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New paradigms of quantification of economic efficiency in the transport sector

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Abstract

Research background: In determining the prices in road transport, carriers usually use the calculations based on a so-called routes utilisation coefficient, which allows the carrier to also take the

possibility of the return rides without load into account. Currently, it is usually used as a constant from the interval from zero to one.
Purpose of the article: Considering a different offer of return transport from individual European Union (EU) countries, it can be assumed that the routes utilisation coefficient should have different values because there is a varying level of non-zero probability that the vehicle will return without a load. This study therefore proposes a new approach to determining the value of this coefficient based on transport direction. The study also aims to identify clusters of EU countries, for which the common value of the coefficient should be set.
Methods: The Analysis of Variance (ANOVA) test was used to verify the assumption of the differences among the means of transport offers. Cluster analysis was used to identify the aforementioned groups of countries. This analysis is based on real data on transport offers to Slovakia from 18 different EU countries.
Findings & value added: The results of the analysis can also be used in other EU countries because if significant differences in transport offers to Slovakia exist in individual countries, there is a reasonable assumption that this conclusion will also be valid in other countries. The analysis demonstrated that it is more appropriate to use the routes utilisation coefficient with various values, dependent on the transport direction. For the transport companies, implementation of the obtained results into practice is beneficial to increase their competitiveness through the more precise setting of transport prices, but also to the optimisation of the transport price itself with regard to the expected costs.

Introduction

Transport is a significant and important component of the economy and fulfils the role of providing goods and services to citizens and businesses in the European Union (EU) and its trading partners from a comprehensive network of private and public companies providing these goods and services. It also provides mobility for Europeans, thus making a significant contribution to the free movement of persons in the internal union market. Efficient transport services and freight infrastructure are necessary in terms of exploiting the economic potential of all regions of the EU and promoting the internal market and growth. They ensure economic and social cohesion. They are also important in terms of trade competitiveness, whereas the availability, price, and quality of transport services have a major impact on production processes and selection of business partners. Given this central role, transport is already inherently interconnected with various other policy areas.

The market for road freight transport is characterised by its high competition between carriers. Nowadays, return transport efficiency is one of the few tools to remain in the road transport market in the face of increasing competition. Carrier costs are increasing faster than the price of transport (Ross, 2015; Rushton *et al.*, 2010). The increase in transport prices is growing significantly slower compared to costs. This situation has led several carriers to breach EU law by subcontracting (Rotondo, 2013). Carriers wanted to gain a competitive advantage despite the infringement of the regulations (Osterloh & Debus, 2012). To maintain uniform conditions for market access, the EU adopted regulations aimed at harmonising conditions in 2009 (Regulations 1071/2009 and 1072/2009). Despite these regulations, various market distortions occur, for example, the MiLoG German Minimum Wage Act. The EU aims to eliminate these market distortions (Regulation 2020/1054). Although the provisions will not come into force until 2022, there are several views from carriers that will not be achieved and that even after 2022, there will be no uniform conditions for all carriers operating in the EU common market. However, there is still strong competition. The transport price within the EU remained almost unchanged between 2000 and 2019 (Ferrari, 2016; Jourquin, 2019), but costs changed significantly. The labour, toll, and fuel costs grew the most. Transportation companies seek to gain a competitive advantage by optimising their costs (Krasnyanskiy & Penshin, 2016). They use cost calculations, which divide the costs into variable and fixed costs, calculating each transport separately but taking only costs connected with transport into account (Ferrari, 2016; Kovacs, 2017). However, the routes utilisation coefficient adjusts costs, and it aims to take the possibility of the return rides without a load into consideration. In practice, the value of this coefficient is usually constant, set for a specific type of vehicle from zero to one (Engholm *et al*., 2020; Lada *et al*., 2016). If the carrier can use at least part of the return ride, the coefficient and thus the carrier's competitive advantage will increase.

The carrier needs to know the costs that arise from each transport as accurately as possible. It is necessary to maintain the position of the transport company in the road freight transport market (Drozdziel & Piasecki, 1995). and Drozdziel and Piasecki (1995) recommend the use of a constant value of the routes utilisation coefficient in price calculations. This coefficient is expressed as the ratio of the distance driven by the loaded vehicle (vehicle with freight) per year to the total distance driven per year. In the case of a year-round expression, this is a mathematically correct approach, but only if there is a similar probability of obtaining transport for the return ride in each direction of transport. In practice, this assumption is not valid. Based on Mitsakis *et al*.'s (2015) and Albalate *et al*.'s (2015) results, Europe has significantly higher east-west traffic flows compared to north-south traffic routes. This means that if a route started from Central Europe and finished in Southern Europe (e.g., in Serbia), the carrier has a lower probability for finding a back transport compared to transports with their final destination in Western Europe (e.g., in Germany). From the above assumption, it can be assumed that the routes utilisation coefficient should not be taken as a constant in the calculations, but rather as a variable dependent on the transport direction. Although the aforementioned studies recommend using a constant value of the routes utilisation coefficient, the main aim of the current study is to show that it is more precise to use it in the price calculations as a variable depending on the direction of transport.

Therefore, our main interest of analysis is the routes utilisation coefficient, which has a significant effect on the costs of the carrier in particular transport. The main aim is to show that from the viewpoint of the competitiveness of price formation in road transport, it is not economically correct to use the constant values of this coefficient for all transports. The main contribution of this study is the proposal of a new methodology of pricing in road transport, demonstrating that the routes utilisation coefficient should rather be used as a variable dependent on the direction of transport. At this point, it is worth mentioning that although ‘coefficient’ is a commonly used term, it may further be inappropriate. Based on the results, it would be more appropriate to refer it as a route utilisation indicator.

Although, to the best of our knowledge, studies to date have not identified such an approach, the current study can be considered innovative from this perspective. Its results are also beneficial for practice, as the implementation of the proposed methodology brings the possibility for the transport company to increase their competitiveness through the more precise setting of transport prices, but also to the optimisation of the transport price itself with regard to the expected costs.

The rest of this paper is structured as follows. Section 2 provides an overview of the development and current state of the issue. Section 3 describes the methodology and the data used in the study, as well as the cluster analysis. Section 4 describes the results obtained by applying statistical methods and their use in determining the routes utilisation coefficient. Finally, section 5 summarises the results of this study.

Literature review

For business in road freight transport with economically correct calculations, it is necessary to pay attention to fixed and variable costs (Jourquin & Beuthe, 2019). According to Forootani *et al.* (2019), McLennan (1984), and Vaishya and Sarkar (2019), such an approach to pricing is necessary, but in road freight transport, the aforementioned routes utilisation coefficient must also be taken into account (Gnap *et al.*, 2018). From the competitiveness viewpoint, it is necessary to apply an economically correct cost calculation (Valaskova *et al.*, 2018; Svabova *et al.*, 2020). It assumes the correct decision when setting the price for providing the service (Kliestik *et al.*, 2018).

Business taxation should also be taken into account (Gnap *et al*., 2018; Osterloh & Debus, 2012; Osterloh & Heinemann, 2013).

Transport is specific as it realises performances not included in the price (Kovacs, 2017). The point is that the vehicle not only drives with the load but also performs the transfer from the place of unloading of the freight to the place of loading the new freight (Lada *et al*., 2016).

If the carrier wants to have cost-effective transport, it is necessary to include these costs in the customer's price for the realised consignments transport. According to the calculation methods described in several studies (Lai, 2010; Poliak, 2013; Rothengatter, 2019), the routes utilisation coefficient adjusts variable costs for a specific transport as follows:

$$VC_T = \frac{f(vc_T;\ d_T)}{K} \tag{1}$$

where VC_T are variable costs related to transport, which are a function of unit variable costs per travelled kilometre vc_T and the distance travelled during transport d_T and adjusted by the routes utilisation coefficient K, which expresses what proportion of the total distance travelled is used for transport of consignment by the carrier. As mentioned above, several authors determine the constant value of the routes utilisation coefficient. For example, for a cistern truck that cannot be used during the return journey, the value of 0.5 is usually used (Bokor & Markovits-Somogyi, 2015). In international road transport, the value of the routes utilisation coefficient is usually between 0.8 and 0.9 (Bao & Mundy, 2018; Drozdziel & Piasecki, 1995; Engholm *et al*., 2020). The coefficient does not adjust the fixed transport costs FC_T, which is given by

$$FC_T = f(fc_D; n) \tag{2}$$

where fc_D are fixed costs per day of vehicle operation and n is the number of days of transport. We can assume that the vehicle is not in service every day of the year. Therefore, the fixed costs per day of operation are a function of the annual fixed costs per vehicle nf_D and the number of days of vehicle operation per year D_V. It means that according to the actual calculation methods, the function, which determines the fixed costs per transport, is as follows:

$$FC_T = f(FC_Y;\ D_V; n) \tag{3}$$

Riha and Tichy (2015) note that most transport companies only register their internal costs, which arise from the business but do not take external costs into account. They are unable to quantify them from their accounting. These costs arise due to the process of transport, for example, costs of infrastructure, environmental protection, and so on. The state covers these costs in most cases (Trigaux *et al*., 2017). However, we will not deal with these because these costs without their internalisation do not affect the carrier costs in particular transport. We will also not deal with the impact of the quality of the transport service, which also significantly affects the competitiveness of the carrier. Askari and Peiravian (2019), Gasparik *et al.* (2015), Jourquin (2019), and Litman (2019) deal with the relationship between the quality and competition of transport services.

Based on the literature review, we can say that although several studies deal with calculations and the method of pricing return transport, they determine this calculation using a constant value of the routes utilisation coefficient. Nowadays, with more powerful computer technology, it is possible to monitor this coefficient in more detail and to determine its different values in price calculations. At present, we have not been able to find a similar approach to this issue in current studies.

Research methodology

We used the data of the largest transport database, Timocom, which registers 43,000 companies from Europe. This database processes on average 750,000 transports per day throughout Europe. In most cases, carriers use the transport databases to find back transports. A transport database is a virtual place where the demand and supply of road transports are met, so it is a database of transport demand for available consignments for transport and offers of free vehicles available for transport. The Timocom database does not archive the status of vehicle offers and free transport offers between every two countries in the database. For this reason, we downloaded the data for processing separately every calendar day during the research.

The analysis period is from 1 September 2018 to 31 August 2019. During this period, we identified the proportion of offered free transports in the transport databank and that of offered free vehicles for transport. We used data from 256 days for the identification of return transports to Slovakia from the other 18 countries in the database. We did not consider days that were affected by public holidays or other special days (e.g. Christmas, Easter, etc.). Due to the amount of data for research into the development of the routes utilisation coefficient, it is sufficient to focus only on return transports to one state. It can be supposed that the behaviour of transport offers from different EU countries to another selected country will be analogous. If there are significant differences in daily transport offers from different EU countries to Slovakia, it can be reasonably assumed that the transport offer to another country will also be different depending on the country of the direction of transport. We focused on the return transport to Slovakia from the following countries: Belgium, Bulgaria, the Czech Republic, France, the Netherlands, Luxembourg, Hungary, Germany, Poland, Austria, Romania, Slovenia, Serbia, Spain, Switzerland, Italy, Turkey, and Great Britain. We have selected these countries as this covers all transport routes from the EU to Slovakia.

Firstly, we verified whether there are any significant differences between transport offers to Slovakia in individual countries. For this purpose, we used one of the most frequently used statistical methods, the one-way analysis of variance (ANOVA) and its post-hoc Scheffe test. Our null hypothesis was that there are no differences among the means of transport offers to Slovakia in the countries with the alternative of the existence of at least one difference between the means of transport offers to Slovakia in at least two countries (Steel *et al*., 1997). In the case of rejecting the null hypothesis, we subsequently used Scheffe post-hoc multiple comparison test to find pairs of countries with significant differences in the transport offers to Slovakia. The consequence of this testing is the creation of subgroups of countries in which the offer of transport to Slovakia is statistically the same. We used the significance level of 0.05 for all the hypotheses.

We then used cluster analysis to identify the groups of countries with a similar mean level of the transport offer to Slovakia. Cluster analysis finds and identifies homogeneous subgroups of the countries and classifies them into disjunctive clusters. The principle of such analysis is that objects belonging to a cluster are as similar as possible and, on the other hand, objects belonging to different clusters are as different as possible. Cluster analysis tries to find some previously unknown structure in the analysed data. Its advantage is that it does not require any specific characteristics of the data (e.g. their distribution) or the independence of the input variables. The analyst does not have to know the examined data in-depth. Cluster analysis was used to identify such groups of countries in which we can consider the transport offer to be so similar that it is possible to set a common value of the routes utilisation coefficient for them. Conversely, for those countries that are in different clusters, it is appropriate to set this coefficient to a different level, as the means of transports offered to Slovakia in them is significantly different. The advantage of clustering compared to subgroups created using multiple comparisons is their disjunction, so each country belongs to only one cluster. There are several methods for creating clusters. We used hierarchical heuristic methods, namely the between-groups linkage method and the most commonly used Ward's method. The between-groups linkage method includes the distance of two clusters determined as the mean distance of all objects in these clusters. In Ward's method, clusters are not formed according to their distances but based on the ANOVA. The sum of squares of deviations from the cluster average must be as small as possible when adding a new object. This method leads to the formation of clusters that are approximately the same size and shape. It means that small clusters are removed, which is its advantage.

The output of the hierarchical cluster method is an agglomerative diagram also known as a dendrogram. It shows the gradual clustering of objects from the first step, when each element is in one separate cluster, through the grouping of elements based on the measurement of their similarity and distance, to the last stage, when all objects are in one cluster. We then chose the appropriate number of clusters of the countries, which are most applicable and interpretable for further research.

All clustering methods work on the principle of measuring the similarity of objects in one cluster. There are several measures for measuring similarity. We used the Euclidean distance and the square Euclidean distance, which are two of the most frequently used clustering methods.

Results

The statistical characteristics of the transport offers to Slovakia for individual countries during the processed one-year period are presented in Table 1. The mean values of the transport offer are reported in the third column. For example, the value of 29.7% in the table means the portion of free consignments in the transport databank. This value reveals the ratio between two types of records in the database. For example, between Austria and Slovakia, there were 29.7% of available consignments for transport, and 70.3% of available vehicles ready for transport from Austria to Slovakia. Based on the values of Table 1, it is already clear that there are significant differences between the transport offers to Slovakia among the countries.

In Table 1, column 4 represents standard deviations that describe the variability of individual values around the mean value. The results indicate that the variability is relatively large. It may be related to the diverse progress of supply during the different seasons. The other columns contain the coefficients of variation and the minimum and maximum value for each country.

This analysis verifies the significance of the differences among the mean values of transport offers to Slovakia in the countries. The sample means are graphically illustrated in Figure 1 (Mean Plot). The values indicate that there are differences between countries. Using the one-way ANOVA, we verified the influence of the country on the level of transport offer to Slovakia. The results are reported in Table 2.

According to the results of the ANOVA model (p-value = 0.000), we can reject the hypothesis about the equality of the means of transport offers to Slovakia in individual countries. We can consider the differences among them as statistically significant.

As the results reveal that there are significant differences among the offers of transport to Slovakia from individual countries, we made multiple comparisons using the post-hoc Scheffe test. The test results are summarised in the form of groups of countries (subsets) in Table 3. In one subset, the differences among transport offer to Slovakia are not significant. However, there are significant differences between the two different subsets. This grouping of countries is necessary for creating a simplified methodology of costs calculation. These groups overlap, but differences between countries are insignificant in one group.

Since we want to demonstrate that it is possible to determine the route utilisation coefficients separately for each country, or group of countries, we further focused on finding such groups, wherein the transport offers to Slovakia are as similar as possible. Due to the overlapping of the subsets listed in Table 3, we used country clustering. The outputs of clustering are disjunctive groups of countries. The output of the hierarchical cluster analysis is the dendrogram shown in Figure 2.

As the most appropriate step of the hierarchical procedure for practical use, we chose the step of five clusters, where the following clusters were created:

1. Luxembourg, Switzerland, Belgium, France, Germany, Great Britain, the Netherlands,
2. Czech Republic and Poland,
3. Romania and Serbia,
4. Hungary, Slovenia, Austria, Italy, Spain, and Bulgaria,
5. Turkey.

We consider the choice of five clusters as the most appropriate and useful option for practical use. In addition, the composition of the countries in the clusters is approximately the same as we assumed due to the distance to Slovakia and current trade relations. It would be also possible to merge clusters 2 and 3, which would give four groups of countries for which it would be possible to determine common values of the route utilisation coefficient, as there are similar levels of transport supply to Slovakia.

We were able to identify the proportion of records of consignments for transport and the proportion of unoccupied vehicles. Of course, it does not represent the routes utilisation coefficient itself. From the data available in the transport databases, it is possible to identify the proportion of available consignment from each state to each other state for a specific day using the total number of records containing available consignments and available vehicles. It is possible to convert records to the routes utilisation coefficient according to the following proposed methodology. Transport from the place of loading of the first consignment to the destination of its unloading is always occupied. The carrier transports the consignment based on the customer's order. The risk for the carrier is only the return transport. It means that during the first transport, the carrier can consider the whole ride as used. We can now express the value of the routes utilisation coefficient cumulatively for the entire transport. The coefficient reaches a level of 0.5. We can also add the value related to return transport. If the vehicle returns empty, we do not add any value of the coefficient and its level remains at 0.5. During the return transport, it is necessary to consider the distance of the transfer, usually from the destination of the previous transport to the place of loading of the next consignment. This distance is usually approximately 5% of the entire distance travelled. This value is valid even if there is sufficient available transport offered. Consequently, the carrier is likely to find an available transport if the proportion of those offered in the destination of the first consignment is higher than 50%. It means that there are more available consignments than vehicles. In this step, it is also necessary to consider a vehicle transfer of approximately 5%, so that the value of the routes utilisation coefficient will increase cumulatively by 45% with the return transport. The resulting value is 0.95%.

On the other hand, the ratio of available transports in the destination country of the first consignment may be less than 50%. It means that on the return route, there are fewer available consignments than vehicles offered for transport. Then, the carrier must make a longer journey with the vehicle to obtain a suitable consignment for return transport. If the identified proportion of available transports from state i to state j for transport P is d_{Pij}, then the value of the coefficient K can be determined (in %) as:

$$K = 50 + \left(d_{Pij} - 5\right) \tag{4}$$

Considering both possible situations, the value of the route utilisation coefficient can be defined as:

$$K = \max\{50 + (d_{Pij} - 5); 95\}. \quad (5)$$

To determine the common value of this coefficient for a group of countries, the results of the cluster analysis allows us to identify countries with a similar situation of transport offers. If we use the route utilisation coefficient, the total transport costs are given by:

$$TC_T = VC_T + FC_T = \frac{f(vc_T;\ d_T)}{K} + f(fc_D; n) \quad (5)$$

or, using (5)

$$TC_T = \frac{f(vc_T;\ d_T)}{\max\{50 + (d_{Pij} - 5); 95\}} + f(fc_D; n) \quad (6)$$

where:
TC_T – total transport costs,
VC_T – variable transport costs,
FC_T – fixed transport costs,
vc_T – variable costs per travelled kilometre,
fc_D – fixed costs per day of vehicle operation,
d_T – distance travelled during transport,
d_{Pij} – available transports from state i to state j.

Discussion

Unfortunately, it is not possible to compare our results with similar studies. The literature usually describes only the general definition of routes utilisation coefficient and its values, which are usually in the interval between 0.8 and 0.9 in international road transport (Bao & Mundy, 2018; Drozdziel & Piasecki, 1995; Engholm *et al*., 2020; Gnap *et al*., 2018). Of course, for some special vehicles that cannot be used during return routes, such as tank vehicles, the routes utilisation coefficient falls below 0.5. Our study does not estimate this coefficient for each country separately, but describes the methodology for converting obtained values to the routes utilisation coefficient.

Our research is based on real data on daily transport offers and free vehicles in the transport databank, covering the period of one year. We have chosen 256 representative days as a representative database for statistical analysis. The ANOVA test supports our assumptions and demonstrates that there are significant differences among the transport offers to Slovakia. The Scheffe test helped to create the subgroups of countries with a similar mean level of these offers. As the disadvantage of this result was the overlap of the countries, we used the cluster analysis to determine the five disjunctive groups of the countries. The results of the clustering allow us to define the common value of the route utilisation coefficient for the countries in one cluster, based on the mean level of the transport offer. As a weakness of this study, it should be noted that we have analysed only 18 countries, not the whole of Europe. Possibilities of return transports were very different in each country during the year.

In recent months, demand and supply in road freight transport have changed significantly in connection with the measures taken to prevent the spread of COVID-19 (Dias *et al*., 2020; Korzeb & Niedziolka, 2020; Kufel, 2020; Kuc-Czarnecka, 2020; Pardal *et al*., 2020; Zinecker *et al*., 2021). Some plants stopped production, which significantly reduced the demand for transportation. Several countries have also restricted the entry of trucks into their territory. Such restrictions also affect supply and demand in road freight transport. For instance, in March 2020, carriers were not willing to travel to Italy, causing a significant decrease in the supply of free vehicles for transport. As a consequence of the shortage of free vehicles, export prices for transport from Italy increased by almost 100%. Therefore, the possible further direction of research should be focused on the identification of the changes in demand and supply in the European sector after the restrictions related to the COVID-19 pandemic.

Furthermore, it should also be based on the finding on the verification and improvements of the proposed methodology presented herein.

Conclusions

The main challenges of the transport sector in the EU lie in building a well-functioning single European transport area, connecting Europe by modern, multimodal, and safe transport infrastructure networks and in the transition to low-emission mobility, which includes mitigating other negative externalities of transport. From a social viewpoint, it is crucial to building a transport system that is affordable, reliable, and available.

Carriers of international road freight transport currently operate in the common market of the EU, where they can conduct transport business under the same conditions. The entire EU market is open to carriers from all European countries, but competition has also increased significantly. A higher competitive environment raises higher demands for more accurate calculations of costs. When analysing the costs calculation procedures, we identified a gap in the possibility of specifying the data for carriers' decision-making. We did not find any studies dealing with the routes utilisation coefficient at various levels in costs calculation. All analysed studies consider this coefficient with a constant value from the interval $(0; 1)$. We conducted extensive research on the data of 43,000 transport companies offering transport in 18 countries. We analysed the records of available transport offers and free vehicles in transport databases. Although the current calculations use a constant routes utilisation coefficient, this study has demonstrated that such a procedure is not correct for maintaining the competitiveness of the carrier in specific markets. Based on an analysis of 750,000 daily records during the period of one year, we found that it is more appropriate to use various levels of the routes utilisation coefficient (instead of one constant value), dependent on the transport direction. Cluster analysis enabled us to develop a solution, which merged the countries into five clusters. We proposed a methodology to convert the records of available transport offers and vehicles to the routes utilisation coefficient. As such a methodological approach to determining the value of this coefficient has not yet been used, we consider this study to be beneficial in filling this scientific gap. The results are of high practical importance as the proposed methodology allows the carrier to more accurately determine the price of transport and thus achieve optimisation of the balance of the revenues and expenses. On the other hand, it also enables more accurate calculation of the transport price to increase the competitiveness in transport from countries with a high level of transport offers.

Although the data on transport offers to Slovakia from 18 different EU countries were used for the analysis, the results are spatially transferable. It can be assumed that if a significant difference in transport offers from different countries to Slovakia is shown, the same results apply in offers of transport to another country.

The possible future direction of the study lies in the verification of the obtained values of the routes utilisation coefficient for each cluster of countries. It would also be beneficial to measure the coefficient in real conditions and, based on these measurements, to estimate the accuracy of the value of the coefficient obtained from the methodology proposed herein. We also assume that in addition to the country of transport, the value of this coefficient also depends on the interaction between the day of the week of transport and the country. Therefore, subsequent research will focus on the specification of the proposed methodology for determining the value of the coefficient using the results of correspondence analysis for different combinations of levels of these two factors.

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Annex

Table 1. The portion of return transports offered from selected countries to Slovakia (%) (statistical characteristics)

Country	N	Mean (%)	Std. Deviation (%)	Coeff. of Variation (%)	Minimum (%)	Maximum (%)
Austria	256	29.70	16.081	54.14	5	85
Belgium	256	8.45	5.168	61.16	2	27
Bulgaria	256	10.08	6.873	68.18	2	32
Czech Republic	256	59.52	23.626	39.69	11	87
France	256	8.78	9.984	113.71	2	74
Germany	256	12.81	12.251	95.64	2	83
Great Britain	256	10.26	9.978	97.25	2	76
Hungary	256	28.01	15.615	55.75	3	84
Italy	256	23.70	10.993	46.38	8	71
Luxembourg	256	6.23	7.214	115.79	2	43
Netherlands	256	13.65	6.563	48.08	2	34
Poland	256	51.94	20.825	40.09	11	80
Romania	256	10.50	10.683	101.74	2	74
Serbia	256	12.85	11.057	86.05	2	55
Slovenia	256	35.18	16.359	46.50	2	65
Spain	256	9.22	7.624	82.69	2	50
Switzerland	256	4.47	6.412	143.45	2	54
Turkey	256	22.43	16.974	75.68	2	77
Total	4608	19.88	20.052	100.87	2	87

Table 2. ANOVA model of the differences among the transport offer from listed countries

Data	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1081098.97	17	63594.057	378.423	0.000
Within Groups	771349.51	4590	168.050		
Total	1852448.48	4607			

Table 3. Subsets of countries with similar return transport offered to Slovakia

Country	N	Subset for alpha = 0.05							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Switzerland	256	4.47							
Luxembourg	256	6.23	6.23						
Belgium	256	8.45	8.45	8.45					
France	256	8.78	8.78	8.78					
Spain	256	9.22	9.22	9.22					
Bulgaria	256	10.08	10.08	10.08					
Great Britain	256	10.26	10.26	10.26					
Romania	256		10.50	10.50					
Germany	256			12.81					
Serbia	256			12.85					
Netherlands	256			13.65					
Turkey	256				22.43				
Italy	256				23.70	23.70			
Hungary	256				28.01	28.01			
Austria	256					29.70	29.70		
Slovenia	256						35.18		
Poland	256							51.94	
Czech Repub.	256								59.52
Sig.		0.084	0.672	0.244	0.128	0.052	0.154	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 256.000.

Figure 1. Mean percentage return transports offered to Slovakia from individual countries

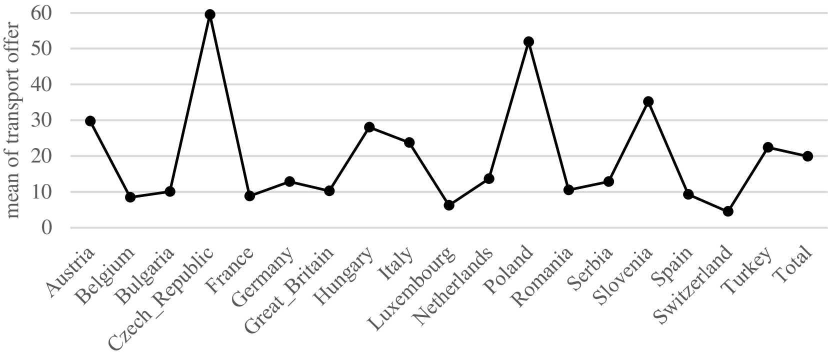

Figure 2. Clustering of countries according to the offer of return transports to Slovakia (Dendrogram using Ward Linkage)