Article

Trust and Distress Prediction in Modal Shift Potential of Long-Distance Road Freight in Containers: Modelling Approach in Transport Services for Sustainability

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Abstract: Confidence in intermodal transport has not yet been defined. There are many different approaches to the concept of trust. However, the authors embedded them in the light of the challenges of sustainability, linking with the shift paradigm. The objective of the article is to indicate the directions and criteria for the implementation of the shift paradigm, inscribed in the idea of sustainable transport. The auxiliary objective is to predict which countries in a given year will have the TRUST status, i.e. implement the shift paradigm, and which will not implement it (DISTRESS). The article uses taxonometric techniques and built a model using General Discriminant Analysis. On their basis, the utility function was approximated, including the directions of implementation of the shift paradigm depending on the scale of the environmental load of transport. In the course of the research, an original and innovative econometric model was constructed, pointing to three variables, which had the greatest impact on trust. Thanks to the cognitive value of the model, it is possible to identify individuals who deserve the trust, i.e. it will implement the shift paradigm, with 93% probability. In the future, it is worth expanding the research by models for each country.

Keywords: sustainability; trust; distress; transport services; road freight transport; modal shift potential; shift paradigm; modelling; prediction; General Discriminant Analysis

1. Introduction

The article focuses on an extremely important subject of trust and distress prediction in modal shift potential of long-distance road freight in containers. An attempt was made to define the concept of trust in the context of the modeling approach in transport services, including the concept of sustainability and the shift paradigm. For the purposes of the article, the main hypothesis was formulated: trust and distress in the implementation of the shift paradigm (based on cooperation) depends on the scale of the environmental burden of transport (production and consumption patterns). Expanding, it can be considered that quantitative predictors express the environmental burden of transport. The aim of the article is to indicate the directions and criteria for the implementation of the shift paradigm, inscribed in the idea of sustainable transport. The auxiliary goal is to predict which countries in a given year will have the TRUST status, i.e. implement the shift

paradigm, and which will not implement it (DISTRESS status). The structure of work is subordinated to these purposes, which consists of 5 main parts: first – introduction; second – literature background, where the literature review was done: the concept of trust was discussed, interpretation of sustainable development and the shift paradigm were given. The third part describes the test methods used and presents the research stages. The fourth part presents innovative, original research - econometric model (GDA) along with utility profiles. The article ended with a discussion.

2. Literature background

Every economic relationship is linked to trust, which is an essential link of services, especially transport. The complexity and dynamics of the real economic sphere requires, on the one hand, cooperation and trust, on the other, it creates an economic distress. Therefore, the semantic delimitation of the term "trust" for classic and innovative approaches is necessary. The first one is associated with a subjective measure, a repeating pattern. The second one takes into account new criteria. Selected literature items were used in terms of the economic environment. Traditionally, trust means a way to deal with social uncertainty and complexity [1]. Confidence is a higher value and increases efficiency. This is a phenomenon that in economics is called external effects [2]. Thus, they can be formulated as an expectation that is formed in a community about the regular, honest and cooperative behavior of other members of the community based on commonly recognized norms [3]. In addition, it is the expectation that the partner can be relied on and that he will keep his commitments in a predictable way and that he will act honestly in the face of various possibilities [4]. Trust imposes on the person of trust the obligation to keep the promise. What counts is the attitude of keeping the promise, the oath as honoring your own declaration of will [5], thus convincing one party of the relationship that the other party will not act against your interests, accepted without doubts and suspicions in the absence of detailed information about the other party's actions [6]. To respect the principles of many people in response to the need for a complex society. Trust is also the conviction that a business partner will take care not only of his or her interest to maintain the exchange relationship [7]. It is also a belief based on moral obligations [8]. Kramer dissociates himself from the recognition of trust as a belief, treating it as a compatible decision with ethical expectations [9]. It is an expression of free will.

Then, the literature recognizes the context of the approach to trust, e.g. from the side of the consumer, manager or the whole organization. On the one hand, it means the regulator of decisions made by consumers on the market [10] and the consumer's expectation that his weaknesses will not be used in a situation considered risky [11]. On the other hand, the manager's faith in the strength and capabilities of his subordinates [12]. It is also a factor enabling organizations to face the complexity and changeability of economic reality [13]. A component of customer relations in the logic of service dominance in the concept of managing a promise [14]. A directed relation between two units: trusting and a trustee with risks [15]. Social aspect of the relations connecting participants of economic life [16]. The capital of credibility is the sum of the resources of economic and social benefits. The plant is made about uncertain future actions of people is a key factor in the relationship [17]. Consumer confidence the reliability and integrity of online resellers that lead to a successful transaction (via the Internet) [18]. Believing that a trustworthy person is motivated by good intentions and that he is capable of fulfilling what is expected of him [19]. Trust is organizational value, which requires strong ethical foundations [20]. On the one hand (rational) means the assessment of competence and credibility and the possibility of relying on the other person; on the other (affective)) - is the result of emotional ties created between cooperating people [21].

An innovative approach to trust captures them as a balance of strategic interaction (moral hazard and uncertainty in political activities) between agents and policy makers with incentives for deviations [22]. A key element of society playing a key role in creating interaction and relationships in the context of a platform and service peer-to-peer [23]. Derivative of the personality of the individual and perceived object reliability [24]. Faith to others in providing accurate assessments due to the preferences of the active user. Global trust is the average opinion of the whole community about the credibility of the user [25]. Relying on others not to be used. On the other hand, being

trustworthy means that you do not use others for lack of satisfaction [26]. Confidence is influenced by intensively and dynamically diverse factors that appear in diverse environments, by the environment of the economic entity and the individual. For example, citizens' trust in local government authorities. The level of attachment to tourist events affects perception and emotional reactions, creating support based on the theory of social exchange and cognitive theory of assessment [27]. The main difference in the perception of trust in traditional and modern style is the distinction of relationships.

Modern global trust models include user reputation calculations, and almost historically local trust models define trust between two users based on their previous interactions. Confidence in classical interpretation usually means expectation, conviction. In turn, in the novel approach - promise. A common element in the various definitions of trust is the intention to accept sensitivity based on positive expectations. A look at trust in transport services requires taking into consideration at least two points of view: the client's perspective and the perspective of the carrier, and the type of transport and the content of transport, i.e. passengers, freight. Taking into account the definitions of trust for the purposes of this article, the authors created a definition referring to the specificity of transport as close to Di Maggio [28] and Bachmann, Zaheer [13] treating trust as a factor enabling enterprises to better use the opportunities created by a variable security-based environment the flow of goods and people XXX is therefore a condition enabling organizations to face the complexity and volatility of economic reality. Furthermore, trust is based on the honoring of commitments and is a factor in facilitating the use of new opportunities provided by the changing environment [28].

Trust-related values are characteristics of service providers in relation to rational action, in accordance with the Order of relations assigned to human-focused services. Among these traits, it should distinguish between compulsiveness, accountability, credibility and a sense of mission [background of my new "Connecting thoughts": The value in combination with trust is the characteristics of service providers towards rational action, according to the Order of relationship, assigned to human-oriented services. Among these traits are dutifulness, accountability, credibility, a sense of mission – ed.]. The desired direction depending on the idea of Ordo is to shape the order corresponding to the human nature, without which it is difficult or impossible to provide services [29].

On the background of the presented positions, it is, in particular, important to place the issue of trust in transport. The problem of transport trust is raised in the studies by Ivuts and Matwiejczuk, paying special attention to the contemporary complexity and multidimensionality of the transport process as well as delivery time, which is considered one of the key factors determining the quality of transport services. The attractiveness of freight traffic is a fairly complex process, including services of various types of transport, forwarding services, handling of cargoes and their storage at terminals, etc. [30]. However, future-oriented, modern processes, including transport, require a continuous flow of information in order to constantly develop knowledge [31]. But with regard to the movement of goods, services and manpower there are still many untapped possibilities for changing and extending economic activity. One of the solutions that can help to improve the business environment and economic growth is to ensure a unitary market [32].

As notes by Załoga, in the context of the socio-economic and political integration of the EU, liberalization is an appropriate method for the creation of a unitary market for transport services [33]. Regulation of the EU's transport services market mainly relied on economic regulation of a structural nature (conditions for market access and the occupation of the carrier), which influenced the shaping of the supply side of services [33]. However, the interest in social regulation has increased in recent years. It has been caused by concern for the environment in a global sense, the need to ensure the safety of transport and its users. As added by Załoga, economic and social regulations often seek to exclude and even conflicting objectives [33]. Sustainability is based on the principle of harmonization of objectives (economic, environmental and social) and long-term actions with short-term decisions. Sustainability is linked to the need for development programming [34]. Alleviating these conflicting objectives is conducive to sustainable transport policies, derived from the idea of sustainable development [33]. One of the paradigms of sustainable transport is the shift paradigm, so-called

modal shift. This paradigm is the expression of new patterns of production and consumption of services, relevant to environmental constraints [33]. Załoga notes the three conditions for the adoption of this paradigm in EU transport policy [33]:

1. The need to halt the dominance of road transport in the transport needs of society and the economy- road transport is characterized by a relatively high environmental impact and affects the barriers to supply of services of modals (congestion, occupancy of area).
2. Convinced of the occurrence of high-substitutability services of inland (road and rail) and water transport.
3. Conviction of high complementarity between modals and means of transport.

In principle, the *shift paradigm* refers to two types of shifts [33]:

- freight - from road transport to water or rail transport;
- people/passengers - from the use of passenger cars for public transport.

From a shift paradigm perspective, the functionality of complementary transport is important. Land transport (road and rail) is a condition for the operation of air and water transport, as it links these transport modals with their target markets [35]. Therefore, the question of cooperation and trust plays an important role.

According to Kożuch and Sienkiewicz-Małyjurek, the phenomenon of cooperation between organizations derives from the necessity of cooperation, goodwill, commitment and trust [36]. This approach should in principle serve as a basis for the implementation of the *paradigm of shift*. Moreover, in addition-from an analytical perspective-may be the approach of Jabłoński [37]. He points out that when performing multidimensional analysis, attention should be paid to the importance of public trust in value building. Trust becomes a determinant of the relationship between individual stakeholders and the audience of public value development [37]. These groups may be referred to all transport users, including shift paradigm implementers and recipient services formed by the realization of this paradigm.

Therefore, the study of modal shift potential of long distance road freight in containers seems to be quite interesting in this context. There have not yet been any author's studies in which this research object was examined in relation to the trust modelling.

3. Data, Methods & Steps

In order to carry out the study on trust and distress prediction in modal shift potential of long-distance road freight in containers, the secondary data from Eurostat [38] and OECD.Stat [39] databases were used. It was assumed that the research period is 2011-2015. The beginning of the research period coincides with the year of publication of the final "*White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*" [40] and end of this period-last updated data. Sixteen countries were included: Bulgaria, Czech Republic, Finland, France, Hungary, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom. The choice of countries was deliberate by reason of the European territory and was dictated by the quality, completeness and availability of the data during the analysis period. The following designations and abbreviations for the representative variables used in the paper have been adopted[1]:

Trust: one of the dichotomous values for the DT variable for trust status, corresponds with value equal to 1;

Distress: one of the dichotomous values for the DT variable for distress status, corresponds with value equal to 0;

DT: qualitative dependent variable with vector-encoded (dummy variable); takes value equal to "Trust" (trust status, not distress) or "Distress" (distress status, not trust); to specify the value, the data from Eurostat database for modal shift potential of long-distance road freight in containers [tran_im_mosp] were used (percentage of total tkm).

[1] Quantitative predictors express the environmental burden of transport.

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In the event that this structure ratio has not increased in relation to the reference period (2011), the variable DT was equal to "Trust" (1); if it increased, then it took the value equal to "Distress" (0);

TS: continuous predictor; modal shift potential of long-distance road freight in containers (in percentage of total tkm); data from Eurostat database [tran_im_mosp];

RFTG: continuous predictor; road freight transport (in tkm per 1000 units of current USD GDP); data from OECD.Stat [..IND-Meas-Roadgood-GDP];

SRFT: continuous predictor; share of road freight transport in total inland freight transport (in percentage); data from OECD.Stat [..IND-Meas-Roadgood-Share];

CO2EG: continuous predictor; CO_2 emissions from transport (in tonnes per 1 000 000 units of current USD GDP); data from OECD.Stat [..IND-Ene-GDP];

SCO2: continuous predictor; share of CO_2 emissions from road in total CO_2 emissions from transport (in percentage), data from OECD.Stat [..IND-Ene-Road];

ENRTG: continuous predictor; motor fuel deliveries (in tonnes per 1 000 000 units of current USD GDP); data from OECD.Stat [..IND-Ene-Fuel-GDP].

Mainly, taxonometric methods and Generalized Discriminant Analysis (GDA) were used in this paper (in-depth research using these methods was carried out by: Zioło, Porada-Rochoń & Szaruga [41]).

The first step in the study is to identify the status (trust/distress) of each country and year on the basis of the criterion described above [Table 1]. It has been assumed that EU countries that implement the shift paradigm (in the sense of year to 2011), which are inscribed in the sustainable transport policy, can be called the TRUST. Those that do not realize it (in the sense of year to 2011), and the name DISTRESS.

Table 1. Countries and years with trust status and distress status in modal shift potential of long-distance road freight in containers for selected European countries

Country	2011	2012	2013	2014	2015
Bulgaria	Trust	Trust	Trust	Trust	Trust
Czech Republic	Trust	*Distress*	*Distress*	Trust	Trust
Finland	Trust	*Distress*	Trust	*Distress*	Trust
France	Trust	Trust	*Distress*	*Distress*	Trust
Hungary	Trust	*Distress*	*Distress*	*Distress*	*Distress*
Latvia	Trust	*Distress*	Trust	Trust	Trust
Lithuania	Trust	*Distress*	*Distress*	*Distress*	Trust
Luxembourg	Trust	*Distress*	Trust	Trust	Trust
Netherlands	Trust	Trust	Trust	Trust	Trust
Poland	Trust	Trust	*Distress*	*Distress*	Trust
Portugal	Trust	Trust	Trust	Trust	Trust
Slovak Republic	Trust	Trust	Trust	Trust	Trust
Slovenia	Trust	*Distress*	Trust	Trust	*Distress*
Spain	Trust	Trust	*Distress*	Trust	Trust
Sweden	Trust	Trust	*Distress*	Trust	Trust
United Kingdom	Trust	*Distress*	Trust	Trust	Trust

Source: own elaboration based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database (access: 02/05/2018).

As indicated in Table 1, Bulgaria, Netherlands, Portugal and Slovak Republic had a trust status throughout the entire period considered, which means that they implemented the principles of the shift paradigm in 2011-2015. Hungary, which in the years 2012-2015 had distress status relative to the shift paradigm, remains in that context. Among the countries that were marked with the distress status in only one calendar year were: Latvia, Luxembourg, Spain, Sweden and United Kingdom. Apart from the reference year, the year 2011 was characterized by the highest number of states with the status of trust (87.5%), the situation was bad in 2012 - as much as 50% of analyzed countries with the status of distress.

The next stage of the study consisted in classifying the examined countries into clusters due to similar features. For this purpose, the k-means algorithm was used (taking into account standardization, the measure of Euclidean distance and maximization of cluster distances from initial centers). Previously conducted test using a test sample, where it was assumed that the minimum number of clusters is 1, and the maximum is 16; the minimum decrease is 5%. As a result of the clustering properties assessment, only one cluster was verified and the distances from the center of the cluster were estimated (Table 2).

Table 2. Distance from the center of the cluster

Country	2011	2012	2013	2014	2015
Bulgaria	1,0509	0,8743	0,9040	0,9104	1,2677
Czech Republic	1,1539	1,4682	1,4597	1,0809	1,1800
Finland	1,2261	1,4941	1,1449	1,4995	1,2797
France	1,1918	1,1200	1,4784	1,5034	1,1979
Hungary	1,1646	1,4722	1,4447	1,4739	1,5637
Latvia	1,4598	1,6924	1,2742	1,2750	1,3906
Lithuania	1,3194	1,5994	1,6095	1,6149	1,3956
Luxembourg	1,3144	1,5965	1,1838	1,1881	1,2510
Netherlands	1,3930	1,3373	1,3369	1,3530	1,4444
Poland	1,2312	1,1528	1,5352	1,5337	1,2991
Portugal	1,1811	1,1163	1,0778	1,1056	1,1961
Slovak Republic	1,3350	1,3252	1,1364	1,1790	1,2453
Slovenia	1,4236	1,7351	1,3847	1,3661	1,7967
Spain	1,2731	1,1786	1,5885	1,1301	1,1964
Sweden	1,2385	1,1674	1,5128	1,1998	1,2667
United Kingdom	1,2335	1,5241	1,1573	1,2246	1,2884

Source: own calculation based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database and OECD.Stat [..IND-Meas-Roadgood-GDP; ..IND-Meas-Roadgood-Share; ..IND-Ene-GDP; ..IND-Ene-Road; ..IND-Ene-Fuel-GDP] http://stats.oecd.org/ (access: 02/05/2018).

By means of estimated Euclidean distances from the center of the cluster using the k-means method, it can be concluded that in no year did any of the countries significantly differ from each other due to the studied statistical features. No outliers were noticed either. Therefore, all years and all countries can be included in one model without the need to divide the sample into smaller ones.

The next stage of the research is the evaluation of the variability of the variables under investigation, and then the estimation of the model parameters using GDA. After positive verification of the model - for the desired properties, an approximation of the utility function should be made. To this end, the utility function for TRUST has been defined:

- low - for 0.00, utility is 0.00,

- indirect: for 0.50, utility equal to 0.5,
- high: for 1.00, utility 1.00,

whereby optimum values have been given to the factors. The curvature of s (low) is equal to 1.00 and t (high) is equal to 1.00. The inverse range would have the usability function for DISTRESS-for low value high usability, and for high value of low usability. In practice, it only means replacing colors on the service contour profiles of scenarios [see part 3 of paper]. The test culminates in obtaining profiles for posteriori and utility probabilities. Empirical results are shown in the following section.

4. Empirical results

Table 3 shows the basic descriptive statistics for the variables examined. The data shows that the greatest variability (in the spatial-temporal dimension) characterized the variable RFTG, and the smallest SCO2. The variability in the spatial-temporal dimension of the remaining variables was at a predictable level of 30-40%.

Table 3. Basic descriptive statistics for cluster

Variable	Mean	Standard deviation	Variation coefficient
TS	53,9900	17,4480	32,3171
RFTG	227,7875	181,8065	79,8141
SRFT	70,2575	19,4214	27,6431
CO2EG	76,9625	31,6230	41,0888
SCO2	95,0375	3,3246	3,4982
ENRTG	23,5375	10,4093	44,2242

Source: own calculation based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database and OECD.Stat [..IND-Meas-Roadgood-GDP; ..IND-Meas-Roadgood-Share; ..IND-Ene-GDP; ..IND-Ene-Road; ..IND-Ene-Fuel-GDP] http://stats.oecd.org/ (access: 02/05/2018).

Table 4 provides summary of multiple regression (stepwise progressive). In four stages it was possible to determine the variables included in the model and excluded from it. Only three variables were significant from the point of view of the conducted study, i.e. TS, CO2EG, ENRTG. Therefore, the parameters of General Discriminant Analysis (GDA) were evaluated further with all effects in next stage.

278 **Table 4.** Multiple regression summary (stepwise progressive)

Effect	Steps	Degree of freedom	F to remove	P to remove	F to put	P to put	Decision
TS	Step 1	1			7,89943	0,006250	Entered
RFTG		1			0,44796	0,505283	Outside
SRFT		1			0,32878	0,568026	Outside
CO2EG		1			0,00414	0,948879	Outside
SCO2		1			1,09327	0,298977	Outside
ENRTG		1			1,13102	0,290839	Outside
TS	Step 2	1	7,89943	0,006250			In model
RFTG		1			1,85578	0,177084	Outside
SRFT		1			0,08135	0,776241	Outside
CO2EG		1			11,43696	0,001134	Entered
SCO2		1			0,80317	0,372940	Outside
ENRTG		1			0,65892	0,419444	Outside
TS	Step 3	1	20,38823	0,000022			In model
CO2EG		1	11,43696	0,001134			In model
SRFT		1			0,00513	0,943069	Outside
RFTG		1			0,40656	0,525637	Outside
SCO2		1			1,67220	0,199882	Outside
ENRTG		1			4,20252	0,043813	Entered
TS	Step 4	1	20,51015	0,000022			In model
CO2EG		1	15,33358	0,000195			In model
ENRTG		1	4,20252	0,043813			In model
RFTG		1			0,28034	0,598040	Outside
CO2EG		1			0,16052	0,689815	Outside
SRFT		1			0,26922	0,605384	Outside

279 Source: own calculation based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database
280 and OECD.Stat [..IND-Meas-Roadgood-GDP; ..IND-Meas-Roadgood-Share; ..IND-Ene-GDP; ..IND-
281 Ene-Road; ..IND-Ene-Fuel-GDP] http://stats.oecd.org/ (access: 02/05/2018).
282

283 The analysis of standardized coefficient β (beta) shows that the strongest influence on the
284 recognition of countries with the status of trust or distress is expressed by CO2EG, then TS and
285 ENRTG. Standardized coefficient shows which variables are the most efficient in discriminating
286 between trust and distress countries. Contribution in discriminating between trust and distress class
287 is distributed as follows: approx.. 66,82% from TS, 79,37% from CO2EG and 355,76% from ENRTG.
288 The correct recognition of countries as trust units with the positive contribution has CO2EG and with
289 negative - TS and ENRTG. Opposite influence with the same level of efficient in discriminating noted
290 for distress units.

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Table 5. The parameters evaluation of GDA for 16 analyzed countries (cluster)

Effect	Trust parameter	Trust standard deviation	Trust t	Trust p-value	Trust β	Trust standard deviation β
Const	1,1479	0,1463	7,8437	0,0000		
TS	-0,0172	0,0038	-4,5288	0,0000	-0,6671	0,1473
CO2EG	0,0113	0,0029	3,9158	0,0002	0,7937	0,2027
ENRTG	-0,0154	0,0075	-2,0500	0,0438	-0,3576	0,1744

Effect	Distress parameter	Distress standard deviation	Distress t	Distress p-value	Distress β	Distress standard deviation β
Const	-0,1479	0,1463	-1,0105	0,3155[1]		
TS	0,0172	0,0038	4,5288	0,0000	0,6671	0,1473
CO2EG	-0,0113	0,0029	-3,9158	0,0002	-0,7937	0,2027
ENRTG	0,0154	0,0075	2,0500	0,0438	0,3576	0,1744

[1] no statistical significance

Source: own calculation based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database and OECD.Stat [..IND-Meas-Roadgood-GDP; ..IND-Meas-Roadgood-Share; ..IND-Ene-GDP; ..IND-Ene-Road; ..IND-Ene-Fuel-GDP] http://stats.oecd.org/ (access: 02/05/2018).

Table 6 presents descriptive statistics for individual classes. Countries with the status of trust had, on average, lower energy intensity than countries with the distress status, to greater extent used other transport modes than the road (difference of 12 percentage points) in long-distance freight transport in containers, but also had a higher intensity of carbon dioxide than states with distress status. However, it should be noted that the trust class has as much as 72.5% of observations and the distress class is the remaining 27.5%, so the difference in the intensity of carbon dioxide emission is insignificant.

Table 6. Basic descriptive statistics of predicates in classes

Variable	Mean	Standard deviation	Variation coefficient	Mean	Standard deviation	Variation coefficient
	Trust (p=0,7250)			**Distress (p=0,2750)**		
TS	50,7517	17,6560	34,7890	62,5273	13,9207	22,2634
CO2EG	77,1035	34,0808	44,2014	76,5909	24,6802	32,2234
ENRTG	22,7759	10,8871	47,8010	25,5455	8,9481	35,0281

Source: own calculation based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database and OECD.Stat [..IND-Meas-Roadgood-GDP; ..IND-Meas-Roadgood-Share; ..IND-Ene-GDP; ..IND-Ene-Road; ..IND-Ene-Fuel-GDP] http://stats.oecd.org/ (access: 02/05/2018).

Table 7 presents the tests of decomposition of effective hypotheses, verifying the significance of the variables used to identify trustworthy and unreliable units. Verification tests of Wilks, Pillai, Hotteling and Roy shows that all variables were significant.

315 **Table 7.** Multivariate tests of significance

Effect	Test	Value	F	Effect - df	Error - df	p
Const	Wilks	0,5526	61,5232	1	76	0,0000
	Pillai	0,4474	61,5232	1	76	0,0000
	Hotelling	0,8095	61,5232	1	76	0,0000
	Roy	0,8095	61,5232	1	76	0,0000
TS	Wilks	0,7875	20,5101	1	76	0,0000
	Pillai	0,2125	20,5101	1	76	0,0000
	Hotelling	0,2699	20,5101	1	76	0,0000
	Roy	0,2699	20,5101	1	76	0,0000
CO2EG	Wilks	0,8321	15,3336	1	76	0,0002
	Pillai	0,1679	15,3336	1	76	0,0002
	Hotelling	0,2018	15,3336	1	76	0,0002
	Roy	0,2018	15,3336	1	76	0,0002
ENRTG	Wilks	0,9476	4,2025	1	76	0,0438
	Pillai	0,0524	4,2025	1	76	0,0438
	Hotelling	0,0553	4,2025	1	76	0,0438
	Roy	0,0553	4,2025	1	76	0,0438

316 Source: own calculation based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database
317 and OECD.Stat [..IND-Meas-Roadgood-GDP; ..IND-Meas-Roadgood-Share; ..IND-Ene-GDP; ..IND-
318 Ene-Road; ..IND-Ene-Fuel-GDP] http://stats.oecd.org/ (access: 02/05/2018).
319

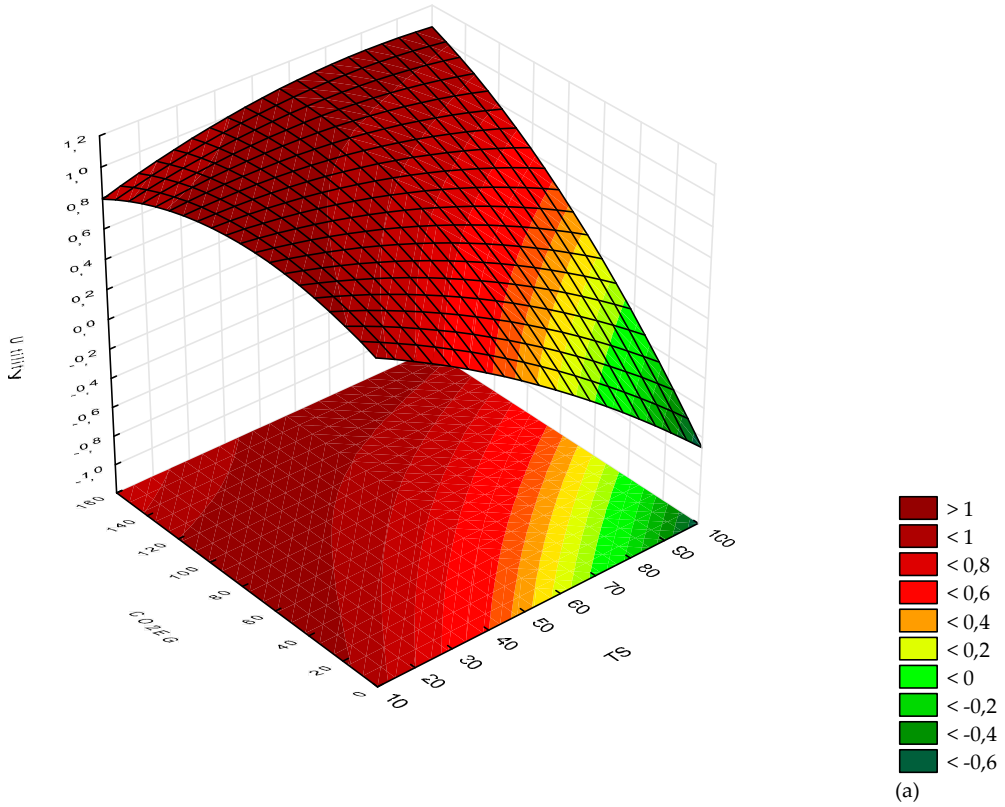
320 Table 8 contains the percentages of correctly classified countries to the trust or distress class. The
321 model allowed to classify up to 80% of cases into two groups. The model was more accurate for
322 trusted units than untrusted ones. On the basis of it, the units with the status trust can be selected
323 with greater probability than with the status of distress. As many as 93% can correctly identify those
324 units that will meet the criteria for achieving a trust, but only in 45% can be selected those units that
325 will change direction to the status of distress.

326 **Table 8.** Classification matrix to trust (1) or distress (0) for cluster

Class	Percent - Correct	Trust	Distress
Trust	93,10345	54,00000	4,00000
Distress	45,45455	12,00000	10,00000
Totality	80,00000	66,00000	14,00000

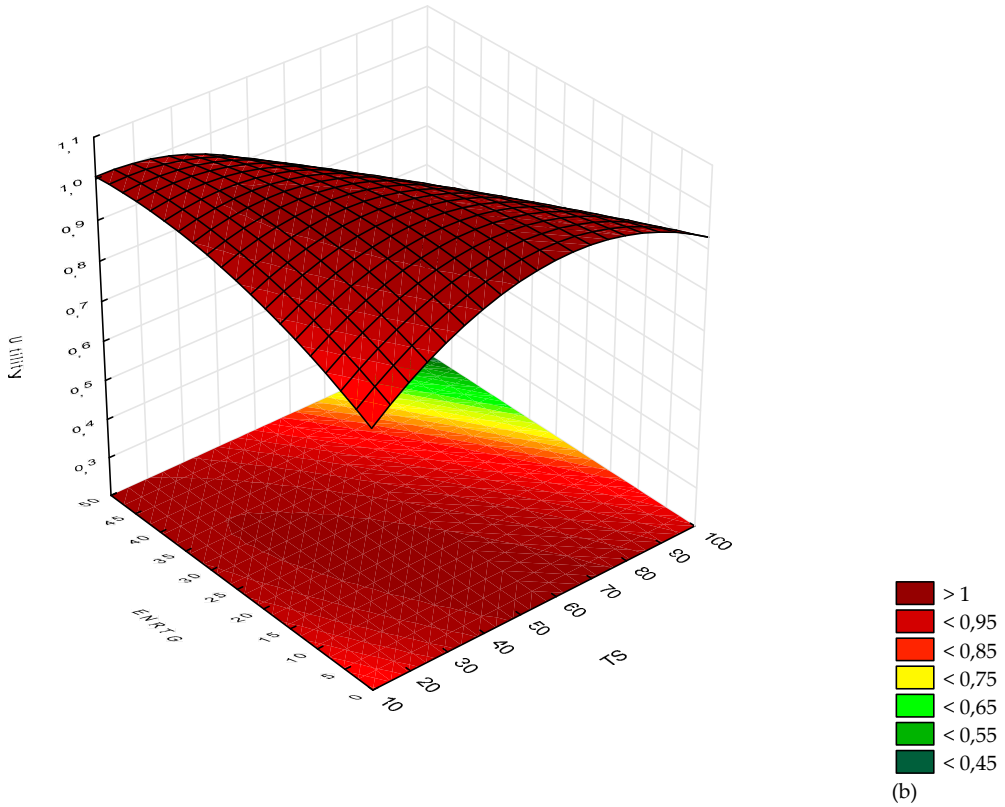
327 Source: own calculation based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database
328 and OECD.Stat [..IND-Meas-Roadgood-GDP; ..IND-Meas-Roadgood-Share; ..IND-Ene-GDP; ..IND-
329 Ene-Road; ..IND-Ene-Fuel-GDP] http://stats.oecd.org/ (access: 02/05/2018).
330

331 Figure 1 shows utility ranges of the examined criteria for the assessment of trust or distress in
332 modal shift potential of long-distance road freight in containers for selected European countries
333 (scenarios). Red fields mean high utility - desired (TRUST) and green low - undesirable (DISTRESS).
334 Which means that there is not one optimal scenario for the implementation of the shift paradigm, and
335 there are infinitely many of them. Similarly when it comes to DISTRESS.



(a)

336



(b)

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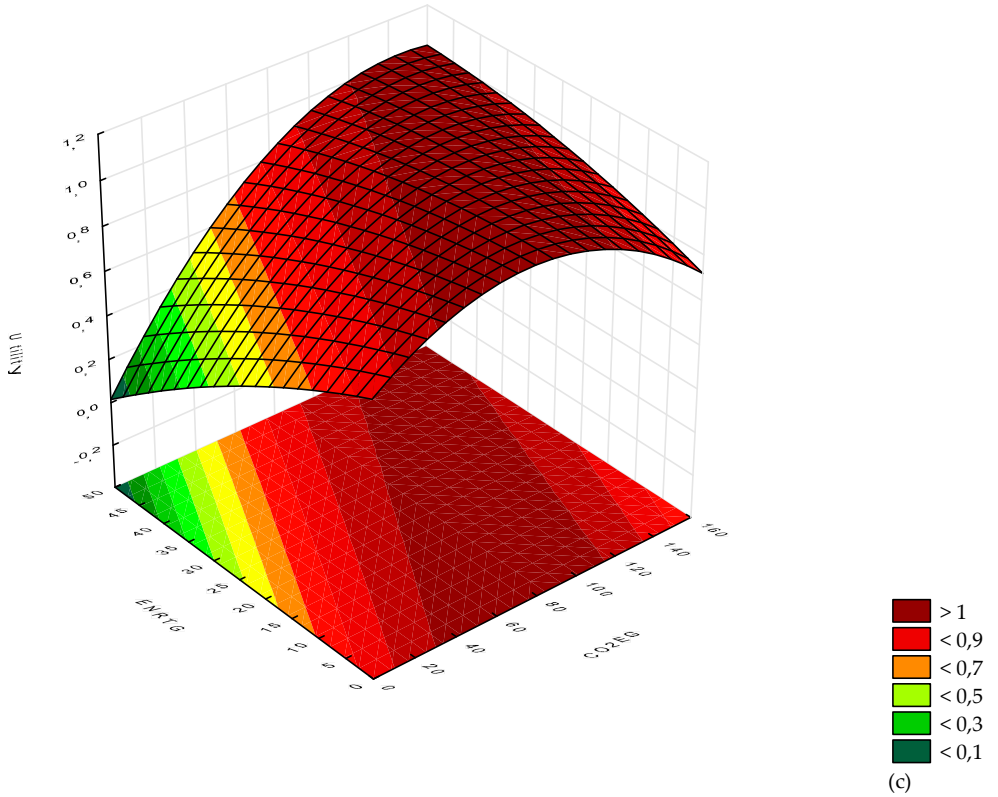

Figure 1. Utility ranges of the examined criteria for the assessment of trust or distress in modal shift potential of long-distance road freight in containers for selected European countries

Source: own calculation based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database and OECD.Stat [..IND-Meas-Roadgood-GDP; ..IND-Meas-Roadgood-Share; ..IND-Ene-GDP; ..IND-Ene-Road; ..IND-Ene-Fuel-GDP] http://stats.oecd.org/ (access: 02/05/2018).

In the summary of the investigation appear the profiles for posteriori and utility probabilities. It can be shown that the selected variables for the identification of EU countries with the status of TRUST were well-founded. Total utility oscillated within the limits of 0.99. Furthermore, it is noteworthy to underline that the aggregate probabilities are 1.00, which indicates a properly conducted study.

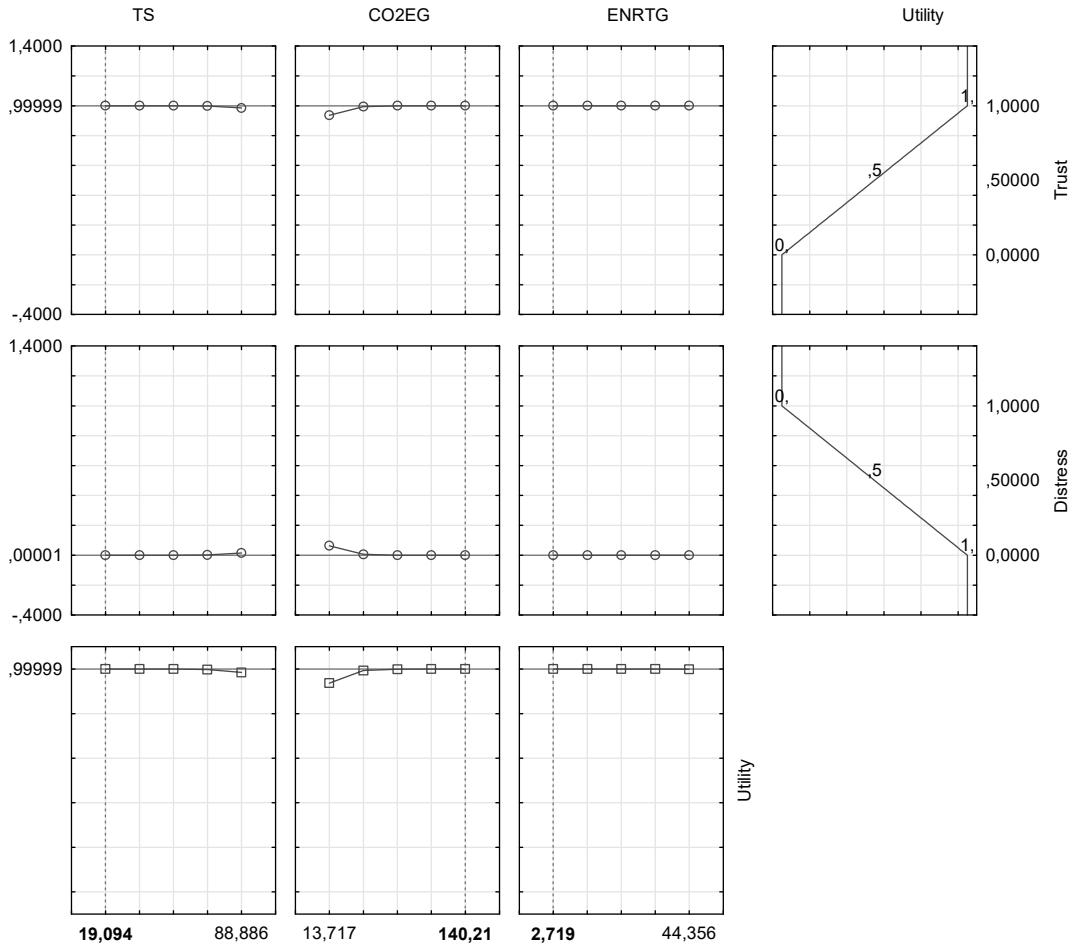

Figure 2. Profiles for posteriori and utility probabilities

Source: own calculation based on data from Eurostat [tran_im_mosp] http://ec.europa.eu/eurostat/data/database and OECD.Stat [..IND-Meas-Roadgood-GDP; ..IND-Meas-Roadgood-Share; ..IND-Ene-GDP; ..IND-Ene-Road; ..IND-Ene-Fuel-GDP] http://stats.oecd.org/ (access: 02/05/2018).

5. Discussion

The conducted research confirms that the quantitative approach to the issue of trust (non-quantitative) is worth deepening and developing. There are not many quantitative studies on trust in economics, a negligible number in transport. However, no research was done on modal shift potential of long-distance road freight in containers (expresses the scope of intermodal transport activities). The authors managed to combine three very broad terms: trust, sustainability, shift, and propose methodology and the results of the author's research. The hypothesis has been verified and the goals achieved.

Only three predictors were significantly different from zero. TS, CO2EG and ENRTG [table 4]. It means that the standardized coefficient β indicates which variables are the most efficient in discriminating between trust and distress countries [table 5]. The most efficient in discriminating between these two groups CO2EG (contribution above 20%), next ENRTG - contribution is above 17% and TS - contribution approx. to 15%. In this discriminatory analysis all variables in analysis were important, what the results indicate by Wilks, Pillai, Hotelling, Roy tests [table 7]. On the basis of the model, it is possible to predict units that will implement the shift paradigm (probability of about 93%) than those that will be characterized by the erosion of confidence in the shift paradigm

(45% probability). Which may mean that it is more likely to correctly identify trustworthy units than those that will lose our trust [table 8].

The model enables correct classification of 80.00% cases to trust and distress group (both).

Regarding the usability ranges of the examined criteria for the assessment of trust or distress regarding the possibility of modal shift of long-distance road transport in containers for selected European countries [figure 1], it should be noted that the choice of the optimal scenario depends only on the utility value that satisfies the decision maker. Optimal scenarios are infinitely many, depending on the extent of the burden on the environment, you can assess how strong changes can be made to be able to implement the idea of sustainable development. The impedance range of the shift paradigm is very flexible, thanks to which it allows adapting to dynamically changing macroeconomic conditions, sometimes even turbulent ones. Therefore, the authors are deeply convinced that the proposed approach is a contribution to the creation of a comprehensive methodology of trust and distress prediction in intermodal transport in the light of the challenges of sustainable development.

Based on the results and conclusions of the research, the own definition of trust in intermodal transport was formulated. Trust in modal shift potential of long-distance road freight in container is based on the implementation of the shift paradigm, inscribed in the idea of sustainable transport. It is expressed by the scale of the environmental burden of transport activity, using a vector: modal shift potential of long-distance road freight in containers, CO_2 emissions from road in total CO_2 emissions from transport and motor fuel deliveries [own definition – ESZ & EZ]. Ensuring safety in the implementation of the shift paradigm is therefore an integral element of trust and a form of protection against the threat. This applies in transport to ensuring continuity in meeting transport needs with various transport modals [own definition – ES & WM].

In the future, it is worth expanding the research by models for each country, taking into account the wider range of macroeconomic conditions and the drifting of the economy. An inseparable element of the drifting drift is structural shocks, which may indicate the participation of the main factors of disruption / erosion of trust.

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