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DESIGN OF AN INNOVATIVE DASHBOARD FOR ASSESSMENT OF RISKS THAT ARE SPECIFIC TO E-COMMERCE ACTIVITY

Abstract. *The current global sanitary crisis determined consumers to use e-commerce in all its forms. It has led to an expansion of e-commerce activity and increased associated risk, as companies must adapt quickly to new market conditions and cope with all the risks that arise in such context. This paper aims to identify and assess the relevant risks specific to e-commerce activity and prevent unethical behavior that is often associated with entities operating in this sector by consumers. The review of a significant part of the literature confirms that e-commerce business directly impacts performance and sustainability, being positively associated with organizational innovation. However, investigating the nature and intensity of the risks associated with the operational activity is difficult to assess. It is the main reason for mistrust increasing among many consumers and stakeholders. This research also derives from the fact that it provides real tools to prevent, reduce and even eliminate risks specific to e-commerce activities. Therefore, it could directly contribute to increasing the sustainability of businesses and gaining the trust of consumers regarding online shopping activities. An investigation was conducted in the following logical sequence: identifying the main risk categories and triggers; establishing the link between working hypotheses and the minimum threshold argumentation associated with them. According to the above, it is possible to establish a specific risk function for each risk category. To determine the minimum threshold of risk influence, the unitary risk assessment methodology was applied using a scale of values from 1 to 5, depending on the impact on the operational activity, performance, and sustainability of the e-commerce business. The research methods are specific to quantitative research, the object of the research being a sample of 208 economic entities operating in the e-commerce sector. The statistical analysis regarding the behavior of the most relevant financial indicators was achieved by collecting data from financial reporting and other internal sources. The results serve as an empirical confirmation regarding the specific difficulties encountered in e-commerce activity that need to be solved. Therefore, a dashboard was developed to monitor triggers by risk segments. The designed dashboard is intended to support management in the decision-making process to*

ensure business sustainability and improve the business model in line with the adopted business strategies. At the same time, with the help of the risk functions developed by risk segments, management could monitor and control the threats to which the operational activity in the online environment is exposed, which will lead to business consolidation and penetration of new online markets.

Introduction. The multiple innovations coupled with extensive changes in the global economic context regarding opportunities on the market and changes in the direction of new business models could help find new and viable solutions against the inevitable old and new risks faced by economic entities. In this context, this paper aims to 1) identify the relevant risks e-commerce activity faces; 2) prevent unethical or tax evasion behavior which e-commerce entities are often suspected of; 3) find solutions and concrete answers to crises that are becoming more and more frequent nowadays. To achieve the aim intended in this paper, the following objectives were pursued: Objective 1 – Analysis of cash-flow behavior, turnover, gross profit, the financial capacity to find the vulnerable niches from the operational activity; Objective 2 – identification of the influencing factors (positive and negative) on the e-commerce activity*; Objective 3 – building the dashboard of relevant risks which affect most the e-commerce activity. The study was carried out on 208 economic entities which operate in the e-commerce domain, and the statistical analysis of the behavior of the financial and accounting indicators was realized by collecting data from annual financial statements and other internal sources. The obtained results include developing a risk assessment model specific to the e-commerce activity. It could be used as a reliable tool in quantifying risks by the economic entities that operate in the sector and by the auditing bodies that often face atypical situations concerning the legislative requirements of fiscality and/or accounting.

Literature Review. E-commerce developed continuously in the last decade, changing business interfaces (Botha et al., 2008). However, it had a rapid expansion in the present conditions created by the sanitary pandemic, which broke out at the end of the year 2019 when the majority of businesses went into the online environment (Habib and Hamadneh, 2021; Harish et al., 2021). The development of e-commerce was influenced by a series of factors like the trust of clients, the quality of goods and services, the developed commercial brands, the involvement of state institutions, the accessibility of clients to the internet (Thompson et al., 2019; Babenko et al., 2019), but also the computer security, the usefulness perceived by the clients on using the electronic commerce (Kabango and Asa, 2018) and the suitable protection of the consumer rights (Bińczak et al., 2018). The theoretical analysis showed that most of the research in this field is approached from the client's perspective and their behaviour regarding e-commerce. This research intended to identify the main financial and non-financial factors that positively and negatively influence the e-commerce. Based on a set of 624 companies from 10 countries, Zhu and Kraemer (2005) demonstrated that a bigger degree of e-commerce is associated with improving business performance. It is in line with the results of Mohamed et al. (2009), Chang et al. (2015), and Morosan et al. (2017), which show that e-commerce positively influences the performance of tourism companies even and applications of e-commerce affect the performance of these companies (Fuchs et al., 2010) positively. Also, Popa et al. (2018) suggest that e-commerce business directly affects financial performance and is positively associated with organizational innovation. On the other hand, Šaković et al. (2020) demonstrated no direct relationship between e-commerce and the company's performance. Still, it is recommended the approach of mediation. The results of these studies motivate us to analyse cash-flow behaviour, turnover, gross profit, and financial capacity to identify the vulnerable niches in the operational activity. At the same time, the present pandemic forced the final consumers to use e-commerce in all its forms, which caused the growth of e-commerce within a relatively short time, contributing thus to the change in their behaviour (Akram et al., 2021). This fact implicitly caused the increase in the risks associated with e-commerce because the companies were forced to adapt themselves rapidly to the market conditions and cope with all the risks that appeared. It is necessary to establish the most relevant

risks affecting e-commerce activity in this context. For example, Lim (2003) identified four sources of risk concerning online shopping: the technological risk, the provider's risk, the consumer's risk, and the product risk, which influence the e-commerce activity. Mou et al. (2020) showed that the dimensions of the risk perceived within cross-border e-commerce could be classified as follows: the risk of the clients' liabilities, the confiscation risk, the delivery risk, the financial risk, and the confidentiality risk which excessed because of the pandemic that broke out. On the other hand, many studies in the literature examine the impact of risks on the behaviour of e-commerce clients. For example, Ariffin et al. (2018) declared that security risk is the main factor that discourages consumers from buying online. In turn, Wai et al. (2019) found that financial risk has irrelevant and negative consequences on consumers' behaviour. Nevertheless, Cao et al. (2021) demonstrated that the financial risks, among which bankruptcy or liquidation related to e-commerce companies, could be prevented or offset through an algorithm of deep learning concerning a mechanism of early warning of these risks. Besides, this paper includes the table with the most relevant studies in the literature which significantly influenced our research.

This study follows Popa et al. (2018), who demonstrated that the e-commerce business has a direct impact on financial performance even if Huang et al. (2009) claimed that the indicator of financial performance is of less importance in the decision of the companies to implement e-commerce. Burinskas and Burinskiene (2019) associated cash flow with human resources for e-commerce companies demonstrating that this decreases considerably compared to an offline business, while cash flow does not vary irrespective of the situation. Li and Liu (2012) formulated four strategies regarding human resources that improve e-commerce activity. At the same time, the risks associated with e-commerce are various and influence adopting these forms of business and financial performance. Although Crespo et al. (2009) consider that the economic and performance risks have the biggest influence on adopting e-commerce, Cazabat et al. (2019) declared the risk of incompatibility between e-commerce activities and how small and medium-sized businesses companies do business influences the e-commerce development. Therefore, on-time identification of the most relevant risks related to e-commerce and maintaining the risks to a low level would ensure an efficient online business process (Sharp, 2007). Overall, we intend to analyse e-commerce activity from the point of view of financial performance and associated risks to ensure business sustainability.

Methodology and research methods. To obtain the suggested results, a database was created. It consists of 208 economic entities operating in the e-commerce field, the selection criteria being according to their turnover. The inclusion criteria in the sample analyzed consisted of: the firms that operate in the e-commerce field; the firms that complied with the principle of continuing the activity; the financial reporting was made public; they were selected from all the fields of activity. The criteria of exclusion are established: the firms that have no online activity; the firms that registered cessations of activity.

To elaborate a reliable model of assessment of risks specific to e-commerce activity, the following strategy of research were used:

- creating a database made of a sample of 208 business entities that operate in the e-commerce field and the relative annual financial statements;
- selecting the financial accounting indicators that signalize the presence of risks specific to e-commerce activity;
- statistic modelling of financial accounting indicators selected to set their behavior for 20 years; identifying the influential factors on e-commerce activity;
- building the picture of risks specific to e-commerce activity and hierarchical classification of elements according to the generated effects;
- assigning the trend functions for each identified risk;
- developing a model of assessment of the risk of e-commerce activity on components of specific risk.

The working hypotheses on which the elaboration of this work was based are as follows:

H1 – The negative dynamic cash flows and/or turnover lead to activity risk, and the accumulation of negative variation leads to restructuring and bankruptcy risk (Manasa and Reddy, 2009; Chen et al., 2011; Wong et al., 2011; Bazhanov and Shaytura, 2013).

H2 – There is an intense correlation between the increase of the degree of indebtedness and reducing the capacity of financing with exposure to activity risk, and the accumulation of borrowed capital with negative return leads to restructuring and bankruptcy risk (Grigoroudis et al., 2012; Eskafi et al., 2015; Maximov and Khalikov, 2016; Li and Zhang, 2021).

H3 – Understaffing or staffing with unqualified personnel who induce unrealistic customer expectations, contribute to delayed orders, or fail to meet delivery deadlines leads to the risk of return of sold products, and the accumulation of negative image capital has an effect affecting the sustainability of business (Turban et al., 2006; Mehregan et al., 2012; Tsai and Cheng, 2012; Ukko et al., 2019).

H4 – There is a direct correlation between the lack of an ethical code of the company's vision and mission, concretized by not complying with the ethical principles in the e-commerce business, and the increase in risk of litigation (Olsina and Rossi, 2002; Chen, 2013; Tsvetkov, 2014a; Tsvetkov, 2014b; Aboul-Dahab et al., 2021).

To design a risk model, it is first necessary to consider the effects that should be mitigated or prevented. Thus, it is important to identify the exceptions to the risk situations that could not be assessed with the proposed model. These types of exceptions are the risks associated with data privacy, ownership and use of personal data, security risks; the regulation of cross-border data flows; fiscal risk, legal applicability, or protection of electronic payments risks. The general risk model proposed in this paper would impact e-commerce operators. It would manage their operational, financing, and investment activities, avoiding risky situations. Thus, it may endanger the relationship with clients and suppliers, investors and creditors, employees, and shareholders, and could even lead to situations of restructuring or bankruptcy. Projecting the general Model of risk. Except for the situations of risk enumerated above, this study considers that there is $R \to 0$. Thus, the perfectible dimension of the economic activity is determined by the vectorial space $R \to N$,

$$R = \prod_{i=1}^{5} R_i; \; R_i = \frac{\sum_{i=1}^{n} \alpha_i * x_i}{\sum_{i=1}^{n} x_i} \qquad (1)$$

where $i \in$ (1-n) and represents the number of nonzero triggers (that surpass the minimum threshold of risk influence); α_i – the level of impact of triggers (considering 5 impact thresholds from reduced to maximum); x_i – the unitary value (1) of nonzero triggers.

The unitary risk assessment methodology is applied to determine the minimum risk influence threshold, using the following scale of values according to the impact on the activity, performance, and sustainability of the e-commerce business. Thus, 1 – minimum risk; 2 – low risk; 3 – medium risk; 4 – significant risk; 5 – maximum risk. For establishing the values, this study considered the results' importance and dependence degree, the capacity to manage the activity of the e-commerce firms. Besides, it involves the danger they pose to managerial decisions, the business's sustainability in general, and/or to stakeholders when their informational requirements are ignored completely or partially. The generalist approach of the model would be complemented in the parts of results and discussion with its customization of the collected data to validate the working hypotheses and achieve the research aim.

Results. Thus, returning to the research aim, the working hypothesis is as follows (H1):

H1: The negative variant of cash flow and/or turnover leads to activity risk, and accumulating negative variant leads to the risk of restructuring and bankruptcy.

This study proposed the assessment of the regression function of the dependent variable cash flows concerning turnover (Cashflow_TN) concerning the regressors stocks concerning turnover (St_TN), the value of debts concerning turnover (Cr_TN); the capital rate invested (EMPRATE), and undeclared workforce (UNDECLWRK). The regression function expressed in the linear form by the method of least squares has the form:

$$MR_1 = \sum_{i=1}^{n} \alpha_i * x_i \tag{2}$$

where MR_1 – risk marker 1 the negative sales increase, respectively, and represents the regression projection of dependent variable Cashflow_TN; α_i – the value of regression coefficients; x_i – the regressors St_TN, Cr_TN; EMPRATE; UNDECLWRK.

The statistical tests carried out for the regression equation with a statistical signification of 80% are:

Table 1. Model 1: Ordinary Least Squares regression for 208 observations (dependent variable is Cashflow_CA)

	Coefficient	Std. Error	t-ratio	p-value	
St_TN	−0.398809	0.0493937	−8.074	<0.0001	***
Cr_TN	−0.298626	0.0657978	−4.539	<0.0001	***
RETURNONDEBTS	0.0370397	0.00920890	4.022	<0.0001	***
EMPRATE	0.331230	0.0223943	14.79	<0.0001	***
UNDECLWRK	0.138858	0.0747565	1.857	0.0647	*
Mean dependent var	0.303331	S.D. dependent var		0.181883	
Residual sum of squares	5.162059	Standard error of the regression		0.159464	
Uncentered R-squared	0.801352	Centered R-squared		0.246181	
F(5. 203)	163.7813	P-value(F)		3.21e-69	
Log-likelihood	89.26585	Akaike criterion		−168.5317	
Schwarz criterion	−151.8440	Hannan-Quinn		−161.7841	

*where **,*** high level of statistical significance; Breusch – Pagan test for heteroskedasticity – Null hypothesis: heteroskedasticity is not present; Statistical test: LM = 255.103 ;with p-value = P(Hi squared (5) > 255.103) = 4.41679e-053; Test for normality of waste – Null hypothesis: error is normally distributed; Statistical test: Hi squared(2) = 80.9618; with p-value = 2.62639e-018*

Sources: developed by the authors.

After applying the model on the sample of 208 business entities that operate in e-commerce, in compliance with the inclusion and exclusion criteria described in the screening methodology. The following regression equation is obtained:

$$\text{Cashflow}_{TN} = -0.399 * St_{TN} - 0.299 * Cr_{TN} + 0.0370 * RETURNONDEBTS + 0.331 * EMPRATE + 0.139 * UNDECLWRK \tag{3}$$
$$n = 208, R - squared = 0.801$$

The results vary inversely proportional to the dynamics of the stocks and receivables, directly proportional to the debts, but especially with the workforce dynamics (1 unit of cash flow (CF) represents 0.3 extra employees). Besides, there is a positive dynamic, directly proportional with undetected work, meaning that 1 CF generates 0.14 units of undetected work. The level of statistical representativeness of the model is 80%, which means that UCF variation is determined by the higher volume of qualified workforce and undeclared work. The e-commerce sector has an incidence rate of undeclared work of

about 5% of the total workforce attracted. A factor of nonperformance and a deceleration generator is the increase of stocks and receivables, especially in an economic crisis. Regarding the UCF dynamics in the branch, this is 30% per year, which is very high since the branch dynamics are accelerated, considering the accumulation rate of the 208 entities analyzed. Figure 1 shows the histogram and distributional representation of the model's dependent variable.
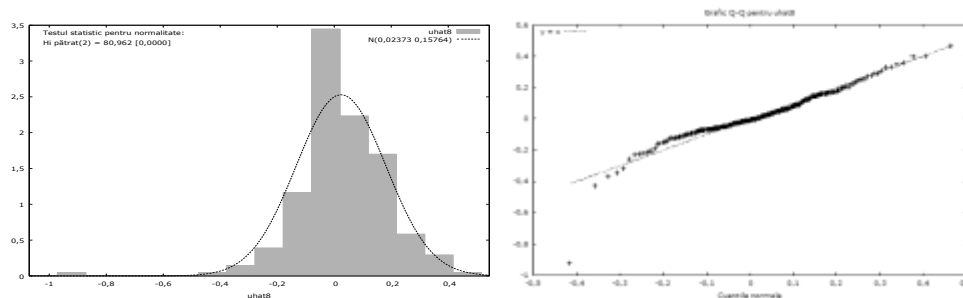

Figure 1. Histogram and distributive representation of the dependent variable of the model of regression projection of Cashflow_TN

Sources: developed by the authors.

The histogram distribution of the dependent variable UCF is vulnerable to the left. It means that economic growth, represented by UCF, is more uncertain. Still, once the inherent difficulties of electronic development of e-commerce platforms are overcome, the economic growth is sustainable with accumulation at the maximum point of the Gaussian curve (median interval on an upward slope). The distribution of the trend line on the graphic Q-Q Plot of the dependent variable is homogenous. It means that the deviations from the forecast line are small and inherent to the period of beginning e-commerce (the study is an observational one conducted on economic entities that operate in the field of e-commerce in Romania over about 20 years). A mathematical economic model proposed for the companies that operate in the Internet sector that considers company decisions based on the evolution of the activity, more specifically the profits generated, was described with the stochastic processes by Zhenova (2017). The scholar considered that companies should make decisions based on the structure of costs and incomes. However, the current paper considers that they should necessarily be correlated with the cash flows to mitigate or eliminate part of the risks we deal with in this paper. Therefore, the impact of the risk marker 1 (negative sales growth) is validated by validation of hypotheses 1, 2, and 4 on levels of intensity, level 5 (maximum) activity risk, if there is a reduction of return debts by 1 unit, which influences maximum 26.998 cash-flow units, or if the undeclared workforce decreases by 1 unit, then influence maximum 7.20 cash-flow units. Also, we assist at a level 3 (medium) activity risk, when the decrease of debts by 1 unit influences minimum 3.35 cash flow units or when the decrease of the rate of capital invested by 1 unit influences maximum 3.019 cash-flow units. By the assessment of the model are validated working hypotheses 1, 2 and 4. Hereinafter, this study supports the following hypothesis (H3):

H3: understaffing or staffing of the scheme with unqualified personnel who induce unrealistic customer expectations, contributes to the delay of orders or failure to meet delivery deadlines, leads to the risk of return of products sold, and accumulation of negative image capital has as a consequence the damage of the sustainability of the business.

To demonstrate working hypothesis 3, the assessment of the regression function of the dependent variable RataTurnover (TNRate) concerning the regressors was proposed: rate of the gross profit

(BTINCOMERATE), return debts (RETURNONDEBTS), rate of invested capital (EMPRATE) and undeclared work (UNDECLWRK).

The regression function expressed in linear form by the method of least squares has the form:

$$MR_2 = \sum_{i=1}^{n} \alpha_i * x_i \tag{4}$$

where MR_2 – risk marker 2 reductions of turnover respectively; α_i - the regression coefficient value; x_i – regressors: BTINCOMERATE; RETURNONDEBTS; EMPRATE; UNDECLWRK.

The statistical tests for the regression equation were carried out with e statistical signification 60%.

Table 2. Model 2: Ordinary Least Squares for 208 observations (dependent variable is TNRate)

	Coefficient	Std. Error	t-ratio	p-value	
BTINCOMERATE	0.148132	0.0489351	3.027	0.0028	***
RETURNONDEBTS	0.528839	0.163456	3.235	0.0014	***
EMPRATE	1.15401	0.243462	4.740	<0.0001	***
UNDECLWRK	3.02858	1.32156	2.292	0.0229	**
Mean dependent var	3.203347	S.D. dependent var		3.116044	
Residual sum of squares	1662.548	Standard error of the regression		2.854776	
Uncentered R-squared	0.598834	Centered R-squared		0.172826	
F (4. 204)	76.12950	P-value(F)		2.15e-39	
Log-likelihood	−511.3103	Akaike criterion		1030.621	
Schwarz criterion	1043.971	Hannan-Quinn		1036.019	

Breusch -Pagan test for heteroskedasticity: Null hypothesis: heteroskedasticity is not present; Statistical test: LM = 70.5718; with p-value = P (Hi squared (4) > 70.5718) = 1.71896e-014; Test for the normality of waste: Null hypothesis: the error is normally distributed; Statistical test: Hi squared (2) = 572.983; with p-value = 3.78739e-125

Sources: developed by the authors.

After using the model on the sample made of the 208 economic entities that operate in e-commerce, in compliance with the criteria of inclusion and exclusion described in the methodology of the research, the following regression equation is obtained:

$$\hat{TNRate} = +0.148 * BTINCOMERATE + 0.529 * RETURNONDEBTS + 1.15 * EMPRATE + 3.03 * UNDECLWRK \tag{5}$$

standard errors in parentheses: $BTINCOMERATE$ – (0.0489); $EMPRATE$ – (0.243)
$RETURNONDEBTS$ – (0.163) $UNDECLWRK$ – (1.32)

n = 208, R-squared = 0.599.

Regarding the analysis of the turnover, the findings showed that it registers representatively statistical modeling in relation to the gross profit, for example, with the attraction of borrowed capital, but also to the dynamics of employees and of the incidence of undeclared work, which means that 1 Turnover Unit (UTN) generates 1.15 employments in the system, with a rate of undeclared work of at least double in comparison with that of the employees. Also, 1 UTN is made based on 0.15 units of borrowed capital. It signifies that financial stability could be fragile if it is less than equity. The statistical representativeness value of the dynamic model based on the configuration of TN growth rates according to which regression variables presented has statistical representativeness of 60%. Still, the homogeneity of the model is confirmed by a highly statistically significant p-value (p-value = 1). In turn, p-value < 0.005 for three of the four variables and p-value < 0.05 for undeclared work represent a heterogenous aspect that varies according to the field

of activity of the entities that operate in e-commerce. Figure 2 presents the histogram and distributional representation of the model's dependent variable.
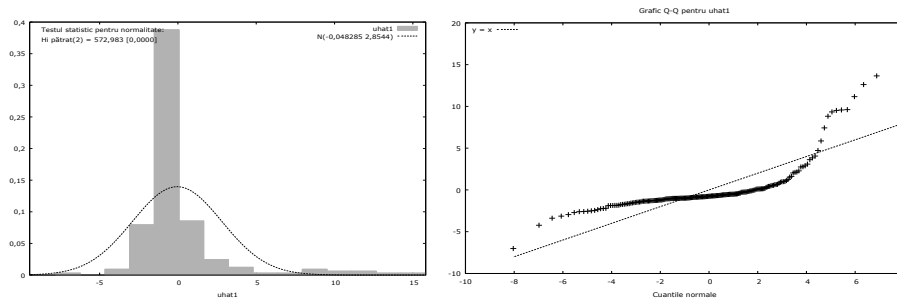

Figure 2. Histogram and distributive representation of the dependent variable of the model of regression projection of turnover rate_TN

Sources: developed by the authors.

In the case of TN analysis, the histogram shows a movement to the left, which signifies a remaining variation of TN concerning the regression variable on the descendent slope, the interval 5-15 (Fig.2). The variation of the dependent variable from the trend line forecast of the graph Q-Q Plot indicates significant y* deviations, both at the beginning. So we can find that the impact of the risk marker 2 (registration of gross losses) is validated by confirming hypotheses 2-4 on levels of intensity, level 5 (maximum) risk of return if there is a reduction of turnover rate by 1 unit, which influences maximum 10.04 units of gross profit. Besides, at a level 3 (medium) risk of return, when the reduction of the rate of net profit by 1 unit influences the minimum of 2.85 units of gross profit, meaning that current expenses generated by the return of products or services would have a direct incidence on the current result, implicitly the net profit. At the same time, the reduction of return debts by 1 unit influences the maximum of 2.415 units of self-financing capacity, which leads to a level of intensity 3 (medium) risk of bankruptcy. By assessing the model, it is validated working hypothesis 3 and is reconfirmed hypotheses 2 and 4. To demonstrate working hypothesis 3 this study proposed the assessment of the regression function of a dependent variable rate of the gross profit (BTINCOMERATE) concerning regressors rate of net profit (NTINCOMERATE), self-financing capacity (SELFFINRATE), and turnover rate (TNRate). The regression function expressed in linear form by the method of least squares has the form:

$$MR_3 = \sum_{i=1}^{n} \alpha_i * x_i \tag{6}$$

where MR_3 – risk marker 3 registration of gross losses respectively; α_i – the value of regression coefficients; x_i – regressors: NTINCOMERATE; SELFFINRATE; TNRate.

Hereinafter, the study analysed the behaviour of the gross profit rate to identify the components of risk that can influence the self-financing capacity or obtain profit for the 208 operators from e-commerce. After using the model on the sample made of the 208 economic entities that operate in e-commerce, under the criteria of inclusion and exclusion described in the methodology of research, the following regression equation is obtained:

BTINCOMERATE = + 0.351 * NTINCOMERATE + 0.540 * SELFFINRATE + 0.0996 * TNRate   (7)
                        (0.0387)   (0.0507)   (0.0449)
n = 208, R-squared = 0.822 (standard errors in parentheses)

Table 3. Model 3: Ordinary Least Squares regression for 208 observations (dependent variable is BTINCOMERATE)

	Coefficient	Std. Error	t-ratio	p-value	
NTINCOMERATE	0.350860	0.0387400	9.057	<0.0001	***
SELFFINRATE	0.540128	0.0506690	10.66	<0.0001	***
TNRate	0.0995609	0.0449100	2.217	0.0277	**
Mean dependent var	3.600322	S.D. dependent var		4.024938	
Residual sum of squares	1076.680	Standard error of the regression		2.291746	
Uncentered R-squared	0.822024	Centered R-squared		0.678931	
F(3. 205)	315.6141	P-value(F)		1.51e-76	
Log-likelihood	−466.1256	Akaike criterion		938.2511	
Schwarz criterion	948.2638	Hannan-Quinn		942.2997	
Mean dependent var	3.600322	S.D. dependent var		4.024938	
Residual sum of squares	1076.680	Standard error of the regression		2.291746	

Breusch- Pagan test for heteroskedasticity – Null hypothesis: heteroskedasticity is not present; Statistical test: LM = 494.833; with p-value = P(Hi squared(3) > 494.833) = 6.28533e-107; Test for normality of waste – Null hypothesis: error is normally distributed; Statistical test: Hi squared (2) = 150.147; with p-value = 2.48917e-033

Sources: developed by the authors.

Model 3, or the analysis of the variation of the gross profit (BTI) estimated by the dynamic model concerning the net profit, the company's financing rate, and TN rate, confirm that the company's financing rate generates directly proportional the accumulation of gross profit so that 1 UBTI is obtained with 0.54 invested capital. In comparison, the increase by 1 UBTI generates 0.35 net profit. Figure 3 presents the histogram and distributional representation of the model's dependent variable.
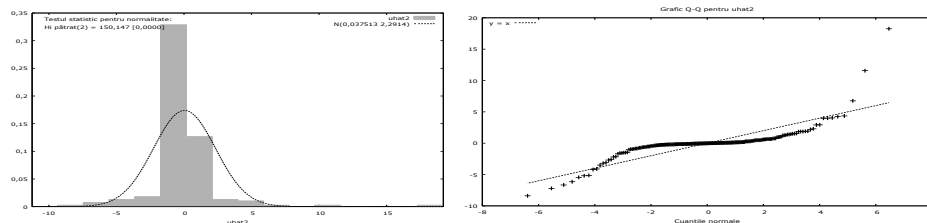

Figure 3. Histogram and distributive representation of dependent variable of the model of regression projection of the rate of the gross profit (BTINCOMERATE)

Sources: developed by the authors.

Therefore, it could be found that the impact of risk marker 3 (reduction of turnover) is validated by reconfirming hypotheses 1-3 on levels of intensity, level 5 (maximum) risk of restructuring, when there is a reduction of gross profit by 1 unit influences maximum 6.75 units of turnover. By assessing the model, it is validated working hypothesis 3 and is reconfirmed hypotheses 2 and 4. To reconfirm the working hypotheses, it was proposed to assess the regression function of the dependent variable SELFFINRATE (self-financing capacity) in relation to the regressors rate of the gross profit (BTINCOMERATE) and return of debts (RETURNONDEBTS). The regression function expressed in linear form by the method of least squares has the form:

$$MR_4 = \sum_{i=1}^{n} \alpha_i * x_i \tag{8}$$

where MR$_4$ – risk marker 4 reductions of financing capacity respectively; α_i – the value of the regression coefficients; x_i – regressors: BTINCOMERATE and RETURNONDEBTS.

Then, the study presents the analysis of the self-financing capacity behaviour to identify the risk components that could be the sources of financing, depending on their origin, namely from sources of the company's capital or borrowed capital of the 208 e-commerce operators.

Table 4. Model 4: Ordinary Least Squares regression for 208 observations (dependent variable is SELFFINRATE)

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
BTINCOMERATE	0.708664	0.0391236	18.11	<0.0001	***
RETURNONDEBTS	0.414019	0.102682	4.032	<0.0001	***
Mean dependent var	3.291741	S.D. dependent var			3.800302
Residual sum of squares	1277.101	Standard error of the regression			2.489883
Uncentered R-squared	0.756434	Centered R-squared			0.572812
F(2. 206)	319.8838	P-value(F)			6.63e-64
Log-likelihood	−483.8794	Akaike criterion			971.7589
Schwarz criterion	978.4339	Hannan-Quinn			974.4579

Breusch -Pagan test for heteroskedasticity – Null hypothesis: heteroskedasticity is not present; Statistical test: LM = 620.408; with p-value = P(Hi squared (2) > 620.408) = 1.90574e-135; Test for normality of waste – Null hypothesis: error is normally distributed; Statistical test: Hi squared (2) = 447.541; with p-value = 6.5726e-098

Sources: developed by the authors.

After using the model on the sample made of the 208 economic entities that operate in e-commerce, under the criteria of inclusion and exclusion described in the methodology of research, the following regression equation is obtained:

^SELFFINRATE = + 0.709*BTINCOMERATE + 0.414*RETURNONDEBTS (9)
                           (0.0391)   (0.103)
n = 208, R-squared = 0.756 (standard errors in parentheses)

Regarding the company's financing, it could be expressed by the dynamic model characterized by the variation of the rate of increase of Gross Profit and the rate of capitalization of borrowed capital. Thus, the increase by 1 unit of the financing rate (UFR) increases by 0.7 units of gross profit and the need for borrowing by 0.4 units. These demonstrate again that the need for financing sources attracted is significant in this sector, the economic development of e-commerce operators being conditioned by foreign financing. The model is significantly statistical in the proportion of 70% and homogenous by the p-value of regression variables < 0.0001. Figure 4 visualizes the histogram and distributional representation of the model's dependent variable. The histogram is cantered without accumulating remaining variables with a homogenous distribution under the Gaussian curve on the medium point of the curve. The diagram Q-Q Plot presents a flattening of the dependent variable distribution from the trendline, except at the end of the curve where y*-y is significant.

Therefore, we can find that the impact of risk marker 4 (registration of gross losses) is validated by reconfirming the hypotheses 1-4 on levels of intensity, level 5 (maximum) risk of litigation, reduction of return debts by 1 unit influences maximum 26.998 cash- flow units. Also, we assist at a level 3 (medium) risk of litigation.
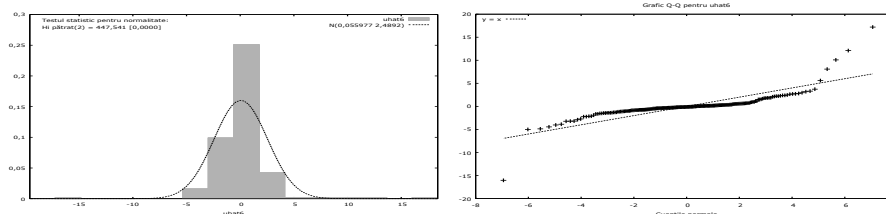
Figure 4. Histogram and distributive representation of dependent variable of the model of regression projection of self-financing capacity (SELFFINRATE).

Sources: developed by the authors.

When the net profit rate reduction by 1 unit influences a minimum of 2.85 units of gross profit, level 3 (medium) of risk of litigation is reached. The risk of litigation is justified by the presence of provisions for litigations reflected in the balance sheet of these economic entities. These provisions are formed based on some current expenses that directly affect the gross profit value. The reason for the formation of provisions for litigations is that of (IAS 37 - Provisions, Contingent Liabilities, and Contingent Assets) to cover the future expenses or debts with uncertain timing result of previous events, but whose obligation is present (Acar and Ozkan, 2017; Nacif, 2018; Ciubotariu et al., 2021). At the same time, the reduction of return debts by 1 unit influences a maximum of 2.415 units of self-financing capacity, which will lead to a level of intensity 3 (medium) risk of bankruptcy. By assessing the model are reconfirmed hypotheses 2-4.

Consequently, the analysis mentioned above shows us that the presence of some maximum levels of risk of activity, litigation, restructuring, or return depends on the behaviour of these indicators, the reason for which all the economic entities that operate in e-commerce should have a quantitative and a qualitative index that reflects these key factors of success (Wu and Tsou, 2008; Hu et al., 2009; Tsai and Chen, 2012). To build the risk picture for e-commerce activities, it is necessary to establish the influence weight of each factor that can expose an entity that operates in e-commerce to significant financial or business continuity risks. The presence of business risk directly conditions the efficiency of the e-commerce system, litigation risk, return risk, restructuring risk, or bankruptcy risk. Based on the results of the statistical analysis carried out previously on the most relevant indicators reflecting the financial performance and position, dynamic cash flows, debt-to-equity ratio for proposing solutions to increase the efficiency of e-commerce activity, it is necessary to know at any moment how to quantify the risks to which these activities are exposed to prevent or diminish them. Therefore, for risk triggers, markers from the sphere of financial reporting have been used based on credible, official information and a series of qualitative data with a direct impact on risk assessment (see Table 6).

Consequently, the risk assessment presented in the above table should be based on the economic and financial context existing in each entity that operates in e-commerce. Each risk in part should be assessed depending on the organizational objectives and finally quantified to have the possibility of any moment of the intensity level relative to each risk. If this way was used, there would be the possibility that the management would clarify the major responsibilities regarding the existence of these risks (according to the determined level) and create a framework for the identification of risk markers in different departments or business areas. Risk assessment could be established on a quantitative basis. Establishing risk levels as objective as possible is the key to efficient performance management and business sustainability. Another solution that should be considered is that these risk levels should be assessed in relation to the organizational objectives. Thus, the risks, once quantified, not only help to identify and analyze the indicators of performance and sustainability (on which should be paid the greatest attention) but also offer the possibility of outlining a clear direction of the business, especially in this economic context threatened by a multitude of uncertainties.

Table 6. The picture of risk factors for e-commerce

Types of risk	Triggers	Correspondence with the validated working hypothesis	Minimum threshold associated with the hypothesis (α_i)	Risk function
1	2	3	4	5
1. Activity risk, expressed by risk marker negative increase of sales	St_TN	H1	If the decrease of stocks by 1 unit influences a minimum of 2.5 units of cash flow, the minimum to the medium threshold of alert of the trigger is reached.	$RA = \frac{\sum_{i=1}^{n} \alpha_i * x_i}{\sum_{i=1}^{n} x_i}$ (10) where: RA – business risk; $i \in$ (1-7); α_i – level of impact of triggers; x_i – the triggers whose values surpass the minimum threshold of influence of risk
	Cr_TN	H1, H2, H4	If the decrease of debts by 1 unit influences a minimum of 3.35 units of cash flow, we say that it has reached the medium threshold of alert of the trigger.	
	RETURNON-DEBTS	H1, H2	If the reduction of return debts by 1 unit influences the maximum of 26.998 units of cash flow, the maximum threshold of alert of the trigger is surpassed.	
	EMPRATE	H1, H2, H4	If the decrease of the rate of invested capital by 1 unit influences the maximum of 3.019 units of cash flow, the medium threshold of alert of the trigger is reached.	
	UNDECLWRK	H3	If the undeclared workforce decreases by 1 unit, it influences the maximum of 7.20 units of cash flow, and the maximum threshold of alert of the trigger is surpassed.	
2. Risk of return expressed by risk marker determined by the registration of gross losses (because of expenses determined by the bad quality of products/ services and the poor training of the workforce, including the lack of strategies, policies, vision, and principles of business ethics)	NTINCOME-RATE	H2, H3, H4	If the net profit rate reduction by 1 unit influences the minimum of 2.85 units of gross profit, the medium threshold of alert of the trigger is reached.	$RR = RA * \frac{\sum_{i=1}^{n} \alpha_i * x_i}{\sum_{i=1}^{n} x_i}$, (10) where: RR – the risk of return; RA – business risk; $i \in$ (1-5); α_i – level of impact of triggers; x_i – the triggers whose values surpass the minimum threshold of influence of risk
	SELFFIN-RATE	H1, H2, H3	If the reduction of the self-financing capacity by 1 unit influences the maximum of 1.85 units of gross profit, the minimum threshold is surpassed. It aims at the medium risk of alert of the trigger.	
	TNRate	H1, H2, H3, H4	If the reduction of turnover rate by 1 unit influences the maximum of 10.04 units of gross profit, the maximum threshold of alert of the trigger is surpassed.	
3. Risk of restructuring expressed by the risk marker determined by the reduction of turnover	BTINCOME-RATE	H1, H2, H3	If the reduction of gross profit by 1 unit influences the maximum of 6.75 units of turnover, the maximum threshold of alert of the trigger is surpassed.	$RRS = RR * RA * \frac{\sum_{i=1}^{n} \alpha_i * x_i}{\sum_{i=1}^{n} x_i}$, (11) where: RRS – restructuring risk; RR – a risk of return; RA – business risk; $i \in$ (1-5); α_i – level of impact of triggers
	RETURNON-DEBTS	H1, H2	If the reduction of return debts by 1 unit influences the maximum of 1.89 units of turnover, the minimum to the medium threshold of alert of the trigger is surpassed.	

Continued Table 6

1	2	3	4	5
	EMPRATE	H1, H2, H4	If the reduction of the rate of invested capital by 1 unit influences the maximum of 0.86 units of turnover, it is situated under the minimum threshold of alert of the trigger.	x_i – the triggers whose values surpass the minimum threshold of influence of risk
4. Risk of litigation expressed by the risk marker determined by the reduction of cash flow as a consequence of covering expenses or debts generated by litigations	UNDECLWRK	H3	If the reduction of the undeclared workforce by 1 unit influences the maximum of 0.33 units of turnover, it is under the minimum threshold of alert of the trigger.	
	RETURNON-DEBTS	H1, H2	If the reduction of return debts by 1 unit influences the maximum of 26.998 units of cash flow, the maximum threshold of alert of the trigger is surpassed.	$RL = RRS * RR * RA * \frac{\sum_{i=1}^{n} \alpha_i * x_i}{\sum_{i=1}^{n} x_i}$ (12) where RL – the risk of litigation; RRS – the risk of restructuring; RR = risk of return; RA = business risk; i $\in$ (1-5); α_i – level of impact of triggers; x_i – the triggers whose values surpass the minimum threshold of influence of risk
	SELFFIN-RATE	H1, H2, H3	Suppose the reduction of the self-financing capacity by 1 unit influences the maximum of 1.85 units of gross profit. In that case, it surpasses the minimum threshold and aims at the medium risk alerting of the trigger.	
	NTINCOME-RATE	H2, H3, H4	If the net profit rate reduction by 1 unit influences the minimum of 2.85 units of gross profit, the medium threshold of alert of the trigger is reached.	
5. Risk of insolvency/ bankruptcy expressed by the risk marker determined by the reduction of the financing capacity reflected by the impossibility of continuing the activity	BTINCOME-RATE	H1, H2, H3	If the reduction of gross profit by 1 unit influences the maximum of 1.411 units of self-financing capacity, the minimum threshold of alert of the trigger is surpassed.	$RF = RL * RRS * RR * RA * \frac{\sum_{i=1}^{n} \alpha_i * x_i}{\sum_{i=1}^{n} x_i}$, (13) where RF – the risk of bankruptcy; RL – the risk of litigation; RRS – the risk of restructuring; RR – the risk of return; RA – business risk; i $\in$ (1-5); α_i – level of impact of triggers; x_i – the triggers whose values surpass the minimum threshold of influence of risk
	RETURNON-DEBTS	H1, H2	If the reduction of return debts by 1 unit influences the maximum of 2.415 units of self-financing capacity, the medium threshold of alert of the trigger is surpassed.	

Sources: developed by the authors.

Developing other solutions according to the level of intensity of possible risks consists in optimizing the income and expenditure budget, ongoing staff training to eliminate the risk of return, increasing the return on equity, attracting new clients from unexplored market areas, creating a formal framework for the constitution of provisions according to the typology of risks (i.e., provisions for risks and expenses, provisions for litigations, provisions for restructuring, provisions for guarantees granted to clients and even proposing provisions for product return), promoting prudential policies of assessing the available resources and the financing sources.

Conclusion. Nowadays, e-commerce has already reached a significant share of total retail trade worldwide, which allows foreseeing its degree of penetration, especially in the present social conditions, when the sanitary risks represent determinant factors in opting for such an activity. Under these circumstances, early identification of the risks relative to e-commerce activity prevents economic, financial, and social difficulties, especially for the entities analyzed in this paper. In other words, in the case of

entities with online activity mainly, there is an improvement of the business model in line with the adopted economic strategies results, but only as a result of the assessment of the risk function (on risk component) on a medium or long term. At the same time, this practice contributes to the increase of the sustainability of the economic activity in the online media. It could lead implicitly to the consolidation of the business environment and /or to the penetration of new online markets. High levels of profitability did not accompany the rapid expansion of e-commerce because, to sell their products and be known on the market, economic operators adopted aggressive discount policies. In turn, it led to decreased profit margins and increased costs, including the costs of the workforce. It also explains why, despite the strong expansion, many entities register net losses, reduced self-financing capacity, and the increase of debts or registration of a level of cash flow under the level of net profit. It entails risk situations (business, return, litigation, restructuring, or bankruptcy) of a level of intensity directly proportional to the variation of these economic and financial indicators. At the same time, we consider that irrespective of how these entities operate. They are in the position of the retail traders that have the sold goods or act as markets or intermediaries in sales. For quantifying these levels of risk, it is necessary to identify the triggers of risk-adapted to the business model. Knowing the business model is very important because it helps us understand better the behavior of the triggers of risks and establish personalized solutions for each encountered situation. Otherwise, it is possible to assist in misrepresenting the way of interpreting the indicators of profitability and financial stability indicators. Thus, it would make impossible the correct quantification of risks specific to e-commerce, a situation that would attract nonperformance and unsustainability of the business.

Therefore, the risk picture proposed in this paper for the e-commerce activity could be a real instrument for eliminating the threats that hang over the operational, financial investment, or financing activity of all the operators in this field. It would ensure their business continuity in the medium and long term.

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Розроблення інноваційної системи індикаторів оцінювання ризиків для e-commerce

Глобальна криза, викликана пандемією, спровокувала стрімкий розвиток електронної комерції у світі. Своєю чергою це сприяло зростанню кількості ризиків, оскільки компанії мають швидко адаптуватися до нових умов ринку. Метою статті є виявлення та оцінювання ризиків у сфері електронної комерції, а також попередження неетичної поведінки у секторі електронної комерції. Систематизація наукових напрацювань засвідчила, що електронна комерція має позитивний взаємозв'язок із організаційними інноваціями та безпосередньо впливає на продуктивність і стійкість бізнесу. При цьому авторами наголошено, що оцінювання характеру та інтенсивності ризиків, пов'язаних з операційною діяльністю є складним завданням, що є однією з головних причин зростання недовіри серед споживачів та зацікавлених сторін. Таким чином, у статті запропоновано інструменти для попередження, зниження та усунення ризиків, характерних сектору електронної комерції, а також підвищення стійкості бізнесу та довіри споживачів до інтернет-магазинів. Для досягнення поставленої мети, дослідження здійснено в наступній логічній послідовності: визначено головні категорії ризиків та їх тригери; встановлено зв'язки між робочими гіпотезами та мінімальною пороговою аргументацією, яка пов'язана з ними. Авторами зазначено, що для кожної категорії ризику може бути встановлена певна функція ризику. Для визначення мінімального порогу впливу ризику застосовано методологію їх оцінювання з використанням шкали значень від 1 до 5 залежно від ступеня впливу на операційну діяльність, продуктивність та стійкість електронної комерції. Якісне дослідження проведено на основі панельних даних, сформованих для вибірки з 208 господарських суб'єктів сектору електронної комерції. Статистичною базою дослідження є фінансова звітність та внутрішня інформація компаній. Відповідно до результатів дослідження авторами розроблено набір тригерів для моніторингу ризиків за їх сегментами. Запропонований набір тригерів може бути основою для прийняття рішення керівництвом щодо забезпечення стійкості бізнесу та удосконалення бізнес-моделі відповідно до прийнятих стратегій. Також, це може стати основою для своєчасного виявлення та контролювання загроз операційній діяльності в онлайн-середовищі, що сприятиме консолідації бізнесу та проникненню на нові онлайн-ринки.

Ключові слова: захист прав споживачів, електронна комерція, інноваційна панель, оцінка ризиків, тригерні фактори.