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The effectiveness of the emergency eLearning during COVID-19 pandemic. The case of higher education in economics in Romania

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ABSTRACT

In this paper, we aim to identify the determinants of online effective learning in the emergency situation created by COVID19 pandemic. Further, we test which of the learning methods (traditional, online, and hybrid) is preferred by Romanian students in economics in this unusual context. Using a sample of 1415 students from five major Romanian faculties of economics and applying ordinal and bivariate logit regressions models, we found that psychological distress and increased concerns about COVID-19 pandemic have a negative effect on learning effectiveness. Also, our results revealed that the students who face problems related to unsatisfactory internet access, insufficient time due to other familial issues, who have inadequate working space at home and also the male ones are more likely to be less effective in their online learning process. Finally, the university infrastructure for online activities decreases the likelihood that students will perceive online studies as less effective.

1. Introduction

Any online learning environment is considered to be a framework that “uses the Internet to deliver some form of instruction to learners separated by time, distance, or both” (Dempsey and Van Eck, 2002, p. 283). At the institutional level, eLearning in exceptional times, such as the case of the COVID-19 pandemic, should be seen as a backup educational system to continue the learning process. This kind of pandemic has spread almost all over the world, although it was not until December 2019 that the first official case in China was confirmed and hospitalized (Huang et al., 2020). Meanwhile, the situation has escalated so much due to the coronavirus outbreak that led the World Health Organization (WHO) to declare a Public Health Emergency of International Concern (Lai et al., 2020) (Figs. 1 and 2).

The impossibility to predict the stopping of this pandemic leaves room for numerous scenarios related to the lack of predictability. This *status quo* generates extremely much uncertainty and confusion that affect the economic, social and political institutions, also the interpersonal connection. All these changes have tremendous effects on humans and their relationships with other people and with institutions.

When it comes to the educational issue, the unexpected health crisis made, on 15th of May 2020, more than 1.2 billion learners, about 70 percent of total enrolled ones, from 158 countries, to be highly affected by the global lockdown (UNESCO, 2020a). Hundreds of million students worldwide were and still are affected by “social distancing” or “self-isolation” measures promoted by their

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Fig. 1. Evolution of the number of new confirmed cases of coronavirus worldwide (January-July 2020).

Source: COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University

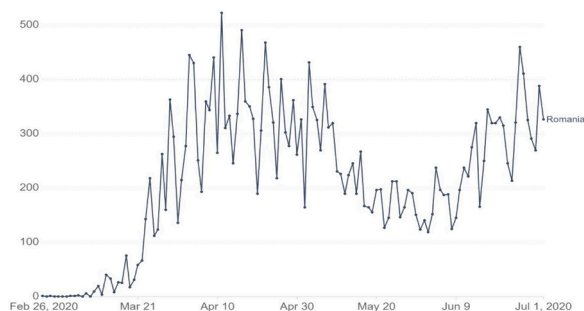


Fig. 2. The evolution of coronavirus pandemic in Romania (February-July 2020).

Source: COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University

countries' governments, because of the impossibility to attend physical classes which may influence their school performance (UNESCO, 2020a). Especially in the case when those students don't have the proper infrastructure for online learning, it is obvious that their grades are critically marked. Also, homeschooling hurts the parents' mobility, performance at work and, overall, on economic productivity of firms (UNESCO, 2020b). The same previous report emphasizes that a low level of familial wealth, reduces the level of democratization of access to technology, due to the difficulty to establish an internet connection, is a powerful barrier towards eLearning and a major source for exclusion, isolation and inequality.

Moreover, the discriminated cohorts of students will continue to be unintentionally impacted in the long term, especially in acquiring and developing new skills (Burgess and Sievertsen, 2020).

Distance education is considered in these difficult times a component of public austerity (Murphy, 2020), especially in higher education (Farinella et al., 2000; Pape, 2010). The expected long-lasting educational isolation or mainstream education distancing will have negative consequences on the use of knowledge (Carlsson et al., 2015) and the process of learning (Lavy, 2015).

In this context, we intend to analyze the effectiveness of emergency distance education, as self-reported by students in economics. Having Romania as a case study, we look at students from the most important faculties of economics in the country for depicting their perceptions on the forced distance learning process. In economics education, unlike other specializations that develop students' vocational, practical skills, online learning seems a proper environment for effectively providing skills and knowledge in economics. The need for such research is threefold: one is based on a factual situation that may generate unexpected educational results; the second is related to one of the best high speed-internet infrastructures from Europe that may support the e-learning process (Botea, 2020); the last one is connected to a lack of devices and home infrastructure for eLearning among the students. However, it should be noted that Romania, compared with the EU average, has one of the lowest levels of administrative digitalization (Tinholts et al., 2019) and digital education penetration of only 5 percent compared to 95 percent for traditional education (Călin, 2017).

The main research hypothesis of our paper is that education lockdown has induced a psychological distress among Romanian students in economics that influences the effectiveness of the educational process and also their perceptions of how they would prefer to learn in the future. In this way, we contribute to the knowledge of the determinants of online learning effectiveness by adding to the existing models (Soong et al., 2001; Khan, 2005) new factors, such as psychological distress. Also, the effectiveness of the Romanian higher education system and the specialization of economics in particular, even among the largest in Europe¹, are less covered by the existing literature. We employ a large data sample collected through an online survey and econometric regression modeling.

¹ According to the data from the Eurostat data portal, 2018: <https://ec.europa.eu/eurostat/data/database> <https://appsso.eurostat.ec.europa.eu/nui/setupDownloads.do>, accessed on February 1st 2021

The rest of the paper describes the context of the eLearning process in Romanian economics higher education during the COVID-9 pandemic (in Section 2) and the relevant literature that already emerges in this topic in section three. Econometric methods and the data are presented in Section 4, while the results are detailed in Section 5. Finally, the Conclusion section ends the paper.

2. eLearning in Romanian economics higher education during the COVID-9 pandemic

Economics education in Romania is an essential part of the higher education system, being continually in the top of the most preferred specializations. Together with Business Administration, Economics and Law there were 130.972 students enrolled in the academic year 2018–2019, almost a quarter of the total number of 543.299 students.²

The Romanian Ministry of Education usually assures the principal and additional funding of higher education institutions and their development. Only a very small share of this funding is provided by private students' contributions in the form of a semester or annual tuition fees. While Romania reported one of the lowest shares of its GDP for education, in 2018, the level of expenditures on public and private higher education institutions per student (expressed in € PPS) is almost 2.5 times lower than the European Union average (European Union, 2019).

Becoming a member of the Bologna Process / European Higher Education Area in 1999, Romania has harmonized its higher education standards and structure just like other European and Asian countries. For example, the adaptation of their higher education based on similar bachelor, master, and doctoral degree structures and durations, European Credit Transfer System (ECTS) or increased students' and staff mobility are some of the most significant implemented reforms (Roman, 2008). The integration of Romanian economics education into the European system makes this study relevant not only at the national level, but at the European level as well.

However, besides all these structural adaptations and reforms, Romanian higher education institutions still have a gap compared to Central and Western European countries in terms of funding and education infrastructure. In this direction, Romanian universities have to make improvements in terms of educational software licenses, digital libraries, technological infrastructure, and access to other educational resources.

In Romania, the coronavirus lockdown was preceded by several active measures imposed by public institutions to draw attention to the danger of this new unintended crisis. From the end of February to the beginning of March 2020, several preventive measures were taken in this direction. When the situation became worrying enough, public institutions instituted the ban of all indoor and outdoor activities that took place with over 1000 individuals.

The need for public institutions to oblige the citizens to stay in their homes for a certain time was mandatory so that the situation could be kept under control until the redemptive remedy was found (Preiser et al., 2020).

After the middle of March 2020, numerous activities were postponed or even prohibited, from which education received special attention.

In the first phase (11–22 March 2020), all schools (including universities) in Romania were closed. Then, this decision was first extended until the end of April, ie after the Easter holidays (Marinescu, 2020), while the latest news confirmed the closure of all schools until the fall of 2020 (Cornea, 2020). It is estimated that over half a million Romanian students have been and still are severely affected by this official decision and the consequences, in terms of skills development and acquisition of new knowledge, are difficult to predict.

In this unexpected context, in Romania, higher education institutions had to adapt in due time their curriculum and protocols to continue the teaching and learning process and assessments for students online, in conditions of transparency, efficiency, and professionalism. The high degree of its contagion and unknown regarding its treatment pushed these institutions to face the new situation, adopting a particular form of academic and scientific resilience. While public authorities have instituted specific measures of "social distancing" to prevent and limit the negative effects of such a virus, Romanian universities, professors, and students have had to find and use the appropriate technological infrastructure to have an active dialogue, a challenge for all actors involved in such a complex interaction. The fear that this health crisis may last for months and even years from now, so that at some point other measures of "social distancing" will be needed to reduce the negative effects of its social transmission, will again make the process of face-to-face education to become less possible and inappropriate in this context, therefore favoring the resurgence of eLearning.

3. Brief Literature Review

3.1. Factors affecting the effectiveness of eLearning

While face-to-face communication has been considered to remain central to the educational process (Baker, 2004; Saba, 2007), the effectiveness of eLearning has been documented and considered for decades (Clark, 1983; Russell, 1999). Compared to traditional classroom education, the alleged benefits of distance education are considered to be related to reduced college tuition (De La Varre et al., 2011), better test scores (Harmon and Lambrinos, 2012), increased task engagement and decreased attrition (Kapp, 2012), and a higher sense of "participatory" belonging to educational communities (Barab and Thomas, 2001) and collaborative affinity (Hermann et al., 2001).

For eLearning to be effective, it is needed for an efficient infrastructure (Zhang et al., 2004), implying not just good technical

² According to the data provided by the National Institute of Statistics, Tempo online data portal, at: <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>, accessed on February 1st 2021.

connectivity, but, much more important, professional management of courses, applications, and superior pedagogical soundness (Costa and Silva, 2010). In the case of Korea, the efficiency of the eLearning platform has been fundamentally influenced by the proactive involvement in setting a sound infrastructure (Teo et al., 2020). Moreover, Liaw et al. (2007) and Selim (2007) find support for the positive role of professors' attitude towards the degree of success of the eLearning. Also, Balfanz and Byrnes (2006) opine that low internet access at home is detrimental to eLearning achievement, just as the poor internet infrastructure at schools (Nicholas and Fletcher, 2016).

When considering different educational cultures and environments, such perceptions couldn't be generalized, since other studies emphasized that negative perceptions have had consequences on students in terms of dropout rates (Carr, 2000), their learning motivation (Maltby and Whittle, 2000), or satisfaction (Kenny, 2003). Moreover, Brown and Liedholm (2002) and Xu and Jaggars (2013) demonstrated that students' school performances were much lower among those who benefited from eLearning.

Also, different researchers have found no evidence related to online learning superiority over the traditional paradigm (Bernard et al., 2004; Zhao et al., 2005). In this direction, Nguyen (2015) pointed out that some other characteristics of students, such as gender, ethnicity, active engagement in different architectures of learning communities, could influence the effectiveness of distance education.

Distance education could be successful when the subject interprets the possible barriers (social interaction, administrative issues, student motivation, and time/support for studies) conveniently and efficiently (Muilenburg and Berge, 2005). Also, it has been found that self-regulation has an essential role in the efficiency and success of such practice (Yukselturk and Bulut, 2007), also proper instructional design and rigorous educational planning (Hodges et al., 2020).

Among the college students, the most known academic stressors are considered the competition for better grades and career plans after graduation (Lee et al., 2005), which usually generate academic stress, which further is detrimental to their psychological health (MacGeorge et al., 2005) and academic performance (Pritchard and Wilson, 2003).

3.2. eLearning and stress under lockdown

eLearning education is considered to be based exclusively on an efficient interpersonal interaction between all the actors who are involved in such a process, just like in any conventional educational form (Bernard et al., 2009), to benefit from the exchange of knowledge and ideas (Cole and Engstrom, 1993). Previous studies found that those students with a certain propensity for depressed behavior or pessimism could face powerful obstacles that may hamper their capacities to cope with disturbing, new, and anxious circumstances (Miceli and Castelfranchi, 2002), therefore obtaining a lower level of achievements (Yates, 2002). That is why the COVID-19 pandemic could be seen as a "curse" for an effective education, especially for such categories of students, but, at the same time, it is considered an opportunity to break the traditional customs and old paradigms in favor of a more accessible, cheaper and technology-based learning systems worldwide (DePietro, 2020). Other research has highlighted that policy measures towards school closures generated more inequities and frustrations among the disadvantaged students (Armitage and Nellums, 2020). Also, these restrictions have affected the core of cognition, namely socialization and interaction (O'Sullivan et al., 2017). The need for academic assistance (Cigognini et al., 2011) and proper educational platforms (Isaeva et al., 2020) are considered crucial elements for an efficient online learning social process under lockdown.

After analyzing previous research on the factors that influence the effectiveness of eLearning, we further highlight the gap in the literature on the non-inclusion in the existing models of the COVID-19 pandemic stress generated by lockdown, together with the psychological factors and current available infrastructure, elements that may affect the preferences for online education. Therefore, this paper aims to analyze the impact of the stress generated by the COVID-19 on the effectiveness of eLearning among major Romanian faculties of economics.

Two research questions could be formulated as follows:

- 1 Which is the effect of the stress associated with COVID-19 pandemic and lockdown on the effectiveness of eLearning education?
- 2 Which is the effect of psychological distress and strain under the pressure of COVID-19 lockdown and the available infrastructure on the preference for online learning?

In the Romanian context, it must be stated the following details. Romania ranked 26th out of the 28 EU countries in terms of digitalization.³ In the academic year 2019–2020, the degree of PC coverage of the school population and teaching staff in the Romanian higher education system was approximately 19%.⁴ Before the COVID-19 pandemic, the online learning infrastructure was developed exclusively for students who couldn't attend regularly the faculty courses and seminars, but we cannot reveal any previous research that assessed the relationship between the effectiveness of distance education and stress under lockdown in the Romanian context. In this direction, all these considered higher education institutions had to adapt very quickly to the new reality, adopting in real time emergency various friendly eLearning platforms, methods, or techniques to properly disseminate information and knowledge.

³ ***, The Digital Economy and Society Index (DESI) 2020: Romania ranks 26th, https://ec.europa.eu/romania/news/20200611_raport_rezilianta_digitala_ro

⁴ ***, Strategy on The Digitalization of Education in Romania, <https://www.edu.ro/sites/default/files/SMART.Edu%20-%20document%20consultare.pdf> (accessed 14 January 2021).

It must be stated that in several surveyed faculties, the eLearning infrastructure was functional for many years. For instance, the Learning Management System (LMS) platforms called Blackboard or Moodle were operational especially for assessment and student management (Edelhauser and Lupu-Dima, 2020).

4. Data and methods

4.1. Data

We use primary data collected from students who currently learn in the five most relevant Romanian faculties of economics that present a regional distribution covering all the country's areas. Also, the number of students enrolled in these faculties (approximately 50,000 students) represents a major share in the total number of students in business, economics and law in Romania. These faculties include the Faculty of Economics and Business Administration from Alexandru Ioan Cuza University of Iași (UAIC), Bucharest University of Economic Studies (BUES), Faculty of Economics and Business Administration from Babes-Bolyai University of Cluj-Napoca (UBB), Faculty of Economics and Business Administration from West University of Timișoara (UVT), Faculty of Economic Sciences from Lucian Blaga University of Sibiu (ULB) and Faculty of Economic Sciences and Business Administration from Transilvania University of Brașov (UTB). In all these cases, distance education is neither a priority nor a majority in the overall education system.

The data were collected through an online survey conducted between the 10th and 17th of May 2020 (two months after the start of the forced online learning due to the COVID-19 pandemic) among Romanian students from the aforementioned universities. This online survey uses a convenience sample with no pre-selected individuals. The dataset includes 1415 unique respondents from the top six largest faculties in economics in Romania specified above. The questionnaire addressed the issue of psychological stress, concerns about COVID-19, and the degree of compliance. Also, the students were asked to provide information about the technologies and infrastructures used for distance education, about the adequacy of the space available at home for online learning, and the available time for it. All the students follow fairly standardized economics' curricula, with similar topics in the first three semesters and more specialized subjects in the last part of their studies. Therefore, there is a high homogeneity in the sample related to respondents' needs in terms of technological infrastructure, workload, tasks, and difficulties felt among these persons.

4.2. Methods and variable measurement

In this paper, we extend the existing models and determinants used for assessing the effectiveness of the eLearning process (Attwell, 2006, and Kay, 2011) by including new factors related to stress that may be generated by the lockdown and emergency.

In line with the objective of the paper, we propose to investigate the following research hypothesis, namely: (H1) the stress associated with the COVID-19 pandemic and lockdown hurts the perceived efficiency of learning; and (H2) the psychological factors and available infrastructure affect the preferences for future online education over classroom or hybrid learning.

Testing the first hypothesis will allow to understand and explain the role played by stress on the effectiveness of distance educations, alongside with other relevant factors. The effectiveness of the online education was assessed based on the self-perception of the respondents. They were asked to express on a scale from one to three the level of agreement with the following statement: "Overall, I consider that online teaching was so far effective", one corresponding to disagreement and three to agreement.

Testing the second hypothesis, which is related to H1, will reveal potential impact of the stress-factor on the students' preferences for various types of learning. Understanding these preferences is crucial as universities are operating in a more volatile environment and they are struggling to find the best strategies for overcoming the negative pandemic effects. At the surveyed faculties the learning process diversified and alongside with classroom learning, new options emerged: online learning, with all the classes taken via internet and hybrid learning; in the former case, the concept of hybrid learning means the possibility for the educational process to take place simultaneously both in the classrooms and online, depending on needs and particular contexts. Similar to distance learning, the traditional method for face-to-face learning is homogeneous among these faculties, from 2-hs lectures and tutorials at courses and seminars to traditional assessments and exams. The preference for each type of learning was assessed using binary variables, with one indicating the preference for a specific type. As reported in Table A1, a small share of the respondents seem to opt for online learning (8%), while many of them prefer classroom learning (48 %) and hybrid leaning (43 %) (Table A1).

For capturing the effects of lockdown during the COVID-19 pandemic, we developed an indicator of psychological distress (*psych_ind*), measured using seven items: depression, anxiety, worry, lack of hope, irritability, stress, and loneliness. This composite index is an adaptation of Kessler Psychological Distress Scale (K10) (Kessler et al., 2003). It has a good to excellent internal consistency with a Cronbach's α of 0.8645. These items are measured on a Likert scale from zero to three, where zero corresponds to a deteriorated situation due to the pandemic, while 3 indicates that the respondent is not affected in any way by the factors counting for psychological distress. The seven items were aggregated into a single measure using principal component analysis (PCA), a standard method applied for reducing the number of items (Field, 2009). After running the PCA, the first component was kept, covering 60 percent of the overall variation (Fig. A1 in the Appendix). The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis, (KMO coefficient is 0.89, "meritorious" according to Kaiser (1960), and all KMO values for individual items were larger than 0.85, which is well above the acceptable limit of 0.5 (Field, 2009). The new index for psychological distress ranges between -0.73 and 2.24 and the distribution shows a large concentration towards lower values, suggesting a large number of respondents in high psychological distress (Fig. A2).

The other explanatory factors employed in our research are: worry (*worry_about_COVID-19*), the use of university platforms (*university_platforms*), the use of external dedicated platforms (*Zoom_platform*), the quality of the internet at home (*internet_poor*), the

Table 1
Logistic regression models.

VARIABLES	(Model 1) Marginal effects from ordinal logistic regression Effectiveness of online learning	(Model 2) Marginal effects from logistic regression Classroom learning	(Model 3) Marginal effects from logistic regression Hybrid learning	(Model 4) Marginal effects from logistic regression Online learning
psych_ind	-0.0605*** (0.0104)	-0.0341** (0.0136)	0.0115 (0.0137)	0.0202*** (0.00700)
worry_about_COVID 19	-0.00983** (0.00438)	-0.000379 (0.00580)	-0.00315 (0.00584)	0.00381 (0.00325)
university_platforms	-0.0620*** (0.0240)	0.00778 (0.0316)	-0.0373 (0.0317)	0.0279 (0.0184)
Zoom_platform	-0.0261 (0.0409)	-0.0483 (0.0511)	0.0189 (0.0519)	0.0281 (0.0293)
internet_poor	0.108*** (0.0268)	0.0310 (0.0356)	-0.00153 (0.0360)	-0.0378 (0.0237)
home_techn_poor	-0.00318 (0.0475)	0.0170 (0.0617)	-0.0769 (0.0642)	0.0454 (0.0309)
time_poor	0.0904*** (0.0223)	-0.0167 (0.0300)	-0.00461 (0.0300)	0.0212 (0.0167)
space_poor	0.0877*** (0.0250)	0.0865*** (0.0334)	-0.0472 (0.0339)	-0.0476** (0.0224)
professor_important	-0.0996*** (0.0103)	-0.0837*** (0.0135)	0.0685*** (0.0139)	0.0184** (0.00849)
cost_low	0.0518** (0.0205)	0.0665** (0.0267)	-0.0490* (0.0270)	-0.0167 (0.0154)
academic_year	-0.0484*** (0.0104)	-0.0447*** (0.0137)	0.0213 (0.0136)	0.0201*** (0.00702)
residence_area	0.00763 (0.0211)	-0.0864*** (0.0275)	0.0692** (0.0280)	0.0187 (0.0162)
gender	0.0597** (0.0238)	-0.00784 (0.0315)	-0.0201 (0.0315)	0.0255 (0.0163)
UAIC	-0.0687** (0.0302)	0.0770** (0.0379)	-0.0921** (0.0383)	0.0135 (0.0172)
UBB	-0.0270 (0.0398)	0.0938* (0.0500)	-0.113** (0.0503)	0.0167 (0.0252)
UVT	-0.0754 (0.0491)	0.0272 (0.0612)	-0.0625 (0.0632)	0.0330 (0.0340)
ULB	-0.226*** (0.0467)	0.121 (0.0769)	-0.230*** (0.0715)	0.132** (0.0656)
UTB	-0.0596 (0.0668)	0.0634 (0.0843)	-0.0896 (0.0862)	0.0250 (0.0497)
other	0.0424 (0.0982)	-0.264** (0.105)	0.222* (0.114)	0.0167 (0.0556)
LR chi ²	251	124	86	47
Pseudo R ² (%)	8.16	6.33	446	5.91
Observations	1415	1415	1415	1415

Standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

quality of the home infrastructure (*home_techn_poor*), the time (*time_poor*) and space (*space_poor*) availability, the role of the professor (*professor_important*) and the cost of education (*cost_low*); academic year, residence area (*urban*) and gender (*male*), as well as the host university. A brief description and justification for each factor is provided in the remaining of this section.

Infrastructure and support provided by universities to their students may be represented by an interactive platform designed for online learning (*university_platforms*). In our sample, different institutions have various approaches to the use of such platforms, and some of them may not be prepared for such changes. Overall, during the survey, the online learning process within the analyzed faculties consisted of different ways of efficiently transmitting the curricular content, depending on the specificities of each course. Thus, the delivery of courses and seminars consisted of lessons, practical applications, case studies, other support materials recorded or uploaded on online platforms in advance (e.g., video tutorials), real-time interactions with students and online examination - partial and final. Students were asked to report if the university provided them with access to an online learning platform or have used other technologies. A large number of responses showed that different dedicated platforms were used in various faculties, including Zoom, Moodle, MeetEx, Facebook/Facebook Messenger, WhatsApp, email, Google Classroom, Skype, in many cases being complementary to the existing university infrastructure for distance education. As the situation was unexpected, the students' home internet infrastructure may also severely affect the effectiveness and efficiency of online learning, as some students may not have access to the Internet or the right equipment. Two binary variables are used for assessing home infrastructure: the first one refers to the quality of

the internet at home (*internet-poor*) and the second refers to the quality or availability of the adequate devices for learning at home (*home_techn_poor*). As shown in Table A1 in the Appendix, the vast majority of students have satisfactory access to the Internet at home (82 percent) and have also used a computer or laptop against a telephone or a tablet.

Learning from home, a generally shared space, may rise additional challenges, as the working place may be partitioned with other family members. The family time and the work-life balance may be affected as well. Two binary variables are included in our analysis, counting for the available working space (*space_poor*) and working time (*time_poor*). Some students indicated that they did not have adequate space (22 percent) or the time they needed (31 percent) to attend correctly in online lectures from home.

Professors play a crucial role in the education process, especially when it is designed for face-to-face training. In many cases, professors had to adapt their style, teaching materials, and requirements to the new context overnight. Some may not be flexible and require a lot of effort. Students acknowledge such issues; respondents were required to assess the role of professors in effective online learning, on a scale from 0 (least important) to 4 (very important). The variable *professor_important* has an average of 3, so students generally perceive professors as relevant vectors of the effective learning.

We also control for the potential economic benefits of distance education from home, such as reduced costs (*cost_low*) for instance, for accommodation or travel from home to university. About 38 percent of the respondents have indicated having lower costs for education during the lockdown (Table A1).

The control variables are academic year, gender, and residence area. We have used dummies for the host faculty of each student. Around 64 percent of the respondents reside in the urban area, and only 22 percent are male, reflecting the population distribution of students in economics at the national level.

4.3. Econometric specifications

The use of the logistic models in educational studies is becoming more and more common (Niu, 2020), being adequate for the case in which dependent variables are binary or measured on an ordinal scale (Field, 2009). A number of regression models were used to analyze the determinants of perceived effectiveness of online learning and the influences on preferences for online, hybrid or classroom learning. In the first case, the ordinal logit regression model was used (Field, 2009), because the effectiveness is measured on a three-value scale. The respondents were required to assess the effectiveness of the online education on three points Likert, by agreeing with the following statement: "Overall, I appreciate that online learning has been effective so far".

The preferences for a certain type of learning are measured as binary variables and, therefore, logit regression models have been developed.

The dependent variable takes the values: $y = 1$ if the respondent specified the preference for one particular type of learning, and $y = 0$ otherwise. The three applied models (Models 2–4 in Table 1) were developed for the cases of online, classroom, or hybrid learning.

We consider the following form of the binary logistic model (Field, 2009):

$$P(y = 1/x_1, x_2, \dots, x_k) = \frac{\exp(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k)}{1 + \exp(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k)}$$

where:

- B_i are the regression coefficients;
- X_i are the following covariates: psychological distress (*psych_ind*), worryness (*worry_about_COVID-19*), the use of university platforms (*university_platforms*), the use of external dedicated platforms (*Zoom_platform*), the quality of the internet at home (*internet_poor*), the quality of the home infrastructure (*home_techn_poor*), the time (*time_poor*) and space (*space_poor*) availability, the role of the professor (*professor_important*) and the cost of education (*cost_low*);
- the control variables are: academic year, residence area (*urban*) and gender (*male*), as well as the host university.

Similarly, in the ordinal regression model the dependent variable takes more than two discrete values (Field, 2009). For the particular case of our model, there are three values assumed by the dependent variable:

$$y_i = \begin{cases} 1, & \text{if the perceived effectiveness is low} \\ 2, & \text{if perceived effectiveness is moderate} \\ 3, & \text{if perceived effectiveness is high} \end{cases}$$

In the most extensive model (Model 1, Table 1), the same set of covariates is used as in the previous cases.

5. Results and discussion

Table 1 reports the results after performing the logit regression models. For an easier interpretation and for avoiding the misinterpretation of the odds ratio (Niu, 2020), both in ordinal and binary logit regression models, the marginal effects were computed.

The interpretation of marginal effects at means for categorical variables (as it is the case for most independent variables in our models) shows how the probability changes as the categorical variable changes from 0 to 1, keeping all other variables at their means.

Before entering into the detailed interpretation of the regression coefficients, we should point out that all four models are

statistically valid (the large values of the LR statistics in Table 1 indicate an adequate goodness-of-fit and have a satisfactory explanatory power of between 4–8 percent (Field, 2009). Moreover, there is no multicollinearity between the explanatory variables, as the maximum Variance Inflation Factor is 4.6 (well below the acceptable standard limit of 10, as underlined by Bowerman and O'Connell (1990)).

First, we aim to explain the effectiveness and key variables that are related to the specific context of forced digitalization under lockdown. The marginal effects (column 2, Table A1) are reported and interpreted below for the baseline case of low effectiveness. A relevant first result is that the effect of psychological distress (*psych_ind*) on the effectiveness of online learning is statistically significant. The results show that less stressed respondents have 6 percent lower probability to perceive online learning as less effective compared to more stressed students. Therefore, low stress is associated with the perception of higher effectiveness, and those students who report higher stress consider that education has generally been less effective. The result is consistent with previous research that pointed out that the low level of academic stress was positively related to online course achievement, regardless of the complexity of the subject (Joo et al., 2012).

Regarding the specific effect of the COVID-19 pandemic, it seems that Romanian students in economics are less efficient in online learning under the pressure of lockdown. Supporting this conclusion, the effect of the variable “worry_about_COVID19” is also statistically significant and shows that those students in economics who are generally more concerned about the COVID-19 pandemic are slightly less likely to be more effective in the eLearning process.

Also, the existing learning infrastructure of the universities considered has a positive impact on distance education and decreases the probability of being less efficient by 6 percent; other dedicated platforms, such as Zoom, have no significant influence. This may indicate that the university platforms for online studies have generally been adequately adapted to emergencies and have created a homogenous environment for eLearning in various universities.

A particular result is given by the fact that a student who has encountered difficulties at home related to unsatisfactory internet access for online study is 10 percent more likely to be less effective. Such a finding is also well documented in other previous studies (Bidder et al., 2016; Zakharov and Maybee, 2018).

Moreover, the lack of time required (due to other family obligations) and adequate work space at home increase the likelihood of being less effective in learning by 9 percentage points and 8.77 percentage points, respectively. In line with our expectations, home infrastructure and material conditions have a strong impact on perceived effectiveness and students must struggle to overcome such barriers. These findings are consistent with other research that has shown that, during periods of school closure, low-income pupils had lower educational achievement compared to high-income ones (Eyles et al., 2020). Other studies have confirmed that online learning performance is affected by the home environment (Harris et al., 2011) and poor time management (Nichols, 2010). It also seems that the vast majority of respondents have the necessary technology (computer, phone or tablet) and this does not affect the learning process.

A student who perceives the situation of distance education as a way to reduce the costs for education is more likely to show a low sense of effectiveness in learning. Such students may be less motivated to learn, but they also probably live outside the campus or the university city and the shift from classroom to online learning can be more dramatic for them. The previous idea finds solid support in other related research that has shown that distance education has important limits set, among other things, by low levels of motivation and participation (Hastie et al., 2010).

The vast majority reported that professors have a high role, so those who consider professors important have a 10-percentage point lower chance of being less effective in learning. The latter result is in line with other previous findings that have highlighted the positive effect of online academic support from teachers or professors for the success of the eLearning process (Castles, 2004), lower dropout rates and increased level of engagement and enthusiasm (Kim et al., 2005; Paechter et al., 2010; Bradford and Wyatt, 2010; Vayre and Vonthron, 2016).

When it comes to the academic year in which the student is currently enrolled, we found that an increase in one unit decreases by 4.84 percentage points the probability of less effective learning. Thus, senior students are more efficient, denoting a much greater experience in the use of technology than their freshman and junior counterparts (Smart and Cappel, 2006). The results also show that males are by 6 percent more likely to be less effective than females, emphasizing the fact that the latter are more receptive (Selwyn, 2007), more intrinsically motivated (Yoo and Huang, 2013), more reflective (Anderson and Haddad, 2005), more communicative and efficient in building networks (Price, 2006) to eLearning share of knowledge than males. Moreover, the area of residence does not play a significant role in the perceived effectiveness of distance education. Compared to students at the Bucharest University of Economic studies (the base category), students at UAIC are by 6 percent less likely to be less effective, while students at ULB are by 22 percentage points less likely to be less effective.

Therefore, our results confirm that stress, as well as the home environment and the university infrastructure for online learning have a significant impact on the perceived effectiveness of eLearning among Romanian students.

When it comes to preferring different forms of education (face to face, online, or hybrid), the results reveal interesting influences reported by the Models 2, 3 and 4 (Table 1). The effect of psychological distress (*psych_ind*) on online learning is antagonistic compared to face-to-face education. The results show that increasing pandemic stress decreases the preference to classroom learning by 3.41 percent, while it increases by 2 percent towards online channels. Therefore, the perceived risks and stress associated with the COVID-19 pandemic increase the preferences for online learning against face-to face learning.

The influence exerted by the adequate work space at home is dichotomous: on the one hand, inadequate work space at home increases the likelihood of preferring traditional classroom education and, on the other hand, decreases the probability of engaging in online learning.

While a student who perceives the situation of distance education as a way to reduce the costs of education is also more likely to

prefer face-to-face education and is less predisposed to choose a hybrid form of education (a mixture of traditional education with digital).

Specifically, the closer the students are to completing their university studies, the more likely they are to prefer a heterodox form of education (hybrid or, with better yet, online education) and less likely the classical classroom learning. In this regard, previous studies have shown that a hybrid form of education generates identical or even better results than a conventional face-to-face education (Ryan et al., 2015).

The students in urban residences are 8 percent less likely to prefer classroom learning and 6.9 percent more likely to prefer hybrid learning compared to those residing in rural areas.

This result can be explained by an increased caution expressed by students living in urban areas, a more populated and riskier environment in the context of the current pandemic. These students are also helped and assisted by a better internet infrastructure at home compared to their rural counterparts.

Compared to BUES students, UAIC and UBB students are more likely to prefer face-to-face learning (by 8 and 9 percentage points, respectively). ULB and UAIC students are also less likely to prefer hybrid learning. It is worth mentioning the case of ULB, where 13.2 percentage points are more in eLearning compared to their BUES peers. They also perceived online learning to be much more effective than BUES students.

6. Conclusion

Using a sample of 1.415 students from five major faculties of economics in Romania and after applying logistic regressions models, our research provides a clear snapshot of the effectiveness of the eLearning emergency during the COVID-19 pandemic and what it supports. The study revealed new evidence that psychological distress and strain under the pressure of lockdown have a negative effect on the effectiveness of online learning in economics. Therefore, it is necessary to mitigate and eliminate this major drawback in order to impose an effective eLearning educational process. In this regard, students may need psychological assistance to diagnose certain emotional problems to minimize their psychological distress for increased effectiveness of the eLearning process. Otherwise, online education can become ineffective, although the economics specialization is very similar to other disciplines that do not require any special approach due to pandemic lockdown such as others, like medicine, music or sports, that need special infrastructure and face-to-face interaction.

Moreover, our results showed that those students who face problems related to insufficient time due to different family problems and inadequate space at home are less efficient in these exceptional times and conditions. Regarding the latter influence, these individuals prefer traditional education instead of online learning.

Senior and female students are less likely to be less effective in online learning, denoting that experience in using technology and gender really matter.

Also, the students living in urban centers are less likely to prefer classroom learning, but are more prone to a hybrid one.

As expected, we find that the students who consider that professors have an important role in this form of learning process are less likely to be less effective in online education. We consider this finding relevant, since the role of professors could not be neglected or overlooked, remaining a strong pillar of the success of the educational process. This finding is essential for decision-makers in the field of education, in the sense that there is no need to focus primarily on learning infrastructures and platforms, but also on the pedagogical and psychological skills of teachers/professors and their associated personalities that can affect in very different ways the interaction with students.

A particular result is given by the quality of internet infrastructure at home and by that offered by the university platforms. It is found that a student who has experienced unsatisfactory internet access at home is more likely to be less effective in online education. Also, the eLearning framework of universities has a positive emphasis on distance education, thus reducing the probability of being less efficient.

All these previous findings could create a useful framework for professors to generate an efficient and strategic pedagogy for the discipline of economics, although it is difficult to offer a silver bullet approach for it. Professors must harmonize the curricular content with the technology of disseminating information and knowledge in such a way as to enhance students' overall performances, but they should realize and understand the limits of this educational approach, the problems that students may face in such special conditions and, thus, ask themselves whether the teaching process is productive and non-discriminatory. Therefore, they must ask feedbacks from the students and encourage them permanently, in order to offer proper support for successfully integrating various personalities with different problems.

The future development of the COVID-19 pandemic is quite unknown at this stage, in Romania, in Europe and worldwide. Experts are concerned about a possible increase in the number of cases in the future, especially that the virus can undergo particular mutations that can make it even more difficult to treat. This indicates the possibility of having an extended period of online learning. In this context, our results are of interest to decision makers, by adapting public policies in higher education to the needs of students,

depending on their particular perceptions and specific situations. Stress is an important factor to consider and a more flexible approach is needed for online teaching and also for online assessment of students.

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CRedit authorship contribution statement

Monica Roman: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Writing - original draft, Writing - review & editing. **Aurelian-Petruş Plopeanu:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare no conflict of interest.

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Appendix A

Table A2

Table A1
Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
classroom Learning	1415	0,484,099	0,499,924	0	1
hybrid learning	1415	0,434,629	0,495,884	0	1
online learning	1415	0,081,272	0,273,349	0	1
<i>Effectiveness</i>					
not effective	1415	0,323,251	0,169,506	0	1
moderately effective	1415	0,280,565	0,449,434	0	1
effective	1415	0,399,293	0,489,926	0	1
psych_ind	1415	0,013,692	1,007,849	-0,73,317	224,653
worry_about_COVID 19	1415	594,629	2,318,659	0	10
university_platforms	1415	0,674,205	0,468,837	0	1
Zoom_platform	1415	0,689,046	0,463,048	0	1
professor_important	1415	3,024,028	0,937,655	0	4
internet_poor	1415	0,183,746	0,387,414	0	1
home_techn_poor	1415	0,050,177	0,218,387	0	1
time_poor	1415	0,319,435	0,466,422	0	1
space_poor	1415	0,226,148	0,418,484	0	1
cost_low	1415	0,387,986	0,487,464	0	1
academic_year	1415	2,036,749	1,009,884	1	3
residence_area	1415	0,641,696	0,479,672	0	1
gender	1415	0,225,442	0,418,021	0	1
<i>Universities</i>					
ASE	1415	0,203,534	0,402,768	0	1
UAIC	1415	0,334,276	0,471,903	0	1
UBB	1415	0,127,915	0,334,113	0	1
UVT	1415	0,196,466	0,397,466	0	1
ULB	1415	0,093,993	0,291,922	0	1
UTB	1415	0,031,095	0,173,637	0	1
other	1415	0,012,721	0,112,107	0	1

Table A2
The design of the questionnaire.

Questionnaire's items	Responses
1. What university do you study at?	ASE București = 1, UAIC Iași = 2, UBB Cluj-Napoca = 3, UV Timișoara = 4, ULB Sibiu = 5, UT Brașov = 6, UMF Iași = 7
2. What academic year are you in?	from 1 to 6
3. Gender	female = 1, male = 2
3. Residence	rural = 1, urban = 2
4. On a scale of 0–10, how worried are you about the coronavirus crisis?	scale from 0–10, where 10 means “very worried”
5. To what extent are you affected by the following problems since the onset of the coronavirus crisis and the control measures put in place? How is the current situation different from the period before the coronavirus crisis?	
[Depression]	worse than before = 0; the same as before = 1; better than before = 2; not at all affected, it is not my case = 3.
[Anxiety]	worse than before = 0; the same as before = 1; better than before = 2; not at all affected, it is not my case = 3
[Worryness]	worse than before = 0; the same as before = 1; better than before = 2; not at all affected, it is not my case = 3
[Lack of hope]	worse than before = 0; the same as before = 1; better than before = 2; not at all affected, it is not my case = 3
[Irritability]	worse than before = 0; the same as before = 1; better than before = 2; not at all affected, it is not my case = 3
[Stress]	worse than before = 0; the same as before = 1; better than before = 2; not at all affected, it is not my case = 3
[Loneliness]	worse than before = 0; the same as before = 1; better than before = 2; not at all affected, it is not my case = 3
6. I encountered the following situations in the online study:	
[I do not have satisfactory internet access]	no = 0, yes = 1
[I do not have the necessary technological infrastructure (computer) for online teaching activities]	no = 0, yes = 1
[Lack of time required (due to other family obligations)]	no = 0, yes = 1
[Lack of adequate workspace]	no = 0, yes = 1
[Stress due to the danger of the coronavirus pandemic for me or those close to me]	no = 0, yes = 1
[I have lower costs for education]	no = 0, yes = 1
7. Mention which of the following platforms were mainly used for online teaching activities:	
[University / faculty platform]	no = 0, yes = 1
[Zoom]	no = 0, yes = 1
[Facebook/Facebook Messenger/WhatsApp]	no = 0, yes = 1
[Moodle]	no = 0, yes = 1
[Meet]	no = 0, yes = 1
[Google Classroom]	no = 0, yes = 1
[Skype]	no = 0, yes = 1
[E-mail]	no = 0, yes = 1
[Other]	no = 0, yes = 1
8. For online teaching activities, you mainly used:	
Calculator/laptop	no = 0, yes = 1
Mobile phone	no = 0, yes = 1
Tablet	no = 0, yes = 1
I do not have the necessary technological infrastructure	no = 0, yes = 1
9. Please indicate to what extent you agree with the following statements:	
[Overall, I appreciate that online learning has been effective so far]	disagree = 1; neither agreement nor disagreement = 2; agreement = 3;
[The effectiveness of online learning depends on the professor]	total disagreement = 0; disagree = 1; neither agreement nor disagreement = 2; agreement = 3; total agreement = 4
10. For the next academic year, I prefer the following form of learning:	
Classroom learning	no = 0, yes = 1
A hybrid between classroom and online learning	no = 0, yes = 1
Online learning	no = 0, yes = 1

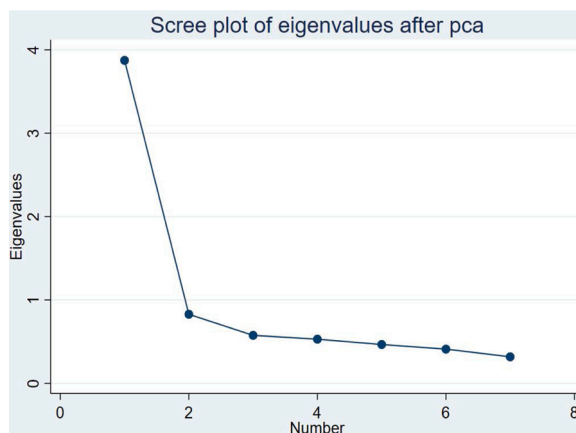
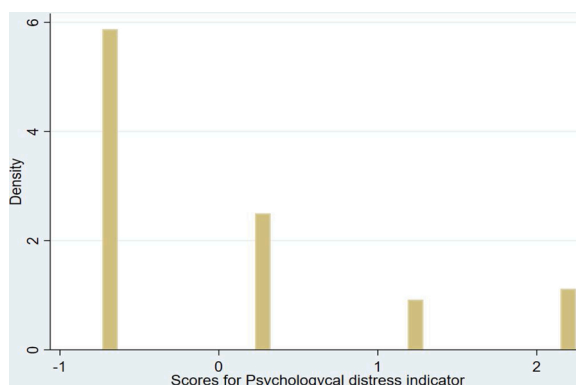


Fig. A1. Principal Component Analysis.

Fig. A2. The distribution of psychological distress (*psych_ind*).

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