

# New coefficients of rail transport usage

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**Abstract**—The article proposes new coefficients of railway transport usage based on real parametric data. New possibilities of using the applicable local government and fiscal law to develop new coefficients of railway transport usage were identified

**Index Terms**—transport, railway, coefficients of usage, novelty.

## I. INTRODUCTION

The reason for writing this article is the introduction of new legal regulations regarding records and financial settlements by all economic entities, including licensed carriers of passengers and goods. Example will be based on Polish law.

## II. REVIEW OF ALL OF SELECTED INDICES OF RAILWAY TRANSPORT USAGE

Since 11 March 2004 the VAT Act has been in force [17], which imposes the obligation of recording specific business activity. According to the Regulation of the Minister of Finance of 4 June 2014 on exemptions from the obligation to keep accounting records using cash registers. It imposes the obligation to keep records of rail transport services.

Moreover, the Regulation of the Minister of Finance of 28 November 2008 on the list of goods for VAT collection in imports which are covered by the 3% rate indicates in § 17 that also single tickets are considered to be invoices if they are issued by taxpayers entitled to provide passenger transport services using:

- normal gauge railway,
- fleet vehicles,
- seagoing vessels,
- means of transport used for short sea shipping and inland waterway transport,
- ferries,
- planes and helicopters,

if they contain the following data:

- a) the seller's name and tax identification number,
- b) the number and date of issuing the ticket,
- c) the fare distance of no less than 50 km,
- d) the amount due together with the tax,
- e) the amount of the tax;

Additionally, it should be stated that if the obligatory payment for booking a seat is an integral part of the ticket which the passenger needs to pay to use the transport [18], the taxpayer may deduct the VAT from the price of the seat.

Pursuant to the act, the authorities which are obliged to collect and analyse information about the rail transport market is the Railway Transport Office (UTK). The president of UTK acts pursuant to regulations specified in the Rail

Transport Act of 28 March 2003 [19].

At present, several indices are commonly used which are related to the use of rail transport. Some of them are over 100 years old.

- Mobility index (passenger transport/number of inhabitants) [2]
- Number of transported passengers [3],
- Amount of transport work which involves transport of passengers [3],
- Railway line density index km/100 km<sup>2</sup> (from 1895) (Fig.1) [2].

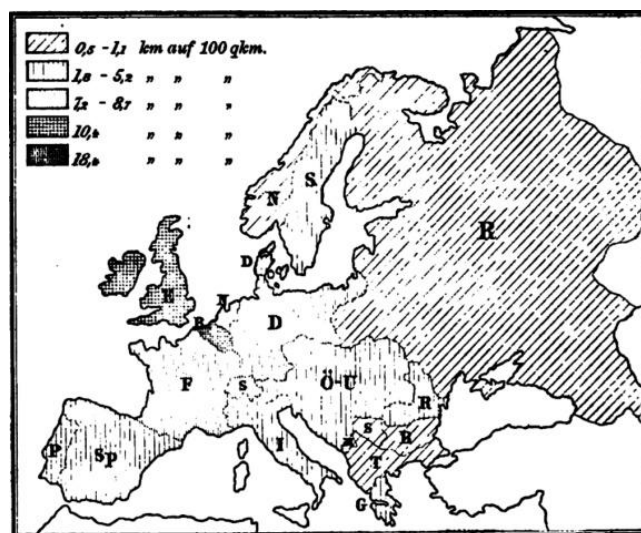


Fig. 1. Density of railway lines in Europe, 1895 [1]

## III. PROPOSED NEW COEFFICIENTS OF RAIL TRANSPORT USAGE

At present, the railway line density index expressed in km/100km<sup>2</sup> is not appropriate for the current competition between individual branches in the country's economy. First, I suggest changing the well-known and very old railway line density index km/100 km<sup>2</sup>. However, it is worth remembering that in this period, the railway did not have an equivalent or stronger competitor in land transport. The first car production line was created in 1907.

Therefore, it is worth finding a new index of rail transport usage. The rights of UTK should be used as the basis. I think that an administrative region should be defined by the province boundaries or if the trade secret allows this, the boundaries of a district or a municipality.

The basis is the information about the number of rail infrastructure kilometers in a given administrative region (1)

$$\text{number of kilometers of railway lines in the region} = \sum_1^n \text{number of kilometers of railway lines belonging to rail infrastructure managers in the region} \quad (1)$$

The notion of railway line kilometers is understood as engineering structures, which are registered as railway structures - railways within the meaning of the Building Law (§ 3 in [16]).

The length of railway lines used in a given region and the index of the use of railway lines in the region (2) can be derived from it.

$$\text{index of railway line usage in the region} = \frac{\sum_1^n \text{length of railway lines operated in the region}}{\sum_1^n \text{km of railway lines in the region}} \quad (2)$$

Another piece of information is the number of railway infrastructure managers in the region (3).

$$\text{number of rail infrastructure managers in the region} = \sum_1^n \text{number of rail infrastructure managers in the region} \quad (3)$$

From these two types of data, an index of railway infrastructure management can be derived (in a given administrative region).

$$\text{wzzis} = \frac{\sum_1^n \text{number of rail infrastructure managers in the region}}{\sum_1^n \text{km of railway lines in the region}} \quad (4)$$

Another piece of information, which is important from the point of view of the region's economic dynamics is the number of users of the railway infrastructure in the region for passenger (5) or cargo transport (6).

$$\text{index of differentiation of railway line usage for passenger transport in the region} = \frac{\sum_1^n \text{length of railway lines used only for passenger transport in the region}}{\sum_1^n \text{length of railway lines operated in the region}} \quad (5)$$

$$\text{index of differentiation of railway line usage for goods transport in the region} = \frac{\sum_1^n \text{length of railway lines used only for goods transport in the region}}{\sum_1^n \text{length of railway lines operated in the region}} \quad (6)$$

The other kilometers of railway lines in the region are used for mixed transport.

The indices presented above can be developed on the basis of data collected by the UTK as part of statutory obligations of infrastructure managers and licensed carriers of goods or (and) passengers.

Other indices can be obtained by imposing the obligation to perform statistical analysis for the Tax Office.

The legal basis for the Tax Office operations is described

in [4][5].

The mode of operation of tax offices is specified in the following acts [6][7][8][9][10][11][12][13][14].

On the basis of these acts, the Tax Office has the legal basis to:

- establish or define and collect taxes and non-taxed budgetary liabilities as well as other liabilities on the basis of separate regulations, except for taxes and budgetary liabilities which are established, defined and collected by other authorities.
- register taxpayers and receive tax returns,
- perform tax audits,
- divide and provide, in line with principles specified in separate obligations, budgetary income between the state's budget and the municipalities' budgets.

Due to the fiscal secret, data on the income of carriers and rail infrastructure managers is secret but data received by tax offices, after being separated from the so-called proprietary or sensitive data can be used to broaden the knowledge about the use of railway transport in the region.

The fiscal secret protects individual data contained in tax returns and in other documents provided by taxpayers, payers or collectors (Art. 293 of the Act [7]).

Let's assume that a licensed carrier of goods or passengers is registered in a given administrative region. It files tax returns to the tax office and transport reports to the UTK in accordance with its requirements.

Identification of the Tax Office as a source of statistical data results from an analysis of the statistical obligation for economic entities.

An economic entity files a report to the Statistical Office where it provides information on:

- The amount of goods produced,
- Changes in the sales situation,
- The cash turnover,
- The number of employed persons.

Economic entities do not provide information on who it orders the transport of produced goods from and which branch of transport performs such services.

A carrier files a report which contains the following information:

- The quantity of transported goods,
- Expenditure on the infrastructure and the rolling stock,
- transport fares,
- The amount of transport work for loads and for passengers,
- The cash turnover,
- The number of employed persons.

Carriers do not provide information on who orders transport services from them or about the place loads were shipped from and their destination.

In UTK reports, only the type of transport needs to be specified (domestic, abroad, transit or through ports). No direction of transport is provided - from region A to region B or J.

Therefore, it seems reasonable to obtain such information from the Tax Office as it has such data from each region separately and it could be summarized. In tax returns, the

carrier informs about revenues and sources of revenues, i.e. economic entities with which it has concluded transport agreements. They usually involve transport of goods. Passenger carriers inform about the number of season tickets - to a named person, issued for groups and individual tickets.

If the Tax Office were obliged to collect statistical data according to the following pattern, its statutory obligations would have to be changed by adding Art. 6. to the Act [14] in the form of a section:

5) Statistical summaries about production transport and services in cooperation with entitled statistical entities pursuant to the Public Statistics Act of 29 June 1995 (Dz.U.2012.591) for the locally competent administrative region [15].

Only the Tax Office has information which can be used for preparing new indices of rail transport usage (Fig.2).

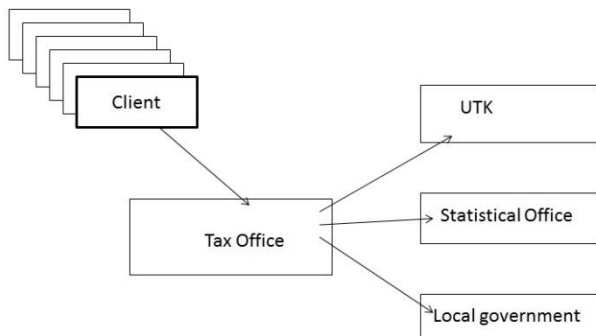


Fig. 2. Diagram of information flow through the Tax Office, Source: own work

A new index of rail transport use in the region is proposed which relies on its use by economic entities registered in the region.

$$\begin{aligned}
 \text{Use of railway by economic entities in the region} &= \\
 \frac{\sum_1^n \text{number of economic entities using railway in the region}}{\sum_1^n \text{number of registered economic entities in the region}} & \quad (7)
 \end{aligned}$$

The data about the number of economic entities using railway transport in the region can be obtained from invoices issued by the rail carrier.

The data about the number of economic entities registered in the region comes from the database of the tax office which updates it every month.

Another index which can be derived from is the index of rail transport usage in the region for the transport of goods (8) or (and) passengers (9).

$$\begin{aligned}
 \text{Use of railway for goods transport in the region} &= \\
 \frac{\sum_1^n \text{total number of loads transported by railway in the region}}{\sum_1^n \text{total number of loads transported by means of transport in the region}} & \quad (8)
 \end{aligned}$$

Data about the total number of loads carried in the region with the use of rail transport can be based on invoices which are the basis of settlements between carriers and their clients - shippers of goods.

Also, transit through the region is taken into account here.

The data about the total number of loads carried in the region can be based on invoices which are the basis of all settlements for all carriers and other clients, who indicate the use of individual carriers in the region as their own expenses, and use this information for their settlements with the Tax Office (9), (10).

Use of railway for passenger transport in the region

$$\begin{aligned}
 &= \frac{\sum_1^n \text{total number of passengers transported by railway in the region}}{\sum_1^n \text{total number of passengers transported by all means of transport in the region}} \quad (9)
 \end{aligned}$$

Use of railway for passenger transport

$$\begin{aligned}
 \text{on a supraregional level} &= \frac{\sum_1^n \text{total number of passengers transported by railway on a supraregional level}}{\sum_1^n \text{total number of passengers transported by all means of transport on a supraregional level}} \quad (10)
 \end{aligned}$$

Data about the total number of passengers transported in the region by rail transport can be based on invoices which are the basis for carriers' settlements and the clients' tax returns for whom a purchase of a ticket for rail transport is a deductible expense.

Data about the total number of passengers in the region can be based on invoices which are the basis of settlements for all licensed carriers in the region.

Other indices which can be developed (11), (12):

$$\begin{aligned}
 \text{index of load shipment in railway transport in the region} &= \\
 \frac{\sum_1^n \text{total number of loads shipped by railway in the region}}{\sum_1^n \text{total number of loads shipped by all means of transport in the region}} & \quad (11)
 \end{aligned}$$

$$\begin{aligned}
 \text{index of load shipment in railway transport on a supraregional level} &= \\
 \frac{\sum_1^n \text{total number of loads shipped by railway on a supraregional level}}{\sum_1^n \text{total number of loads shipped by railway nationwide}} & \quad (12)
 \end{aligned}$$

#### IV. NEW POSSIBILITIES OF ASSESSING THE REGION'S ECONOMIC DYNAMICS

Specification of the Tax Office as an element of statistical settlements will make it possible to obtain detailed information about the load on each branch of transport and the dynamics within individual regions. This will allow a presentation of, for example, Lower Silesia as a region where:

- 35% passengers of licensed public transport passenger carriers use the railway,

- 65% of loads shipped by licensed carriers of goods in the entire Lower Silesia region are transported by railway,
- 55% of transit through the Lower Silesia region involves rail transport,
- 35% of goods transport in the Lower Silesia region involves rail transport,
- 25% of loads transported by railway from the Lower Silesia Region are transported to seaports,
- 45% of loads transported by railway from the Lower Silesia Region go abroad,
- 40% of all loads are brought to Lower Silesia by railway,
- 22% of railway passengers in all licensed carriers travel on business,
- 80% railway passengers who board a train in Lower Silesia to go to Warsaw in all licensed carriers travel on business.

For the Mazovian Province, where Warsaw is the main city, new indices can be helpful in the assessment of connections with other Polish regions.

- 37% passengers of all licensed public transport passenger carriers use the railway for trips to Warsaw,
- 55% passengers of all licensed public transport passenger carriers use road transport for trips to Warsaw,
- 8% passengers of all licensed public transport passenger carriers use air transport for trips to Warsaw.

Among all passengers brought to Warsaw by licensed passenger carriers:

- 23% are from the Mazovian Province,
- 25% are from the Łódź Province,
- 20% are from the Greater Poland Province,
- 15% are from the Silesian Province,
- 10% are from Lower Silesia,
- and 80% of travellers from Lower Silesia go to Warsaw on business,
- Out of which 55 % are business delegations from public entities and the rest are private business entities.

The data presented above allows for better assessment of railway use for each region separately and their mutual economic relations.

## V. SUMMARY

The proposed new indices of using railway transport will allow for better measurements of each region and in each branch of transport. Each province would probably like to provide information about its good connections with the surrounding areas and the use of rail transport which enables reduction of environmental load. This is part of a sustainable transport strategy. Such information would also help to prepare better analyses of the region's economic development and plans of future development.

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## AUTHOR BIOGRAPHY

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