with "climate" (yellow) one should also consider "well-to-tank" (light green), i.e. greenhouse gas emissions e.g. from fuel refineries in aviation's case. In rail's case, to a large extent it represents emissions related to power generation – which are steadily decreasing as renewables replace coal and gas.

*Comment on freight chart: also including **light commercial vehicles** would further improve the picture for rail compared to road freight*

By showing heavy goods vehicles (HGVs) only, but not light commercial vehicles (LCVs)[4], the freight chart hides major road freight externalities. As a previous study showed[5], externalities per tkm of light-duty vehicles (LDVs) used for freight (then called LCVs) exceed those of HGVs by a factor of around 4, giving a road freight average of nearly 50% above the HGV externalities already in 2008. Given LCVs rise in recent years (often encouraged by tolling exemptions for LCVs), total road freight's average externalities per tkm today will amount to at least 1.5 times the HGV externalities per tkm.

The freight chart also shows that noise accounts for around half of rail freight externalities. The new TSI Noise regulation will reduce rail noise in the near future by providing a legal framework for quieter rail freight wagons, as those without retrofitting will be banned from driving on quieter routes in Europe from December 2024 onwards. Even before 2024, rail noise will be drastically reduced in Austria, Germany, the Netherlands and Switzerland.

Conclusion: Rail freight externalities as a proportion of road freight externalities are likely to be much smaller than the HGV-rail comparison in the chart above suggests, and soon they will further decrease due to extra measures reducing rail noise.

*Comment on both charts: **road congestion** is 'excluded' – but in practice it could be relieved by a modal shift to rail*

Congestion is not included in the charts, despite that fact that, especially in road transport, the damage from congestion is huge: € 271 billion for 2016, or 27% of transport's total externalities.[6] This cost could be reduced by carrying less persons and goods on roads and more on rails – the long envisaged modal shift that is waiting to happen once policymakers implement the right framework conditions (see conclusions in section 5).

4. Externalities: more in-depth comments and another key insight

Building on the previous section, this one discusses a few particular issues in relation to transport externalities. Whilst more technical (so some readers might want to skip certain bits), it concludes with another key insight: *Rail's externality advantage over other modes turns out even bigger when externalities are considered more comprehensively.* Rough estimates for rail versus road are provided.

Regarding methodology choices, a key issue relates to the **monetisation of climate-change externalities**. The study could have used a higher cost value to better reflect the cost of CO_2 avoidance over time, until 2050 say, and not just until 2030.

While for most other externalities the study uses the 'damage cost approach', for climate change it relies on the 'avoidance cost approach'.[7] Specifically, the authors use a literature-based central estimate of € 100/tCO_2 equivalent, a value said to reflect climate change avoidance costs in the "short-and-medium-run (up to 2030)". At the same time, they

[4] The study's authors decided not to include LCVs here: "Light commercial vehicles (LCV) are used both for freight and passenger transport. Therefore, a comparison with other passenger or freight modes cannot be easily made. The derivation of average costs per tkm or pkm is not feasible as it is not known which part of the transport performance (vkm) is freight or passenger transport." See "Handbook on the external costs of transport", p. 134.
[5] See in particular its Figure 2 on p. 9, which likewise excludes congestion.
[6] See the study's "Main findings" part, p. 48-50.
[7] On this and the following, see "Handbook on the external costs of transport", p. 28-29, 66-67. In damage cost approach, "the willingness to pay (WTP) of individuals to (partly) avoid the damage or the willingness to accept (WTA) the damage, is used as an indicator of individual preferences". In the avoidance cost approach, the cost to achieve a particular policy target (e.g. EU CO_2 reduction targets) is determined by estimating an avoidance cost function, giving a cost estimate for avoiding one ton of CO_2. This study's authors explain their choice of the avoidance cost approach by the uncertainty and difficulty to measure the damage from greenhouse gas emissions, e.g. with regard to potentially catastrophic effects, such as the melting of the polar ice caps.

quote – but do not use – a central estimate of € 269 for the "long run (from 2040 to 2060)".

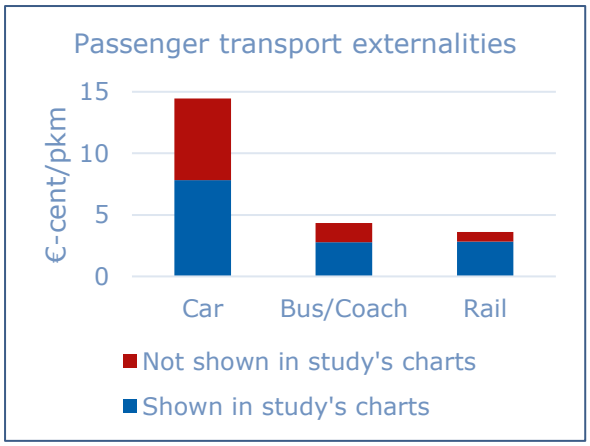
This is debatable – and a possible source of bias in the study's results. Naturally, with today's low-hanging fruit, avoiding an extra ton of CO_2 today is relatively cheap compared to say 2050, when advanced techniques will have to be used to avoid yet another ton. To reach the EU's envisaged 'net-zero' target in 2050, however, using such costly techniques will be necessary. By ignoring the high marginal cost of CO_2 avoidance in future, the study understates the average marginal cost of CO_2 avoidance over time.

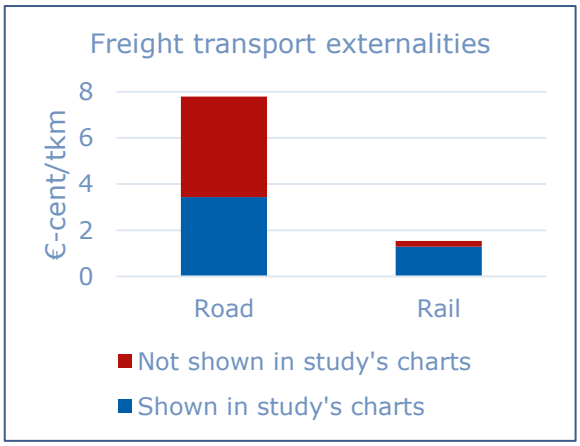
The estimated external-cost advantage of a low-CO_2 mode like rail compared to other modes would be bigger still if a CO_2 marginal avoidance cost value had been used that is more representative of the whole range of necessary CO_2 avoidance, e.g. the average of € 100 and € 269 per tCO_2 equivalent.

Climate externalities related to some **other important life-cycle emissions** are not considered in the study either. For example, vehicle production, maintenance plus upstream and end-of-life processes emit 63 g of CO_2 per pkm for cars and 13 g for coaches, but just 8 g for passenger trains. On the freight side, such emissions on average amount to 19 g CO_2 per tkm for trucks, but just 4 g for freight trains – still another reason to promote rail.[8]

So when, in contrast to the study, we do take into account road congestion, the particular impact of light commercial vehicles (LCVs) and the long-term costs of CO_2 avoidance and life-cycle CO_2 emissions, what would externalities amount to for rail and road, the major modes in land transport?

Externalities incl. road congestion, LCV impacts and more comprehensive climate costs[9]:





[8] Numbers compiled by Austria's environment agency (Umweltbundesamt) for 2017 and accessible here. While based on data for Austria, they are likely to portray well the relative indirect emissions of rail versus road in Europe, given that vehicles used are broadly similar across the continent.

[9] In line with the discussion above, the charts reflect climate change costs at an average of € 100 and € 269 per tCO2 equivalent, including also life-cycle (LC) CO_2 emissions, road congestion costs (as estimated in the study) and LCV externalities that are assumed to imply that, in order to yield a road freight total, a factor of 1.5 must be applied to HGV externalities per tkm.
That this factor of 1.5 is also applied to congestion means that overall we are obtaining a conservative estimate. Why? As stated in section 3, per-tkm externalities *other* than congestion were estimated for LCVs to amount to about 4 times those for HGVs, giving rise to the factor of 1.5 (which compounds the lower share of LCVs with their higher externalities per tkm). However, LCV congestion costs per tkm are not just 4 times those of HGVs, but around 9 times, according to the study's "Handbook on the external costs of transport", Table 41 on p. 96, showing the following average congestion costs in €-cent/tkm for LCVs vs HGVs: 11.63 vs 1.30 (delay costs approach) or 2.01 vs 0.21 (deadweight loss costs approach).

This illustrates that, for a proper comparison between modes, relevant externalities must be taken into consideration as far as possible. Future studies on transport cost internalisation should also look at the following two externalities in more detail.

One is **urban parking**, an externality the study does not consider due to a lack of data.[10] Parking is sometimes partly internalised through fees, but often free or available to residents at low rates. A study for the Netherlands estimates the value of parking at 17.5% of total infrastructure of road transport or € 1.9 billion in 2013.[11] So, in the Commission's new study for the EU, an inclusion of urban parking would have raised the estimated externalities of road transport significantly. And many countries grant considerable income tax reductions, i.e. **subsidies, for car commuters and company cars**.

Still another issue relates to **micro-plastics pollution**, e.g. particles from brake wear, tyre wear and road surface, an externality not considered in the study either.[12] According to a recent report for the UK, such particles "currently constitute 60% and 73% (by mass), respectively, of primary PM2.5 and PM10 emissions from road transport". NGO Friends of the Earth estimates that "68,000 tonnes of microplastics from tyre tread abrasion are generated in the UK every year with between 7,000 and 19,000 tonnes entering surface waters". In Germany, around a third of micro-plastics pollution is estimated by Fraunhofer Institut to come from tyre wear. NGO Bellona estimates that "on a global level 28% of primary microplastic releases to our oceans come from tyres". These numbers suggest that, like for urban parking, including micro-plastics pollution could raise the estimated externalities of road transport significantly. By contrast, rail's specific micro-plastics pollution from composite brake blocks abrasion is likely to be much lower.

So overall, while the present study does confirm rail's low externalities, the discussion above suggests this:

INSIGHT 4: The externality advantage of rail over other modes like road transport would have turned out even bigger if the study had taken into account long-term CO_2 avoidance cost, noise reductions in the near future and some other relevant externalities, like those from light commercial vehicles, congestion, urban parking as well as micro-plastics pollution and other life-cycle emissions.

5. Conclusions

The European Commission's study on transport cost internalisation shows that rail, both for passengers and freight, leads transport on cost coverage of variable infrastructure and external costs. Moreover, rail's low externalities in general and its very low climate impact in particular stand out. Had the study also considered a few other important externalities especially from road transport, it would have shown an even stronger lead by rail.

So the study results suggest a greater role for European railways. They amount to a call on governments to rebalance transport policy towards modes with low externalities such as railways. Better implementing the principles of 'user pays' and 'polluter pays' in transport would entail distance-based infrastructure charging on all major roads (just as EU law requires track charging for each and every train-km), but also external-cost charging for all modes and removing market distortions caused by environmentally or otherwise counterproductive subsidies (e.g. income tax reductions for car commuters or company cars) and regulations. The resulting modal shift to rail, by increasing rail's performance at given fixed costs, would also decrease rail's fixed costs per ton-km or passenger-km.

[10] See the study's part "Transport taxes and charges in Europe", p. 27.
[11] See this CE Delft study, which in footnote 29 on p. 58 quotes the relevant 2014 study by Delft and VU.
[12] See the study's part "Handbook on the external costs of transport", p. 183: "A certain amount of tyre wear can end up as emissions to soils or water, but these have not been taken into account in this Handbook."

There are more factors making rail even more cost-competitive, e.g. EU-wide harmonisation of rail equipment standards (in line with the EU's 4th Railway Package Technical Pillar, the implementation of which is now starting), digitalisation and automation. Railways are improving load factors in freight and occupancy rates in passenger rail, following achievements in the coach sector.

On CO_2, rail leads transport already. And also noise, rail's major externality, is increasingly mitigated thanks to retrofitted wagons. The EU's precautionary principle in relation to the environment (TFEU, art. 191.2) suggests EU policymakers should act now to prevent damage. Cleaning up transport with a shift to rail is an obvious solution, at the same time relieving congestion on Europe's roads, a major issue according to the study. That should be supported by robust investment, both via CEF (Connecting Europe Facility) and national resources, in new and enhanced rail infrastructure, including TEN-T freight corridors and cross-border high-speed rail passenger lines with high EU added-value.

Moreover, from an accounting perspective, the transparency of transport's external costs and any taxes or charges paid to cover them should be improved, to support proper cost internalisation and efficiency of the transport system. This calls for a coherent classification of transport-related taxes and a framework for the accounting of transport infrastructure expenditures.

Climate action is a top priority for citizens, as recent elections have shown, and European railways stand ready for a bigger role in transport. A shift to rail – as recommended to the new European leadership by think tanks Jacques Delors Institute and Bruegel[13] – would benefit the environment and citizens in Europe. Policymakers should therefore make it a priority to create the right framework conditions for rail to flourish, including proper internalisation of transport's external costs, and to help further develop the rail system itself, so that more persons and goods can move in a sustainable way. Rail, the most energy-efficient motorised mode of inland transport, could then fully play its role as the backbone of transport, in an increasingly digitalised and seamless multimodal system.

* * *

[13] See Jacques Delors Institute's policy paper on energy and climate (p. 5-6) and Bruegel's set of 'memos to the EU leadership 2019-2024' (section on "Transport emissions", p. 169+), both of early September 2019.

Annex

This annex explains why, when comparing cost coverage between modes, we should look at the *absolute gap in variable-cost coverage* (rather than at full-cost coverage or coverage expressed in ratios, i.e. as percentages).

1) Coverage of variable or 'marginal' cost matters most, not of full cost

Which cost (and its coverage) should one look at to measure how well a transport mode complies with the principles of 'user pays' and 'polluter pays'? Answer: variable or 'marginal' cost. That is what economists say.

And **that is what the European Parliament has said**, in its Resolution on low-emission mobility of 14 December 2017, item 18: "*Each transport mode should cover its marginal costs, both for infrastructure wear and tear ('user pays') and for external costs, e.g. for air pollution and noise pollution ('polluter pays') … Applying those two principles EU-wide will help address the current charging discrepancy between transport modes.*"

What does this mean, and why do economists advocate marginal-cost pricing? Marginal infrastructure cost in transport is, for instance, the cost of running an extra train or truck, in terms of wear and tear of rail tracks or roads. The transport system is called 'efficient' only if the social utility of running an extra train or truck equals related social costs. If marginal social utility is below marginal social cost, then the infrastructure is overused – and it would make sense to reduce usage so that only the most useful trains or trucks are run, down to the 'marginal' train or truck for which utility equals cost. In the opposite case, it would make sense to increase usage.

In a decentralised economy (as opposed to a centrally planned command economy), achieving efficiency requires to give train and truck companies (and ultimately the end users) the right incentives: For using the infrastructure, ask them to pay society a price that equals the cost to society. Companies will then pay for the right to run trains and trucks up to the point where marginal utility to each company equals its own marginal cost, i.e. the price it must pay to society as society's benefit (and which is set equal to society's marginal cost). In this way, marginal-cost pricing 'internalises' the social cost of running a train or a truck to the individual decision-maker – a condition for efficiency in a decentralised transport system.

By contrast, fixed costs (as well as full or total costs, which include fixed costs, but also average total costs) are irrelevant here. While fixed costs do matter for the decision whether or not to build a new piece of infrastructure (a decision that should normally take into account life-cycle costs and benefits), they are 'sunk' (i.e. non-recoverable) once it has been built. In that situation, marginal costs alone matter for efficient decision-making. This is true for infrastructure fixed costs, but also for environmental fixed costs such as habitat damage from building new infrastructure.

Why look at variable rather than marginal costs here? The marginal cost of running a train or truck depends on the precise circumstances, such as vehicle type and load. By contrast, variable costs (defined as total costs minus fixed costs) sum up the marginal costs over all vehicles types, loads etc. Assuming then that marginal cost – or the cost of running an extra train or truck – is constant (i.e. does not increase or decrease with the total number of trains or trucks run, which is often a good approximation), the variable cost per passenger-km (pkm) or respectively per ton-km (tkm) is a good *proxy* for the marginal cost. Variable costs are therefore extensively used in the study.

And in line with the above, the study's authors highlight Marginal Social Cost Pricing (MSCP) as first-best approach to internalisation and as the one "in line with the ambitions

of the Commission to realise full internalisation of external costs, including wear and tear costs".[14]

When analysing compliance with the principles of 'user pays' and 'polluter pays', it is therefore appropriate to look first and foremost at the coverage of marginal or variable costs.

2) Absolute gaps in cost coverage matter most, not ratios

In the study, the coverage of a particular cost type is compared between modes mainly in two different ways:

i) The ratio (i.e. a percentage) of costs covered (= sum taxes and charges paid by a mode to society, divided by the cost it causes to society).

Example: Of variable infrastructure and external costs, a truck (HGV) is said to cover 33% and an electric freight train 35%, suggesting both are very similar.[15]

This example is depicted in 'Figure 9' in section 2.

ii) The sum of taxes and charges minus cost, with a certain gap between them.

Same example (coverage of variable infrastructure and external costs): For an electric freight train, we have a (negative) cost-coverage gap of 0.52 minus 1.42, so just -0.90 €-cent/tkm. For a truck (HGV), we have 1.32 minus 4.02, that is -2.70 €-cent/tkm, exceeding rail's cost-coverage gap by far. So cost coverage is actually much better for an electric freight train than for a truck.[16]

In presenting results, the study clearly emphasise measure i).[17] However, from an economic or social perspective, measure ii) is more relevant. To see why, consider the example above – or a simplified example involving two hypothetical freight transport modes:

Mode A: costs to society amount to 10 €-cent per tkm, of which 6 are borne by the mode.

Mode B: costs to society amount to 2 €-cent per tkm, of which 1 is borne by the mode.

Mode A covers 60% of its cost, but leaves 4 €-cent per tkm uncovered. Mode B covers just 50%, but also leaves only 1 €-cent per tkm uncovered.

Mode B is clearly the better option for society to promote freight transport, as it requires less subsidy per output (just 1 €-cent per tkm, not 4). To minimise freight transport subsidies, society would promote mode B, not mode A. In the real world, society would promote freight transport by electric train, not by truck.

So from society's perspective, measure i), the cost-coverage ratio, is misleading. What matters most is measure ii), the absolute cost-coverage gap in €-cent per tkm. The same goes for the absolute cost-coverage gap in €-cent per pkm for passenger transport.

Annex conclusion: To compare cost coverage between different transport modes in an economically relevant way, look at the uncovered variable costs (as a proxy for marginal cost) per tkm or pkm – or, for short, at the *absolute gap in variable-cost coverage*.

* * *

[14] See the study's "Main findings" part, p. 15, 63-64, 83.
[15] See the study's "Main findings" part, table 5 on p. 16 and the extensive listing of such ratios in chapter 5.
[16] Numbers taken from the study's Excel annexes (file "Annex D Final_total_avg_Cross Modal Comparisons.xlsx", sheet "Variable_ext_infra_CC", area A43:I58).
[17] E.g. in its Executive Summary, where the cost-coverage overview (table 5) gives ratios only.

Commission study supports shift to clean transport modes like rail and proper internalisation of external costs

CER
The Voice of European Railways

The study

TITLE

"Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities"

MAIN QUESTION

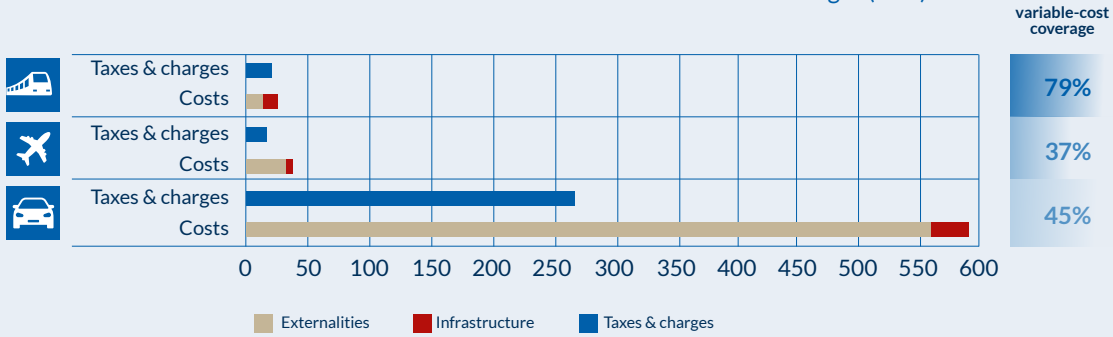
To what extent are the principles of 'user pays' (for infrastructure) and 'polluter pays' (for air pollution, CO_2, noise etc.) applied across the EU?

PUBLISHED BY THE EUROPEAN COMMISSION IN JUNE 2019[1]

Three key insights[2]

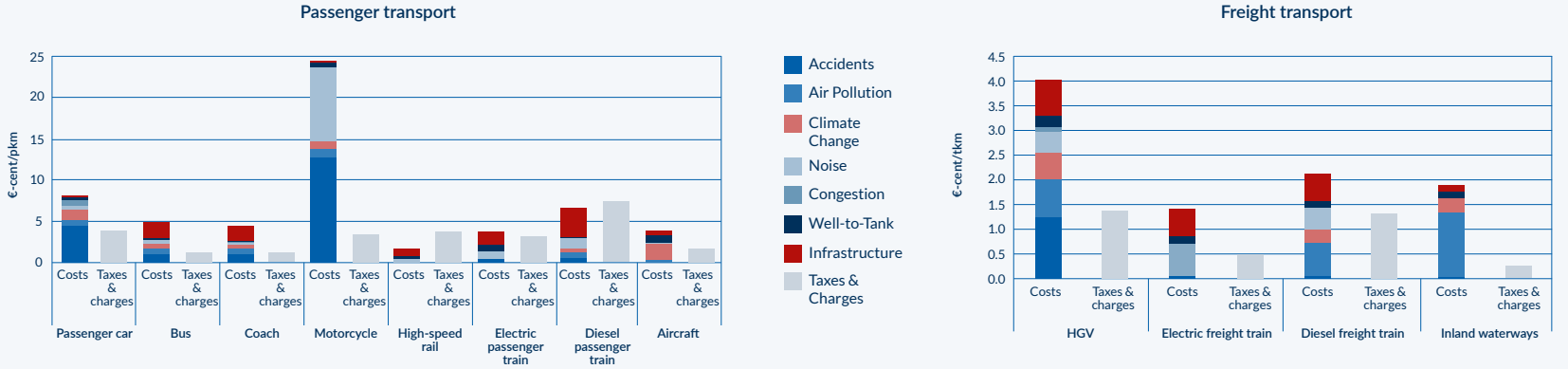
Insight 1: Rail leads transport in variable-cost coverage: 79%, against 45% for road and 37% for aviation

Total variable external and infrastructure costs vs. total variable taxes and charges (bn €)



Insight 2: Cost-coverage gaps (i.e. variable costs minus taxes and charges) in € per passenger-km or tonne-km are smaller for rail than any other mode. High-speed rail even 'over-pays' to society

Average variable external and infrastructure costs vs. average taxes and charges



Insight 3: Rail's externalities are among the lowest, both for passengers and freight[3]

Average external costs (excluding congestion)

[1] Accessible at https://ec.europa.eu/transport/themes/sustainable-transport/internalisation-transport-external-costs_en

[2] Charts reproduced from State of play of Internalisation in the European Transport Sector and Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities: Main Findings, European Commission, 2019

[3] Besides heavy goods vehicles (HGVs) and buses/coaches, light commercial vehicles (LCVs) are also important. However, consultants decided not to include LCVs here, as they are used both for freight and passenger transport, so LCV transport performance for each could not be derived reliably.

Commission study supports shift to clean transport modes like rail and proper internalisation of external costs

Understanding the different costs

- **External costs (externalities):** the cost to society of running trains or trucks, e.g. the cost of accidents, air pollution, climate change, noise, congestion, etc.
- **Infrastructure costs:** the cost of building or maintaining tracks or roads
- **Variable vs fixed costs:** costs can be variable, i.e. increase and decrease according to the amount of trains or trucks a company is running; or fixed, i.e. remain the same no matter how many trains or trucks are operated. Fixed costs are 'sunk' (i.e. non-recoverable and independent of future costs) and therefore irrelevant for socially optimal pricing.
- **Marginal costs:** the cost of running an extra train or truck

Why are variable costs most relevant when assessing cost coverage for 'user pays' and 'polluter pays'?

- Variable costs are a good proxy for marginal costs, i.e. the cost of running an extra train or truck.
- It is these 'marginal' or additional costs on society, which need to be paid by users and polluters so that they do not override the social benefit of running extra services.
- The European Parliament itself recognised this in item 18 of its Resolution on low-emission mobility of 14 December 2017.[4]
- Accordingly, Marginal Social Cost Pricing is highlighted in the study as 'first-best approach' to internalisation and as the one "in line with the ambitions of the Commission to realise full internalisation of external costs, including wear and tear costs".

Key takeaways

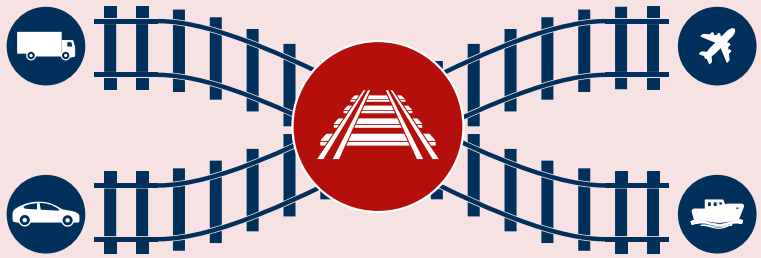
- Rail stands out with low externalities and better variable-cost coverage than any other motorised transport mode, both for passengers and freight.
- European railways comply with 'user pays' and 'polluter pays' better than any other motorised transport mode
- A shift to rail would benefit the environment and citizens in Europe
  - ⇢ lowering the overall environmental impact of transport
  - ⇢ relieving congestion on Europe's roads, a major issue according to the study

The study amounts to a call on governments to rebalance transport policy towards modes with low externalities such as railways.

Recommended policy measures

- External-cost charging for all transport modes (polluter pays)
- Distance-based infrastructure charging on all major roads (user pays)
- Robust investment, both via the Connecting Europe Facility and national resources, in new and enhanced rail infrastructure including
  - ⇢ TEN-T freight corridors
  - ⇢ cross-border high-speed rail passenger lines with high EU added-value

Rail, the most energy-efficient motorised mode of inland transport, could then fully play its role as the backbone of transport, in an increasingly digitalised and seamless multimodal system.



[4] Accessible at www.europarl.europa.eu/doceo/document/TA-8-2017-0503_EN.html