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ANALYSIS OF THE ROAD AND RAIL TRANSPORT CHARGING SYSTEM – EXPECTATION CONTRA REALITY

Introduction

The basic principle of the Czech Transport Policy, which is based on the European Transport Policy, is the social equity idea with the fulfilled Public Service Obligation. It means that transport should be charged to cover its costs applying the polluter pays principle and also to provide additional financial sources for the social development and public service provision without the previously determined mean of transport provider.

The desired status of the transport system is the moment, when all transport users pay consumer prices, which reflect all types of costs. It means infrastructure costs (optimal level of infrastructure maintenance and optimal development of investments), as well as the external costs (generated and not covered by transport users). External costs represent damage to the environment and society – noise, accidents, congestion, etc.

The research in the field of fair and sustainable transport charging, based on the internalization of external costs, is very active for last ten years. Since the early 90's, the polluter pays principle has been emphasized. This principle is considered to be the useful instrument for the restriction of the negative trends in

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the transport. In relation to the PPP, the transport user charging is derived from direct production costs as well as the wider costs in terms of damage to the environment or society (external costs). The polluter pays principle was formally adopted by the EU in 1992 and presented in the Rio Declaration. This declaration formed the basis of the Commission's Green Paper on „Fair and Efficient Pricing in Transport" from 1995 which was transformed into the White Paper on European Transport Policy for 2010. European Transport Ministers adopted in 1998 Resolution 1998/1 on „the Policy Approach to the Internalization of External costs in Transport". The first proposal for the „full internalization of social and environmental costs of transport" was heard during the Göteborg Council of 2001. Polluter pays principle has been gradually supported by the European Parliament. According to this political direction, two generally appreciated studies about external costs in transport (INFRAS) were elaborated in 2000 and 2004. The new revision of the Eurovignette Directive (Directive 1999/62 on the charging of heavy goods vehicles for the use of certain infrastructures) was started in 2004. In May 2004, the European Parliament approved the following text of the proposal for amendments to the Eurovignette Directive: „Not later than two years after entry into force of this Directive, the Commission shall devise a generally applicable, transparent and comprehensible model for assessment of all external environmental, congestion and health related costs to serve as the basis for future calculations of infrastructure charges". In 2006 the Eurovignette Directive was amended by Directive 2006/38/EC of the European Parliament and of the Council of 17 May 2006. At the same time, the Commission set the deadline for the finalization of the Final Report on impact of internalization of external costs on all types of transport including the definition of optimal implementation and has launched the realization of the IMPACT study. It is actually the most up-to date document covering the complex area of related research. Identical conclusions with those that can be found in the EU transport policy are stated also in the OECD report „Environmental Outlook to 2030". This document includes the findings that „transport prices rarely reflect their full social and environmental costs, resulting in over-use and sub-optimal choices of the type of transport to use. The essential source of information about this topic can be found in the international project GRACE (Generalisation of research on accounts and cost estimation), realized within the 6th FP a finalized in December 2007.

The aim of this article is the introduction of results, achieved in the authors' dissertation thesis, which is dealing with the disproportions between the user

charging and exploited service in the road and rail transport. The dissertation thesis was finalized in December 2008. The most important part of the dissertation thesis is the theoretical section, defining a general methodology for calculation of transport costs, generated by users of road and rail infrastructure and the comparison with transport charges paid by these users. The methodology for costs and charges calculation is applicable in the Czech Republic and is useful for the fair appreciation of the disproportions between user charges in single categories of road vehicles, charging of freight and passenger rail transport and charging of road and rail transport in the global evaluation.

Data about road and rail transport costs and charges are processed in the analysis model, which assesses the different level of costs and charges pursuant to real parameters of the road and rail transport. This assessment have brought the clear view about disproportions between user charges in single categories of road vehicles, charging of freight and passenger rail transport and charging of road and rail transport.

Methodology of the thesis

Solution of the problem is based on the calculation of all costs, generated by users of road and rail infrastructure (i.e. financial flows from the Central State Budget into the road and rail transport sector) and all charges which are paid by those users (i.e. incomes of the Central State Budget from road and rail transport users). The methodology of costs and charges calculation is based on the quantitative verification of costs and incomes of road transport published by Dr Ivo Drahotský. This quantitative analysis was actualized, modified and significantly extended with the calculation of costs and charges in the rail transport.

1. Procedure of analysis consists of 4 single parts:

1.1. Calculation of infrastructure costs

Infrastructure costs can't be simply quantified in the real annual amount of Central State Budget expenditures for the maintenance and development of the road and rail infrastructure. To avoid distorted results, it is necessary to present

infrastructure costs in the ideal amount which is essential for the desirable quality of the road and rail infrastructure according to the actual standards and regulations.

1.2. Setting of the enter data for the analysis model

Following parameters presents the enter data for the analysis model:

- number of road vehicles,
- total performance of the road and rail transport (passenger-km, tonne-km, gtkm)
- average annual distance moved and the average distance of one journey of the road vehicle,
- average number of passengers in the road vehicle (car, bus),
- average loading of freight road vehicles,
- total annual petrol consumption of motor units in the passenger and freight rail transport,
- average consumption of road vehicles in single categories,
- rate of the road and excise tax,
- average number of road vehicles charged by the road tax,
- average price of the fuel,
- external costs in the road and rail transport,
- specification of destructive effect of road vehicles,
- specification of destructive effect of freight and passenger trains.

1.3. Composition of the analysis model

The analysis model is designed upon defined enter data. Total costs of the road and rail infrastructure are distributed in individual variants into single categories of road vehicles:

- real expenditures from the Central State Budget into the road and rail infrastructure,
- total costs of the road and rail infrastructure (ideal amount of expenditures) without internalization of external costs,
- total costs of the road and rail infrastructure (ideal amount of expenditures) taking into account the external costs of road and rail transport,

- total costs of the road and rail infrastructure (ideal amount of expenditures) taking into account the external costs of road and rail transport and also calculated and un-calculated revenues and costs.

The same method is used for the distribution of the revenues from road and rail transport charges which were paid by relevant users and which flew into the public budgets.

1.4. Analysis of final results and potential disproportions

In terms of final results of the analysis model, costs generated by road and rail users are compared with revenues of the public budgets from transport charges that were paid by relevant users. The level of transport charges is compared with the utilization of the relevant infrastructure, and services and potential disproportions should be defined.

2. Results of the dissertation thesis

Final results in the analysis model are calculated in 4 basic variants:

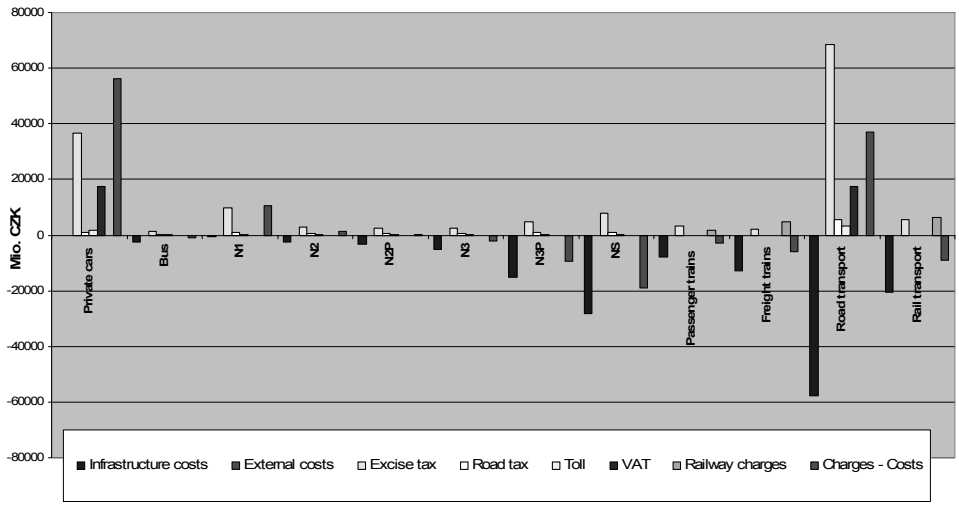
2.1. Actual expenditures into the road and rail infrastructure

In the first variant, actual expenditures from the Central State Budget in the specific year (2006) into the maintenance and development of the road and rail infrastructure are compared with relevant incomes, which flew into the Central State Budget from transport charges.

Total actual expenditures into the road infrastructure were lower than total incomes from charging of users of the road and rail infrastructure in 2006. The final positive difference at the total amount of CZK 37 billions is fundamentally influenced by the income from the excise tax and from VAT. Both of these taxes are determined as the fiscal income of the state and only a small portion is refunded back into the transport area. Other factor which has a negative affect on the equal charging is the unequal splitting of generated costs and paid charges between single categories of road vehicles. The essential disproportion was identified in the category of passenger cars and freight cars category N1, which destroy the road infrastructure minimally and which are paying on the other hand

the biggest part of transport charges. The positive balance was identified also in the categories N2 and N2P. The negative balance was found in the categories of buses and heavy goods vehicles (HGV). The alarming disproportion exists in the category of N3P and NS. Those two categories generate together ¾ of the overall road infrastructure destruction at the same time with the relatively low level of charging.

Totally different situation is in the rail transport. Passenger trains as well as freight trains generate more infrastructure costs than are paid back in the form of transport charges. Passenger trains pay back approximately ⅔ from generated infrastructure costs. Freight trains pay back only ½ from generated infrastructure costs. The most important part of the overall revenue from the rail transport is the infrastructure charges. These charges are returned directly back into the transport sector and they are determined for further investments. If we compare the disproportions between passenger and freight rail transport, we have to positively assess the similar proportion between generated costs and related charging level. On the other hand, it is necessary to stress the certain inequity in the higher infrastructure charges for freight trains in comparison with passenger rail transport.



Picture 1. Comparison of actual expenditures into the road and rail infrastructure with incomes from taxes and charges

Identification of disproportions between road and rail transport in this variant is irrelevant. In the simplified view it should be possible to highlight the better effectiveness of the road transport which generates less infrastructure costs in comparison with higher revenues from transport charges. There are various reasons why this statement is distorted. Firstly, only infrastructure costs are calculated. Therefore we do not have complex idea about total social and environmental transport costs. Secondly, essential part of revenues from the road transport comes from the excise tax and from VAT. These taxes are determined as the fiscal income of the state and they are not primary dedicated for the maintenance and development of road infrastructure. Following picture presents the mutual comparison of costs and related charges:

2.2. Total real costs of the road and rail infrastructure

In the second variant, the comparison between transport costs and related charges is based on the real infrastructure costs, which are derived according to the optimal maintenance of the road and rail infrastructure and the desired development of the network. Total costs for the modernization of existing road and rail infrastructure and for the optimal infrastructure development are summarized in following tables:

Table 1

Total internal debt of the road and rail infrastructure

	Billion CZK
Total internal debt of the road infrastructure	800,0
Total internal debt of the rail infrastructure	195,0

Source: MDČR, SŽDC

Table 2

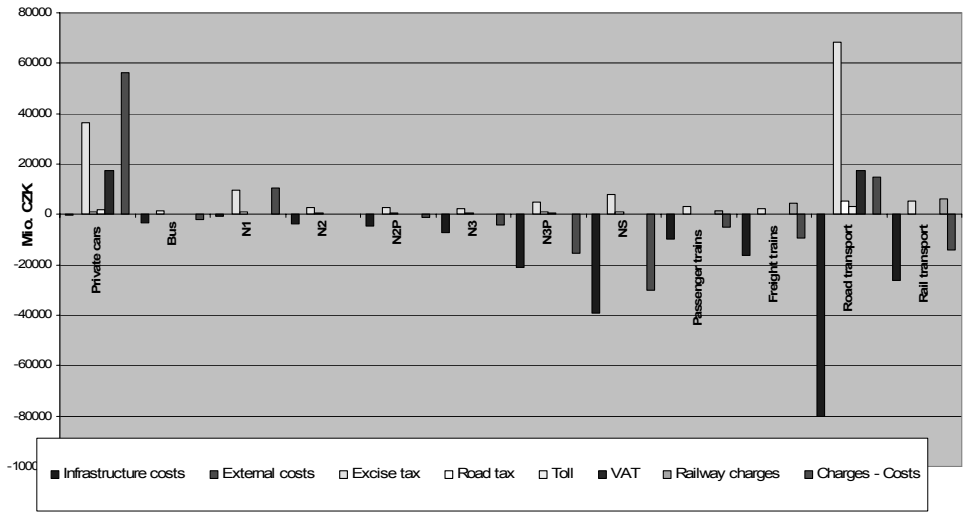
Total investment costs for the development of the road and rail infrastructure

	Billion CZK
Total development of the road infrastructure	400,0
Total development of the rail infrastructure	195,0

Source: MDČR, SŽDC

Total costs, as stated above, were split into 15 years, which are necessary for the revitalization of road and rail infrastructure. Real annual costs for the development of road (27 billions CZK) and rail (13 billions CZK) infrastructure together with real maintenance costs of road (53 billions CZK) and rail (13 billions CZK) infrastructure are compared with relevant charges which were paid by users of road and rail infrastructure in 2006. Based on this calculation, it is possible to set the necessary investment in the road and rail infrastructure at the amount around CZK 100 billions. This amount is in conformable with the expertise of the Ministry of Transport and with other transport analysis, carried out by relevant experts in the Czech Republic.

The side of revenues (transport charges) stays the same as in the first variant. It was possible to identify the significant increase of infrastructure costs in the second variant. Infrastructure costs have increased by 22 billions in the road transport and by 5 billions in the rail transport. Despite the fact that the overall balance of the road transport is still positive, the higher disproportions between single categories of vehicles were identified and the problem of fiscal purpose of the excise tax and of VAT was stressed. Following picture presents the mutual comparison of costs and related charges in the second variant:



Picture 2. Comparison of real expenditures into the road and rail infrastructure in the optimal amount with incomes from taxes and charges

2.3. Total social and environmental costs of the road and rail transport

In the third variant, the comparison is based on total social and environmental costs of the road and rail transport and related charges paid by users of the road and rail infrastructure in 2006. The revenue side of the calculation is the same as that in the first and second variant. The fundamental difference presents the extension of the side of transport costs with externalities. Final results are totally different in comparison with former variants after the internalization of external costs. Cardinal change was identified in the final ration between generated costs and related charges in single categories of road vehicles and also between road and rail transport.

Marginal costs are based on the IMPACT study. Related values were adapted into the area of the Czech Republic. Marginal costs are defined in the CZK per passenger kilometer in the passenger transport and in the CZK per tonne kilometer in the freight transport. Following tables summarize the values, which were used for the calculation:

Table 3

External costs in the passenger transport

External costs	Road transport		Rail transport
	Private car	Bus	Passenger transport
	CZK/pkm	CZK/pkm	CZK/pkm
Accidents	0,375	0,048	0,013
Air pollution	0,210	0,315	0,125
Noise	0,125	0,437	0,063
Climate change	0,063	0,158	0,014
Secondary transport impact	0,129	0,090	0,035
Land use	0,030	0,030	0,020
Total	**0,932**	**1,078**	**0,270**

Source: authors.

Significant difference in comparison with former two variants did not arise in the rail transport. It is caused by low marginal external costs of the passenger and freight rail transport. A clear advantage lying in the lower negative influence on environment and external subjects of the rail transport against road transport came out after taking external costs into account. The final negative balance of the rail passenger transport increased to the final amount of minus CZK 7 billions. Inclusion of external costs sharpened the negative balance of the rail freight transport to the final amount of minus CZK 13 billions.

Table 4

External costs in freight transport

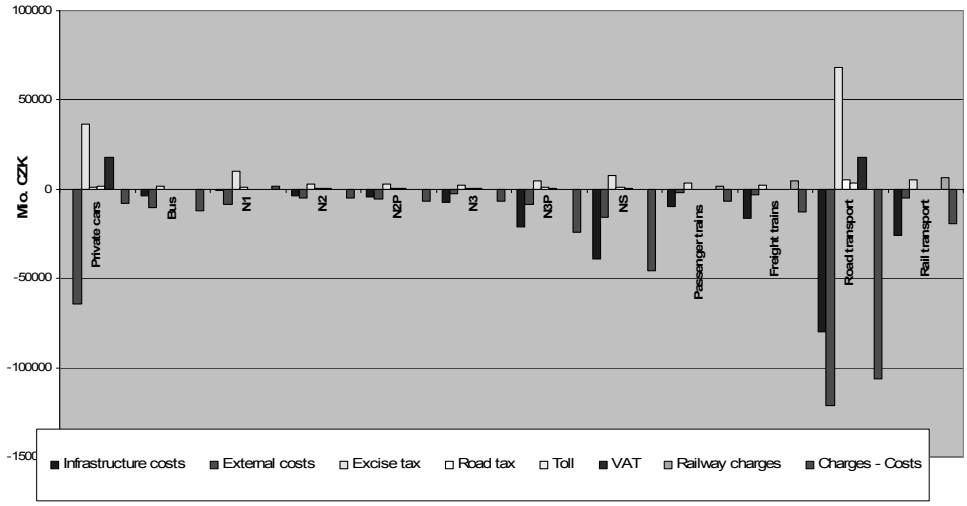
External costs	Road transport		Rail transport
	N1,N2,N2P	N3,N3P,NS	Freight transport
	CZK/tkm	CZK/tkm	CZK/tkm
Accidents	0,390	0,125	0,005
Air pollution	0,452	0,250	0,113
Noise	0,196	0,098	0,043
Climate change	0,052	0,052	0,015
Secondary transport impact	0,370	0,185	0,029
Land use	0,020	0,020	0,002
Total	**1,480**	**0,730**	**0,207**

Source: authors.

Dramatic change raised in the road transport. Total external costs in the road transport were at the total amount of CZK 121 billions in 2006. The former positive balance from the first and second variant changed into the negative balance between charges and costs at the total amount of minus CZK 106 billions after the extension of external costs. Each category of road vehicles showed negative balance between charges and costs except the N1 category. Dramatic difference in comparison with the first two variants happened in the category of private cars, where the former positive balance changed into the negative one at the total amount of minus CZK 8 billions. Significant downgrade happened also in the category N1 and with buses. Relatively small increase of total costs was identified in the categories of HGV. The analysis of final results after the significant increase of costs caused by the internalization of external costs can be done without the assessment of the total performance of the single categories of road vehicles, passenger and freight trains. Extremely high amount of external costs of private cars is caused by the total performance in 2006. In spite of this fact, we can assess the final increase of costs in the road and rail transport through the help of marginal external costs. Rail passenger transport has minimally three times lower costs per 1 passenger-km than the individual road transport. Bigger difference was identified between passenger rail transport and busses, where the marginal external costs per one passenger-km are four times lower in rail transport than in the road transport. The big difference is also important in the freight transport. Freight rail transport has totally three times lower marginal external costs per one tonne-km than HGV (categories N3, N3P and NS) and even seven times lower marginal external costs per one tonne-km than LGV (categories N1, N2 and N2P). This is the reason why the situation in the

road and rail transport becomes different and more social effective mean of transport is the rail mode after the internalization of external costs.

Following picture presents the final comparison between costs and charges in the third variant:



Picture 3. Comparison of infrastructure and social costs with incomes from taxes and charges

2.4. Total social and environmental costs including calculated and un-calculated revenues and costs

As stated in Table 5, total costs include also subsidies to public transport and other un-calculated costs (tax relieves, state programme for the renewal of transport vehicles and rolling stock etc.) in the last variant:

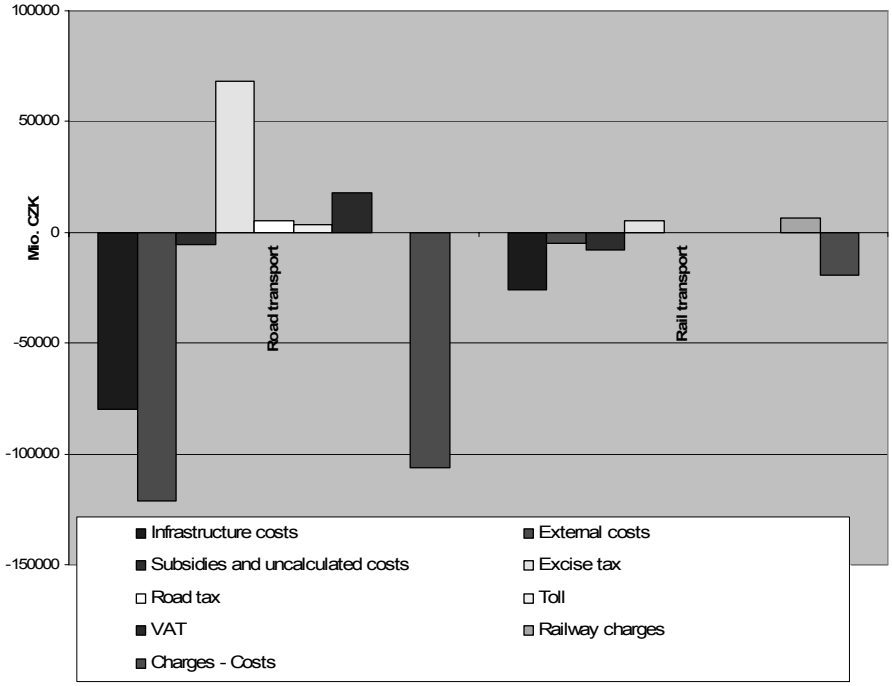
Table 5

Subsidies and other un-calculated costs in 2006

Expenditure from the Central State budget	Road transport (Mio. CZK)	Rail transport (Mio. CZK)
PSO	4 099	7 334
Tax-relieves	1 388	0
State subsidies – vehicle purchase	290	388
Other expenditures 327 SR ČR	0	491
Total	**5 777**	**8 213**

Source: authors.

Covering of those costs categories did not affected results significantly in comparison with the third variant. It is necessary to stress that the last variant is more or less irrelevant for the analysis of disproportions between the user charging and exploited service in the road and rail transport. Following picture presents the overall view on the variant No. 4:



Picture 4. Social costs, subsidies and other un-calculated costs

3. Other actions

Proposals for necessary changes in the actual pricing system and general principles which should be kept when the new pricing reform of the road and rail transport is carried out were defined by the author of the dissertation thesis. These proposals are based on results of the analysis model:

1. retaining the actual level of the excise tax,
2. increasing the level of toll assigned to concrete roads and motorways,
3. extending the road charges into the entire road infrastructure,
4. performance motivating structure of the rail infrastructure charges,

5. reallocation of additional revenues from the pricing reform into the maintenance and development of the transport infrastructure,
6. implementation of road pricing systems in large urban areas.

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ANALIZA SYSTEMU POBIERANIA OPŁAT W TRANSPORCIE DROGOWYM I KOLEJOWYM – OCZEKIWANIA KONTRA RZECZYWISTOŚĆ

Streszczenie

W artykule zajęto się systemem pobierania opłat w transporcie drogowym i kolejowym oraz wzajemnymi dysproporcjami między użytkownikiem pobierającym opłatę a wykorzystanymi usługami, co ma bezpośredni związek z całymi kosztami wytworzonymi przez użytkowników infrastruktury drogowej i kolejowej. W niniejszym opracowaniu przedstawiono wyniki tezy dysertacji, która została opracowana w szczegółach i obroniona w lutym 2009 roku. Końcowe wyniki czterech różnych wariantów modelu analizy zostały głęboko zanalizowane, poza tym zdefiniowano własne rekomendacje dla przyszłej reformy cenowej w transporcie drogowym i kolejowym.