The Distinction of Market Segments on the European 1520 mm Rail with Primarily Freight Transportation

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ABSTRACT

Article 32 (1) of Directive 2012/34/EU provides that in order to obtain full recovery of the costs incurred by the infrastructure manager (IM) a Member State may, if the market can bear this (MCB), levy mark-ups on the basis of efficient, transparent and non-discriminatory principles, while guaranteeing optimal competitiveness of rail market segments. The charging system shall respect the productivity increases achieved by railway undertakings (RUs).

The main implementation problem is a question how to evaluate the MCB level, the productivity increases achieved by RUs and optimal competitiveness in an efficient, transparent and non-discriminatory way if: 1) the meanings of the included concepts are unclear for natural monopoly; 2) there are mutual contradictions among these concepts, for instance, obligation to allocate trains „which can pay at least the cost that is directly incurred as a result of operating the railway service…" and a commercial advantage to give priority to the most productive RU when capacity is limited; and 3) it is impossible to make unified methodology for mark-up evaluation due to the differences among EU rail markets.

As a result of the study it was concluded that the distinction of market segments in networks with primarily freight transportation appears as a result of the requested deviations from the optimal usage of the rail network.
Keywords: competitiveness of rail transit corridors, rail charges, train service segmentation, mark-up, rail market

1. INTRODUCTION

From general microeconomic theory point of view, the average cost of one-unit transportation is at its minimum and is equal to the cost that is directly incurred as a result of operating the railway service if the rail infrastructure has the same technological conditions within the whole network and it is equally and fully loaded with uniform trains. But in fact, there are deviations from the mentioned optimal situation, attributed to the technological (the initial unevenness of the network) and operating (RUs' advantage to change technological processes according to their needs) processes.

Therefore, the following hypothesis was stated and examined in this study: the distinction of market segments appears as a result of the requested deviations from the optimal usage of the rail network.

The research was made in three stages. First a preliminary analysis of more than 100 Latvian and international (mainly European (due to legislative area) and Russian (due to main origin of cargo)) scientific and practical sources were examined. Then, after concluding that none of the existing charging systems could be directly transposed to the Baltic States case due to non-analogous circumstances of the Baltic States' railways (significantly different using of network in Europe, and significantly different charging system in Russia), the main insights were generalized in propositions in order to make expert focus interviews.

As the next step, the propositions were given to 13 experts in different railway undertakings area: passenger transportation, freight transportation, infrastructure management, rail market regulation and administration. The questions insignificantly had been adapted for freight and passenger undertakings type. Two experts (RUs' and governmental) from each field had been selected upon assessing their independency, relevancy to the research subject and professional competence on the study subject. Propositions, which were divided into 3 sections (concepts used, market segmentation and mark-up assessment), were offered for assessment. The experts were asked to evaluate these propositions in 6-point system, and provide short (less than 20 words) explanation of their position. Whereas all the examined experts were without knowledge about the legal framework of charging, the questioning was made orally and unclear concepts were explained on request. The field worker took verbatim report of the interviews. Later the verbatim reports were sent to the experts and they made corrections. The results of in-depth examinations were summarized using content analysis.

Last, the results of the examination were discussed on the annual charging body meeting in order to understand the relevance of the study to other networks.
This paper reflects findings of the first and the second section of the study – the disclosure of concepts and market segmentation.

2. MARK-UP CONCEPTS

"optimal competitiveness"
Rail competitiveness is not only the task of market liberalization. It also depends on the ability to meet consumer needs for the different transport modes and in the different transport corridors [34]. Rail benefits have non commercial nature and therefore meet unwillingness to pay from the final consumers. The commercial competition will remain only when these externalities are compensated in direct way or by tax or regulatory policy.

Nine out of thirteen experts have made a positive evaluation of this concept. There are social benefits most commonly mentioned by experts, that should be compensated by the state in order to assess competitiveness level on a commercial basis: national security requirements; administrative barriers; environmental impact; multiplicative economic effects. Experts that have made negative evaluation of the concept mentioned that there is no possible fair competition on rail market because of high politization of decision making.

"optimal network usage"
The optimum competitiveness concept is fundamentally different and even contrary to another directive underlying concept - the optimal utilization of the network capacity. From the IMs' point of view, the optimum network usage is achieved when it is equally and fully loaded with the same type of trains. From the RUs' point of view, the optimum competitiveness is achieved when different consumer needs (to run at a specific time; within particular route; considering different technical and technological conditions) are fully satisfied both by network and by carrier services. Thus railway network performance optimization is related to the balance between the loading of network and its utility for transport processes and not related only to maximum possible loading.

Nine out of thirteen experts agreed with generalized proposition that railway network is optimally used if the average cost per transport unit provided is at the lowest possible level. Experts that did not agree with the proposition mentioned that rail policy should be focused on equally and fully loading of network, that allows predictable maintenance and operation and does not allow deviations from the optimal process.

"market can bear"
From previous propositions and theoretical point of view [20] [39] it was concluded that the MCB is a level of infrastructure charges that RUs wish and are able to pay for a certain amount of infrastructure capacity in a certain quality (value-based mark-up). Prior to determining the level of infrastructure charges it is necessary to acknowledge value features [19] where RUs are willing to pay on a commercial platform, and where the state is willing to pay on a social platform.

Rail market imperfections reduce MCB charging policy benefits [2]. The following factors that limited MCB conception were extracted [14]:

- asymmetric information;
- slow response to necessity to adapt costs due to state budgeting rules;
- lobbying processes;
- RUs are not interested in competition, large capital intensity scale approach promotes monopolization trends and collusion.

Only 7 out of 13 experts agreed with the proposition of value-based mark-ups. Experts mentioned that MCB should be driven by infrastructure access conditions of competing transport modes and transport corridors and that the charge level should be strictly regulated on the lowest possible price in order to allow making business in competitive parts of logistic chain. During discussion with IM, they also recognized that the value-based MCB concept is too theoretical and ambitious.

Another concept used for MCB assessment is cost-based conception. The need to set a mark-up is justified by transport investments recovery theory [26], [4]. Using marginal cost theory in scale economies (high fixed costs) will meet a financial deficit. Thus it can be concluded that it is necessary to realize a premium charging policies or to reckon with the need for subsidies [33].

Cost-based MCB conceptions are based only on input costs and desired profit, so if such costs do not meet solvent demand, then the product may be subsequently discounted and sold with no mark-up or even with losses. This concept is much more understandable for users -most experts agreed with this conception and noted that all constructions and distinctions of network should be negotiated on prior.

3. DISTINCTION OF MARKET SEGMENTS

Before approving mark-ups, Member States shall ensure that IMs evaluate market segments, considering at least the pairs listed in point 1 of Annex VI of the Directive and retaining the relevant ones and may further distinguish market segments according to commodity or passengers transported. Market segments in which RUs are not currently operating but may provide services during the period of validity of the charging system shall also be defined.

Mandatory segmentation
The list of market segments defined by IM must contain at least the three following segments: freight services, passenger services within the public service obligations (PSO) and other passenger services.
Most researchers agreed that the freight services must be analyzed separately from passenger services. Sure, all railways combine these services, but the conditions and cost structure of the railways, which deal mainly with freight (USA) and those railways which deal mainly with passenger traffic (EU) are completely different [31]. Therefore, at the moment in most countries direct costs are calculated separately for freight and passenger transport by using activity-based costs systems. The results of these calculations completely differ in networks with primarily freight transportation and primarily passenger transportation.

In EU main part of the revenue consists of the revenue from passenger tickets (about a half) and the government subsidies (more than one-third), while the revenues from freight transport is about one-fifth of total. All EU countries except Belgium and Sweden have shown an increasing trend of passenger ticket prices. Two-thirds of rail transportation in the EU in 2013 was carried out on a PSO basis. The results of the study clearly indicate that the increase of ticket prices is highly related to PSO basis [11].

In Latvia, where primarily is freight transportation, the major revenue is received from the freight, one third comes from PSO funding and the lowest part is covered by passenger charges. The revenue of one passenger km is one of the lowest in EU and does not have an increasing trend, oppositely to freight transportation where freight rates are rising.

It could be concluded that activity-based costs systems are not fair for multiproduct networks and that direct costs could be assessed commonly for passenger and freight services and then differentiated by using MCB cost-based theory. 9 out of 13 experts agreed with the proposition.

Domestic versus international services
There is a perception [33], [13] that the greater part of the traffic has foreign origin, the smaller part of the financing should have national public funding source.

It can be concluded that the domestic and international traffic segmentation may be justified if the state funded domestic non PSO in order to support other industry sectors.

Most of experts agreed with this proposition.

Urban or regional versus interurban passenger services
The difference between urban and interurban transportation, largely differ depending on the country's urbanization degree, intensity of occupancy and distances between the larger cities. If there is possible scale transportation the competition among transport modes can appear. For example, in most countries there is a competition between low-cost air carrier (LCC) with high-speed railways (HSR) [17]. Another distinction between

this segments can appear if there are different kinds of funding rules.

It was concluded that urban and interurban transport segmentation may be justified in case of different state funding or if different kinds of competing transport modes or transport corridors exist.

Only half of experts agreed with this preposition. Most objections were related to the idea that if there are no technical distinction of infrastructure service, then segmentation is unnecessary.

Combined transport versus direct trains
Combined (intermodal) transport is defined as a transportation with a sequence of at least two different modes of transport [37].

Railways are lagging behind from an intermodal concept and therefore lose market segments where there is no scale economy [25]. Northern America example shows 254% growth in intermodal traffic (t miles) in the period 1993 to 2007 and it is the largest revenue segment in the railway sector at the moment [12]. The changes in charging concept have to appear due to the competitive pressures of the global supply chains [41], specifics of intercontinental transportation [40], as well as industrial globalization [36].

Rail transport is mostly combined with maritime transport and container logistics [42], [1], as well as with auto transport [29], [5], [16]. The latter is also preferable from social costs point of view [7], [18].

There are three stages of transport mode combination [28], [10], [44]:

- functional integration, that appears as a total cost reduction;
- internal integration, that appears as internalization of common functions, and
- external integration, that appears as a transparency of the system to achieve a high customer value and satisfaction.

The major trend is development of through rates on the "door to door" principle [27].

It was concluded that segmentation of combined transport may be justified if there is (or is planned to be) an integrated transport network with a common charging policy as well as on cost-related grounds.

Most of experts agreed with this proposition with a remark that this is most related to freight transportation, less to passenger, where other transport modes can be adjusted to rail, not contrary.

Block trains versus single wagon load (SWL) trains
Two theoretical rail transportation flows are distinguished [24]: “point to point” and “hub and spoke”. Both have advantages and disadvantages. While "point-to-point" trains provide direct access to destinations and thus require less inventory, as well as fixed and variable resources, it is limited to serve a specific type of cargo. Oppositely “hub and spoke” services meet customer requirements, but require more inventory, and specific process management in nodes [6], [25], [21], [22], [23].

In 2005 a SWL provided 40% of European rail freight market. Five years later, in 2010, the Eurostat has demonstrated 10% fall of SWL services. This is due significant needs in fixed and dynamic resources for SWL that are operated at the level of 10-15% of operational capacity. SWL tends to be replaced with containerization and intermodal transportation trend.

It was concluded that the SWL transport segmentation can be justified with costs related reasons. Most of the experts agreed with this proposition with a note to attribute such a segmentation only for transportation where nodes are used for begin and end operations.

Regular versus occasional train services
Railways compared to other network industries have a very strong interaction between the capacity planning and infrastructure operations. The greater is oscillation amplitude, the greater capacity reserves and consequently greater maintenance resources are needed [30].

The problem of unpredictable traffic flow was stated in the Baltic states in the previous studies [14]. Occasionality of traffic reduces network utilization efficiency. Even more, SCI Verkehr predicted [38], that the transportation volume reduction is expected in the Baltic Sea region in 2019.

It can result in network underloading. Therefore, it can be concluded that occasional services segmentation can be justified on optimal network usage grounds. There are no common opinion on the issue from the experts. Half of them did not agree with this kind of segmentation arguing that occasionality is out of RUs’ control.

Trains carrying dangerous goods versus other freight trains
Given that the transport of dangerous goods have potential social costs it was concluded that distinction of dangerous goods segment can be justified if the social risk is not balanced by tax or regulatory policy.

There is no common position on the issue as well. Some of experts noted that responsibility on possible accidents is fully on RU. Some of experts see potential risks on IM (network disturbance) too.

Segments that are not exist at the moment

Piggyback trains: The most essential for ensuring RoRo transportation is regular shipping services provided in accordance with the schedule and sea or dry port connectivity to the other shipping network including land- and sea- based connections [8] where connectivity indicators are as follows: number of RoRo directions; service intensity; a number of providers; a number of stops on the way.

Baltic sea ports’ connectivity ratings lag behind the other ports ratings and distinctive charging of this transportation mode may increase the attractiveness of this segment.

Most experts agreed with RoRo segmentation, but some of them see possible justification as a state interest to shift freights from road to rail.

Reverse logistics: Factors affecting reverse logistic success are: environmental problems in the region, the customer service, overall quality, legislative conditions [9], [3]. Reverse logistics is a relatively new transportation service that could be realized in cooperation with the global logistics chain and can contribute to the railway network optimal load.

The experts were mostly negative to this proposal, in a view of possible additional costs that cannot meet demand. The experts saw more possibilities in military freight and oversized cargo segmentation.

More detailed segmentation

In order to increase revenues, IM may consider to replace less profitable cargo, such as cereals and coal with more profitable goods, such as chemicals. Charges of focusing only on goods with higher added value are prohibited, because entry barriers "cheaper goods" [43] lead to network load reduction and increasing of socials costs [32]. It is therefore necessary to evaluate the criteria that affect different types of goods with a view to timely detect factors that reduce rail attractiveness and make a decision on charging differentiation.

Grains: When comparing two possible grain transportation ways: accumulation on centralized elevators and full train formation, and the route transport to the terminal elevators, there are three critical transport dimensions can be distinguished: travel time, cost and capacity. It was concluded [15] that the grain transportation with the route transport to the terminals is faster and reduces logistics supply chain costs as compared with traditional services. This also matches results made on SWL segmentation. Therefore, it may be useful to distinguish grain segment where by charging rules the movement of trains with incomplete number of wagons is encouraged. Experts mostly agreed with the conception with a note that grain cargo segmentation is a subject for direct public funding due to social importance of agriculture.

Factors that impact MCB of different types of other cargo were specified in the previous study [13]: coal - world production, world demand, world prices etc., construction materials - existence of big projects; availability of specific rolling stock etc.; chemical products and fertilizers - demand of agricultural production; state subsidies in key importing states; wood - world prices for the final wood products; availability of specific rolling stock etc.; metals - construction programs, world metal prices etc.; oil and oil products -world price level, consumption level, mode choice; all these factors are considered both by the authors and the experts as unpredictable from IM point of view. Factors that affect container cargo [35] (flexibility, reduced time to launch on the market etc.) met MCB requirements of combined transportation.

4. AN ALGORITHM OF MARKET SEGMENTATION RELEVANCE TEST AND EVALUATION OF MARK-UPS FOR SPECIFIC MARKET SEGMENTS

Based on the theoretical part of research the algorithm of market segmentation relevance test was created (see Table 1) and presented at the annual charging body (represents 17 EU countries) meeting in order to understand the relevance of the study to other networks.

IMs were asked to write comments and examples possible in their countries below the Latvian examples. As a result of this step of the research, it was possible to generalize that the study fits networks where commercial use of rail infrastructure is significant. In networks where the main usage of rail network is PSO the distinguishing of market segments is close to mandatory level. If there are no any deviations from optimal network usage from RUs and all externalities are compensated IM have no reasons to introduce mark-ups and have to balance its' costs with charges set on direct cost level.

Table 1

Algorithm of market segmentation relevance test

Step 1 –a determination of network usage optimal conditions	– RUs use no less capacity than allocated during allocation process; – RUs provide traction facilities and the locomotive staff for all existing trains within their traffic responsibility, including suspended trains and wagons uncoupled from the train and delivers them to the specified destination station, considering technological and technical standards.
Step 2 –a determination of RUs' desirable deviations and their measurement	trains carrying dangerous goods versus other freight trains: – utility: specific transportation conditions; – measurement: premium rate for dangerous cargo transportations versus common. international versus domestic services: – utility - priority in transportation, specific time schedule; – measurement - the difference in ticket price
Step 3 –measuring of competitiveness and the liberalization level	trains carrying dangerous goods versus other freight trains: – compete with Lithuanian and Russian transport corridor; – internal oligopoly. international versus domestic services: – international trains compete with buses, airlines, private transport; – domestic train service has a monopoly.
Step 4 – excluding of externalities	trains carrying dangerous goods versus other freight trains: – congestion, accidents, pollution, noise, infrastructure cost, fuel consumption are not balanced; international versus domestic services: – infrastructure cost is compensated for domestic services, others externalities such as congestion, accidents, pollution, noise, fuel consumption are not balanced.
Step 5 – making provisions for market liberalization plan	Mark-ups may be relevant to market segmentation into trains carrying dangerous goods versus all other goods and international trains versus domestic trains, but it is not possible to make transparent MCB test until a Member state ensures market liberalization plan for all segments, at least at: – providing information about tariffs firstly from concrete RU and lastly from RU consumers markets; – managing the risk that the surplus could be transferred to associated entities (expeditors, operators and so on) and a rent could not be reflected in MCB. A railway tariff is not competitive with comparable service tariff due to not balanced externalities and not balanced state policy requirements, which are different from the rival's services.

Source: Authors' composition

In other case the algorithm of evaluating the relevance of mark-ups for specific market segments have to be used. The example of test and possible conclusions as an example were created (see Table 2) and presented to the charging bodies.

As a result of this step of the research, it was possible to generalize that the study fits networks where freight share is significant with a popular disclaimer from the experts that the final consumer for IM is only RU (not its market conditions).

In the networks where passenger transportation share is significant the mark-up approaches probably are quite different. IMs evaluate that the MCB level is very close to the direct cost (mostly based on expectations). PSO MCB level depends on political decision whether the RUs will be subsidized or the IM. And for HSR there are two dominant approaches used: comparing prices of neighboring countries or a modeling.

Table 2

Algorithm of mark-up relevance test

Step 1 – a determination of deviations from network usage optimal conditions for each utility	trains carrying dangerous goods versus other freight trains: – utility - specific transportation conditions; – deviations: capacity allocation on demand of specific cargo; the trains could be suspended and wagons uncoupled only at the specified stations. international versus domestic services: – utility - priority in transportation, specific time schedule; – deviations: priority in transportation; timing of operations; using of congested lines.
Step 2 – a determination of mark-up for competitive market segment	tender proceeding
Step 3 – a determination of mark-up for failured market segment	– requesting information from related (or possibly related) RU. Analysis of the cost and elasticity of the identified utility, as a difference between the final consumer price with and without entire utility that is reduced by possible RU expenses ensuring the utility; – public consultations on result achieved.
Step 4 – the notification of mark-ups before capacity allocation process	publication of the list of market segments in the network statement
Step 5 – ex-post analysis of marked-up segment allocation process	carrying out analysis of the capacity allocation process, productivity of RU, final consumer prices and utility for transferring to the final consumer

Source: Authors' composition

5. CONCLUSIONS AND PROPOSALS FOR ACTIVITIES

As a result of the study it could be concluded that the hypothesis stated cannot be rejected: the requested deviations from the optimal usage of the EU rail network with primarily freight transportation leads to the distinction of market segments. The RU are ready to reimburse additional costs of deviations, but are not ready to disclose the commercial value of deviations requested. At the same time when RUs can see social benefits of train services they wish to distinguish social market segments in order to attract public funding for social advantages. Therefore, on this stage of market development, the States will be responsible both for social benefits of railways and for losses of network where costs do not meet solvent demand.

In order to minimize social costs of railways it would be useful to deal with rail market features which reduce MCB transparency: integration to global supply chains; adaptation of state budgeting rules to IM needs, providing transparency of lobbying processes, increasing RUs' and IMs' competitiveness.

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