

Determining the dependence of supplementary charges in the ZSSK CARGO tariff in the context of the customer approach, competitiveness, and globalization

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Abstract.

Research background: The article deals with the study of the dependencies of selected supplementary charges in rail freight transport. In the environment of a globalized society, it is very important that railway undertakings maintain their competitiveness in an open market. The article is part of a case study that deals with the development of pricing. The research was primarily focused on the structure and development of the price of supplementary charges in the years 2004 – 2020 at Železničná Spoločnosť Cargo Slovakia, j. s. c.

Purpose of the article: Based on two selected supplementary charges, and the hypothesis of whether or not the development of their price is dependent will be verified by means of regression analysis. The aim of the research is to point out of the disproportionate increase in the prices of supplementary charge, which form a significant part of the calculation of the price for transportation. And for most customers it is a priority for the price of transport.

Methods: The article will use a simple regression analysis according to the relationships depending on the type of dependence used (linear, polynomial, ...)

Findings & Value added: The results of the research can help to better set the structure of supplementary charges. The goal of the company should be a satisfied customer and a dominant market share.

Keywords: *supplementary charges; freight transport; customers; globalization*

JEL Classification: *R4; M48; J32*

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1 Introduction

There are currently two opposing trends in the world in the area of goods transport. On the one hand, it is the growth of the transport volume of cargo and better use of the volume and total weight of means of transport. On the other hand, the demand for the transport of smaller quantities of freight is growing because of the application of logistics in circulating processes and efforts to increase the quality of freight transport services [1]. Between these two different requirements, it is sometimes hard to find the passage. One way to ensure a cost-effective bridging of these two demands is to introduce supplementary charges.

In the context of the advancing globalization of society and the liberalization of the rail freight market, a problem arises here. When transporting goods, one of the decisive factors is price, and if the customer has more carriers at his disposal, he will choose the one who offers him the lowest price for reasonable quality. This somewhat ties the hands of the state carrier ZSSK CARGO, which must adapt to the maximum possible extent and the jury changes the transport tariff year after year. Unfortunately, mostly with higher prices. This somewhat prevents competition between it and private carriers, especially when transporting direct block trains. However, it can use its dominant position in the transport of handlingtrains, but unfortunately, there is a lack of flexibility and a customer-oriented approach.

Using a simple regression analysis, the article aims to find the relationship between the amount of the selected supplementary charge and the factor from the external environment. Based on this, we will then be able to verify the dependency hypothesis and determine the factor that has an effect on the amount of these fees.

More articles have been written about this problem. For example *Financial Risk Measurement and Prediction Modelling for Sustainable Development of Business Entities Using Regression Analysis* by the authors Tomáš Klietík, Katarína Valášková, Lucia Švábovská and Peter Adamko [2]. It is also possible to use them in investment decisions, for example in the article *Investigating the Links of Interpersonal Trust in Telecommunications Companies* by the authors Helena Bulíňská-Stangrecká and Anna Bagiěńska [3]. The article *Transport policy, rail freight sector and market structure: The economic effects in Brazil* from authors Admir Antonio Betarelli jr., Paulo Edson Domingues and Dennis John Goeffrey Hewings also deals with the economics of rail freight [4].

2 Methodology and Data

Tariff is a word of Arabic origin and in today's terminology means the promulgated price schedule and the conditions for the use of such prices [5].

The tariff for the carriage of wagon consignments is divided as follows [6]:

- change records - each change is the responsibility of the relevant employee,
- explanations of abbreviations - contains a list of the most used abbreviations and symbols,
- Section 1 - introductory provisions
- Section 2 - General Tariff Provisions,
- Section 3 - special tariff provisions,
- Section 4 - import tables,
- Section 5 - additional fees,
- Section 6 - charges for services performed at a contractually agreed place other than the general loading and unloading siding.

Additional fees can be found in sections 5. The tariff is valid for one year, usually from 1 January to 31 December. Since 2018, it has been accessible to customers only after logging in to the carrier's internal system (ISP CARGO).

The additional charge represents the acts performed by the carrier or shipper with the shipment in excess of the agreed price for transport. The location of the additional charges when calculating the freight (the price for the carriage that the customer pays to the carrier) is given in relation 1.

$$P = D + DP \quad (1)$$

where,

P – railway freight,

D – a freight charge,

DP – supplementary charge.

VAT is also included in this calculation, which is currently 20% and applies to each shipment. Payment for transport may be made by either the consignor, the consignee or a third party.

The structure of the surcharges has changed over the years. Since 2005, since the establishment of the company, the section of supplementary charges has been divided into supplementary and other fees.

Since 2009, the two parts have been merged into one and only an additional fees section has been created.

The article *Eliciting the regulation of an economic system: The case of the French rail industry* by Marc Ivaldi and Jerome Pouyet dealt with the tariff. [7]. This article deals with tariff setting in the context of the economic regulation of the railway industry in France. The article *Strategic partnerships in local public transport* by the author Andrej Dementiev deals with tariffs in urban public transport [8]. This is the context of the strategic partnership in these companies.

2.1 Regression model

The aim of the use of regression models in research is a deeper penetration into the essence of the observed phenomenon (in our case it is the creation of additional charges in the context of the competitiveness of rail transport against other modes of transport) and processes in a particular area. When solving, we get to the so-called causal links. The causal relationship between two observed phenomena is a state where the existence of one phenomenon is related to the existence of another phenomenon [9].

When examining the dependencies in this article, a free dependence will be used, because it is not certain for the observed phenomena to what extent their indicators will be dependent. This is the type of dependency that regression analysis deals with [9].

This is a state where the explanatory variable in the causal role and the explained variable in the consequence role stand against each other [9]. Table 1 lists the dependencies examined.

The calculations will be based on the basic linea regression line (simple regression model), which is expressed using Equation 2.

$$v_i = n_i + \varepsilon_i \quad (2)$$

when:

n_i – regression line,

ε_i – random error of the i-th observation.

2.2 Values on the vertical axis

Data on work accidents on the ŽSR (Railway infrastructure manager) network will be plotted on the vertical axis.

In the context of globalization, the issue of accidents is topical because it negatively affects railway operations.

If the accident occurs to a third party (shipper during loading or unloading), the whole process of investigating the accident will be further extended compared to railway employees. Graph 1 summarizes data for 15 years, from 2004 to 2019.



Fig. 1. Accidents at work in railway transport [10].

The largest number of accidents on the railway was in 2006, while in 2014 the number of accidents was more than twice as small. This chart includes all types of accidents (serious and less serious).

The issue of accidents and safety at work is addressed, for example, by the article *Construction of a Bayesian network model for improving the safety performance of electrical and mechanical (E&M) works in repair, maintenance, alteration and addition (RMAA) projects* by Albert Chan, Francis Wong, Carol Hon and Tracy Choi [11]. This article uses the Bayesian network to increase the safety of electrical and mechanical repair and maintenance work. The article *Finding the Parallels: Practitioner learning from cross sector disaster cases* by Jan Hayes and Sarah Maslen deals with an empirical study of the generalization of accidents in one sector and their impact on another sector [12].

2.3 Values on the horizontal axis

An additional fee for writing the survey minutes will be applied to the horizontal axis at the request of the shipper (customer).

The minutes can be written mainly for the following reasons:

- finding out the loss of goods upon delivery to the recipient,
- detection of damage to seals,
- detection of damage to the goods,
- finding out the loss of goods.

Part of the writing of such minutes is also the process of complaint of transport, where the degree of fault and responsibility for the situation is determined. Table 1 shows the amount of the fee for writing the survey minutes in the years 2004 - 2020.

Table 1. Development of the price for writing the exploratory minutes at the customer's request [13].

Year	Price for writing the exploratory minutes at the customer's request
2004	6,83€
2005	7,16€
2006	7,50€
2007	8,07€
2008	8,37€
2009	10,84€
2010	10,84€
2011	10,84€
2012	10,84€
2013	11,30€
2014	20€
2015	20€
2016	20,40€
2017	20,80€
2018	21,20€
2019	21,85€
2020	22,30€

The price development had an upward trend. The largest increase was recorded between 2013 and 2014 by € 8.70.

Another significant increase was between 2008 and 2009, by a total of € 2.47. In the years 2009 - 2012 and 2014 - 2015, the prices of the additional fee did not change.

2.4 ANOVA test

To determine the dependence between the observed phenomena, the so-called ANOVA test. An ANOVA test is any static test in which the tested F statistics have a distribution. provided that the null hypothesis is valid. It is most commonly used when comparing stochastic models, which are estimated from a data set, to identify the model that most closely matches the set from which the data were collected. Accurate ANOVA tests arise mainly when the models have been estimated using the least squares method [14].

If the tabular value of the ANOVA test is less than the calculated value, it can be stated that the investigated quantities are dependent.

However, if the tabular value of the ANOVA test is larger than the calculated value, it can be stated that the quantities are not dependent. Equation 3 can be used to calculate ANOVA test values.

$$(R^2/k)/((1 - R^2)/(n - k + 1)) \quad (3)$$

when:

k – coefficient which takes the value 1 when using a linear dependence

n – number of years in the observed period (in our case 15)

R² – determination of the regression model.

There are a number of articles dealing with the use of the ANOVA test. For example, *Asymptotic F tests under possibly weak identification* by Julian Martinez-Iriarte, Yixiao Sun and Xuexin Wang address the issue of using the ANOVA test in an asymptotic environment. [15].

In the article *Should We Use ANOVA tests for Model Fit Instead of Chi-Square in Overidentified Structural Equation Models?* by Daniel McNeveish [16]. Research on causation is also addressed in *The Benefits and Pitfalls of Using Satellite Data for the Causal Inference* by Meha Jain [17].

3 Results

In the first step, it is necessary to establish statistical hypotheses that we will test. Price for writing the exploratory minutes at the customer's request is dependent on the number of accidents at work on the railway.

We will deal with two hypotheses:

- H₀: Price for writing the exploratory minutes at customer's request is not dependent on the number of accidents at work on the railway,
- H₁: Price for writing the exploratory minutes at the customer's request is dependent on the number of accidents at work on the railway.

In examining this relationship, we use the linear dependence, because the dependence of variables R² shows the highest value. In the second step, we create a graph based on the relationship 2 and the data in Figure 1 and Table 1.

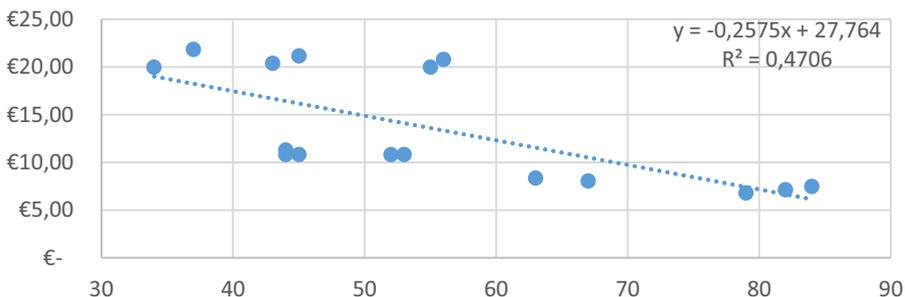


Fig. 2. The linear relationship between the price for writing the exploratory minutes at the customer's request and the number of accidents at work on the railway.

The data in the statistics will be for the years 2004 - 2019, as the final number of accidents for 2020 is not yet known and the current number of accidents would not be relevant with regard to the overall picture. Figure 2 shows the dependency equation and the coefficient of determination R².

You must create a table to verify this dependency. Table 2 shows the factors of the independent variables according to Equation 3 for which the dependency or independence will be verified.

Table 2. Dependency verification

R^2	0,47
k	1
n	16
$n-(k+1)$	14
F	12,44
F_{TAB}	4,60

Table 2 shows that there is a relationship between the price for writing the survey report at the customer's request and the number of third-party injuries on the railway. We accept the hypothesis H_0 and reject hypothesis H_1 .

It is therefore clear that when writing the investigation minutes, after the deterioration of a wagon consignment, injuries to both the injured party and the injured party may occur.

4 Discussion

Regression models can be used in different fields of transport. In the context of the globalization of society, it is important to identify certain dependencies. Identification should be primarily the customer. As in this article, when a higher level of security of the shipment and the entire transport means a smaller number of injuries of intruders. Table 3 provides further examples of examining dependencies in both freight and passenger transport.

Table 3. Suggestions for further research

Dependence	Possible reasons for the investigation
number of accidents in road freight transport and number of customers in rail freight transport	demonstrating dependence will make it clear that customers prefer a safer mode of transport, despite the higher price and less flexibility.
the price of the delivery of the ZSSK CARGO wagon for loading abroad and the number of deliveries	if dependence is shown with a declining trend of customers using this service, it is clear that the carrier will have to adjust prices to be more motivating
the dependence between the number of loaded individual wagon consignments and loaded trucks in the selected town	if the dependence between the use of road and rail transport in such transports is demonstrated, it will be clear that low flexibility and high price in such transports demotivate customers
dependence between the number of accidents and the way to ensure the movement of trains	in the case of proof of dependence, it is necessary to increase safety in line sections

The purpose of these topics is, on the basis of this article, to make such analyzes of dependence, on the basis of which it is possible to improve the quality of rail transport and increase its competitiveness in the environment of a globalized society. Articles can be used for research in this direction [18] [19].

5 Conclusion

Globalization, as one of the phenomena of the last century, brings advantages and disadvantages to individuals and legal entities.

One of the advantages is the dynamic transport of goods by various types of transport. The customer has a choice of different carriers and it only depends on him what his priorities are.

For carriers, this situation represents the implementation of a pro-customer approach in an effort to gain as many customers as possible.

As one of the decisive factors for choosing which carrier is also the price for transport, carriers try to adapt to customers in this area as much as possible.

The article dealt with the dependence between the rising price of additional fees in the tariff of the carrier ZSSK CARGO, specifically the supplementary charges, which concerned the writing of the survey minutes at the customer's request, and the accident on the railway. Demonstrable dependence proves that, despite safety measures, there are cases where not only the rolling stock is damaged but also the health and life of the person associated with this activity.

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