https://doi.org/10.17221/286/2021-AGRICECON

Interplay between environmental, social and governance coordinates and the financial performance of agricultural companies

Marilen Gabriel Pirtea[1], Grațiela Georgiana Noja[2], Mirela Cristea[3], Mirela Panait[4,5]*

[1]*Department of Finance, Faculty of Economics and Business Administration, West University of Timişoara, Timişoara, Romania*
[2]*Department of Marketing and International Economic Relations, Faculty of Economics and Business Administration, West University of Timişoara, Timişoara, Romania*
[3]*Department of Finance, Banking and Economic Analysis, Center for Economic, Banking and Financial Research (CEBAFI), Faculty of Economics and Business Administration, University of Craiova, Craiova, Romania*
[4]*Department of Cybernetics, Economic Informatics, Finance and Accounting, Faculty of Economic Sciences, Petroleum-Gas University of Ploiesti, Ploiesti, Romania*
[5]*Institute of National Economy, Romanian Academy, Bucharest, Romania*

**Corresponding author: mirelas.cristea@gmail.com*

Citation: Pirtea M.G., Noja G.G., Cristea M., Panait M. (2021): Interplay between environmental, social and governance coordinates and the financial performance of agricultural companies. Agric. Econ. – Czech, 67: 479–490.

Abstract: On the complex framing of the agricultural fields, related to the corporate social responsibility (CSR), the general objective of this paper is to assess the impacts of environmental, social and governance (ESG) credentials of CSR and human capital features on the financial performance of agricultural companies. The data consists of a sample of 412 public companies from the Thomson Reuters Eikon database, with data for 2020, operating in 17 agricultural areas with headquarters allocated around the world. The methodological endeavor embeds two econometric procedures, multifactorial models of robust regression and structural equation modelling (SEM). The research results bring new evidence to underline the risks related to the sustainability of the financial performance of agricultural companies and the decisive role played by the ESG dimensions to counteract these risks, particularly by the environmental pillar, along with CSR specific strategies and human capital characteristics (management board and employees). We propose several strategies for companies operating in agricultural fields in order to enhance profitability by CSR measures.

Keywords: agriculture; econometric modelling; environmental dimensions; profitability; social responsibility; strategy

Globalization, increasing competition, digitalization and the escalation of the frequency with which various crises occur have generated a reconfiguration of the business environment for companies around the world (Brzozowska et al. 2017; Song 2019). In addition, climate change has led to new challenges, especially for agricultural companies, given the dependence of their production on environmental conditions (Tomchuk et al. 2018; Florea et al. 2020). The growth of the world's population has put pressure on the agricultural system, which must provide food for more and more consumers in a safe manner (Jeníček 2010; Grófová and Srnec 2012). Furthermore, the need for a new energy transition comes with challenges for the agricultural system

https://doi.org/10.17221/286/2021-AGRICECON

because the production of biofuels must provide viable solutions from an energy point of view but must not affect food production capacity (Andrei et al. 2016; Subić and Jeločnik 2018).

In this wide universe, agricultural companies are in a process of metamorphosis because they must meet the demands of stakeholders who are interested in both financial, social and environmental performance, given the negative externalities generated, such as environmental pollution determined mainly by emissions of methane (CH_4), ammonia (NH_3) and carbon dioxide (CO_2), the impact that the consumption of agricultural products and food has on the health of the population, deforestation for agricultural purposes (Panait et al. 2020; Vrabcová and Urbancová 2021). On this complex framing of the agricultural fields, given the pressures exerted by consumers, but also by other categories of stakeholders, managers of agriculture companies have become increasingly interested in the issue of corporate social responsibility (CSR), as foregoer of environmental, social and governance (ESG) measures, in order to enhance the financial performance of agricultural entities (Levkivska and Levkovych 2017; Ika et al. 2021; Vrabcová and Urbancová 2021). Hereupon the nowadays multifaceted challenges that the agricultural fields are facing to, and different from previous findings, the aim/novelty of our research is to empirical assess the CSR coordinates in their interplay with the financial performance of agricultural companies, in order to settle tailored actions in this complex and modern framework.

Our research objective is two-fold, namely: *i*) to assess the impacts (direct and overall) of the ESG dimensions, with a specific focus on the environmental pillar and human capital characteristics (board and employees), on the financial performance (absolute and relative) of public companies from the agricultural fields, and *ii*) to set specific strategies for companies operating in agricultural fields to enhance financial performance by CSR measures. The sample consisted of a total number of 412 public companies operating in various agricultural areas, with headquarters allocated around the world, which are large companies, because the size of the company has a considerable impact on CSR behavior (Udayasankar 2008). Data comprising ESG indicators (scoring and reporting), along with the financial performance indicators, were extracted for the fiscal year 2020 from Thomson Reuters (2021) Eikon database. Financial performance is explored both by the instrumentality of absolute measure [earnings before interest and taxes (EBIT)] and the relative dimensions [return on assets (ROA) and return on equity (ROE)].

Following our general objective, the research methodology consisted in applying two modern econometric procedures, namely, the multifactorial models of robust regression with Huber and biweight iterations (to assess the direct impacts of ESG measures and characteristics of human capital on the financial performance of public agricultural firms), and structural equation modelling (SEM) processed through the maximum likelihood estimator (MLE) (to assess global interlinkages).

The current research has both theoretical and practical implications and enhances the innovations in this scientific field by entailing the uttermost relevant coordinates that shape the financial performance of companies operating in agricultural fields, and in this frame of reference, the essential role of CSR activities in agriculture. The paper contributes to the theoretical and empirical debate in agricultural economics and underlines that CSR should be implemented in agriculture as a value-creating strategy and fundamental tool of sustainable development and firm profitability, providing a keen orientation towards socially responsible agricultural activities. CSR is extremely important for agricultural companies considering that more than any other sector, agriculture is dependent on natural resources and significantly impacts the environment and biodiversity in a double-causality framework, while the ethical and social issues often arise in supply chains and companies' activities, notably shaping public perceptions and adding significant pressures on companies to adopt socially responsible behaviors. These issues are increasingly important and significantly affect firm profitability and overall financial performance.

Literature review. The financial performance of agricultural companies is of interest to multiple categories of stakeholders, such as shareholders, creditors, employees, stock exchanges and public authorities. On these integrative concerns, the CSR activities have become paramount as a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis (European Commission 2011). Therefore, more and more studies (Resmi et al. 2018; Roudaki 2018; Buallay 2021; Khan et al. 2021) are focusing both on the impact that CSR, respectively, ESG actions have on the financial performance of companies, and on the non-financial performance of agricultural companies given the contribution that this field must achieve Sustainable Development Goals (Vrabcová and Urbancová 2021). These studies, con-

https://doi.org/10.17221/286/2021-AGRICECON

ducted for various countries/regions, have shown the interdependence between the financial and non-financial performance (social and environmental) of agricultural companies. Across the European Union (EU), the appearance of Directive 2014/95/EU, called also Non-Financial Reporting Directive had positive effects on the non-financial reporting at the level of the EU countries (The European Parliament and the Council of the EU 2014, Directive 2014/95/EU of 22 October 2014 amending Directive 2013/34/EU as regards Disclosure of Non-Financial and Diversity Information by certain large undertakings and groups). This directive raises the awareness of companies and stakeholders about the importance of non-financial risks to be identified (in terms of environmental and social matters, human capital, board diversity, anti-corruption and bribery measures) so that company managers can reconfigure their business strategy, stakeholders have access to data presented in a similar way that allows the comparability of information over time but also between entities. As regards the CSR actions for the agricultural companies, Vrabcová and Urbancová (2021) demonstrated their paramount need, by applying a questionnaire survey in Czech organizations in 2020, given the negative externalities generated, such as the use of pesticides, other chemicals or genetically modified organisms, water management and waste. CSR measures may involve companies in developing their financial performance and competitiveness through a management system focused on quality, environment, and health and safety at work (Vrabcová and Urbancová 2021).

In order to analyze the relation between the ESG score and the financial performance indicators [ROA, ROE, and Tobin's Q (TQ) ratio], Buallay (2021) demonstrated that there is no significant relationship between the variables selected, for specific data for agricultural companies from 31 countries (period 2008–2017). Still, when specific components of the ESG were distinctively analyzed, the findings proved a positive impact only for governance on market performance (TQ).

Regarding the impact of investments in CSR programs on several financial indicators, like ROE, ROA, earnings per share (EPS) and net income, for agribusiness companies in Bangladesh, Resmi et al. (2018), through purposive sampling method, for the period 2015 to 2017, showed a strong link between the variables used, only in the case of the CSR impact on ROE and net income, and no significant influences on ROA and EPS. As regards the interlinkages among CSR strategies and ROA, no implications were revealed also by Ika et al. (2021), for the agriculture companies listed on the Indonesia Stock Exchange for the period 2011–2013. These findings suggested that CSR strategies were in the process of consideration as a 'new dimension growth factor', and advanced management components must be further considered (Resmi et al. 2018).

Moreno-Moreno et al. (2018) recommended the implementation of technological innovation in order to heighten the operational and environmental performance of agricultural companies from Latin America and the Caribbean, as the main tool for improving their unified (operational and environmental) efficiency of the agricultural activity.

With regard to corporate governance, revealed by board ownership, compensation, independence and gender diversity, Roudaki (2018) found negative interlinkages only for board ownership and board gender diversity, while board compensation and independence had no impacts on the financial performance of agricultural companies from New Zealand.

Knežević et al. (2017), starting from the belief that agriculture is seen as 'the male-dominated sector', analyzed the impact of board gender diversity on the financial performance [measured by ROA, ROE and return on sales (ROS)] of Serbian agriculture companies. They proved a weak positive linear relationship between the number of women on the board and the financial performance measured by ROA and ROS, and no evidence of any interlinkages with ROE.

Based on these findings in the literature, we summarize that: the CSR actions became of greater importance for the agricultural companies in their interactions with stakeholders, as regards social and environmental issues; the CSR implications, mainly the ESG coordinates, on the financial performance of agricultural companies evidenced low linkages with main financial performance indicators (ROA, ROE, TQ, EPS, net income), considering empirical analysis for different period of times; the human capital dimensions proved also weak relationships with the financial performance. We, therefore, note that even though the literature acknowledges the importance of CSR credentials and human capital features in significantly shaping the financial performance of companies operating in agricultural fields, there still lacks a consensus on the direction, nature and magnitude of the impact, induced by these coordinates on companies' financial outcomes. Hence, the literature needs to be strengthened with updated comprehensive assessments and robust empirical evidence to cover this gap and enhance the knowledge in this scientific field.

https://doi.org/10.17221/286/2021-AGRICECON

MATERIAL AND METHODS

In view of literature underpinnings, namely non-financial reporting components of companies emphasized on Directive 2014/95/EU (environmental and social matters, human capital, board diversity and anti-corruption and bribery measures), related to various measures of ESG, data enclosed in our research mainly target the ESG indicators (scoring and reporting), both of general ESG measures and of the environmental pillar (Boffo et al. 2020).

The sample includes public companies from the agricultural fields, comprising the following 17 sectors: agricultural chemicals, brewers, consumer goods conglomerates, department stores, distillers & wineries, environmental services & equipment, fishing & farming, food processing, food retail & distribution, forest & wood products, non-alcoholic beverages, renewable energy equipment & services, renewable fuels, restaurants & bars, tobacco, textiles & leather goods, water & related utilities. The sample gathers a total number of 412 companies from these sectors, with headquarters allocated around the world as follows: Denmark (15), France (82), Germany (69), Italy (32), Russia (50), South Africa (32), Spain (21) and the United Kingdom (111).

The set of indicators selected for the empirical analysis covers the following 4 groups:

– Financial performance (mean): *EBIT* (USD, millions), ROA or economic profitability (*ROA*) (%), ROE or financial profitability (*ROE*) (%);
– ESG indicators from environmental pillar (scores from 1 to 100): total CO_2 equivalent emissions to revenues (*CO2_emissions*), targets emissions score (*Targets_emissions*), policy emissions score (*Policy_emissions*),

Table 1. Summary statistics

Variables	Unit of measure	*N*	Mean	SD	Min.	Max.
EBIT	USD, millions	348	207.70	1 040.97	–648.26	15 495.58
ROA	%	411	0.65	4.87	–66.50	35.21
ROE	%	411	–2.17	89.78	–1 787.67	103.70
CO2_emissions	score (1–100)	95	50.58	30.97	0.84	98.88
Targets_emissions	score (1–100)	117	53.44	38.17	0.00	89.39
Policy_emissions	score (1–100)	117	58.88	19.74	0.00	77.27
Resource_policy	score (1–100)	115	71.48	12.48	6.01	75.81
Environmental_products	score (1–100)	117	28.58	37.87	0.00	90.75
Targets_diversity	score (1–100)	105	26.79	41.61	0.00	96.96
CSR_sustainability	score (1–100)	117	53.74	15.04	0.00	76.97
CSR_strategy	score (1–100)	117	50.60	25.84	0.00	97.26
CSR_sustainability_audit	score (1–100)	70	59.84	29.21	0.00	86.44
Bribery_corruption_policy	score (1–100)	117	54.66	22.15	0.00	70.58
Bribery_corruption_fraud	score (1–100)	117	50.35	24.31	0.06	62.93
Compensation_committee	score (1–100)	101	45.97	26.86	0.35	92.68
Board_size	number	118	10.07	3.63	3.00	21.00
Board_gender_diversity	%	117	46.33	28.35	1.26	95.55
Turnover_employees	%	54	16.25	14.42	2.01	81.00
Number_employees	number	353	18 113.73	61 025.58	0.00	548 143.00
ESG_score	score (1–100)	117	55.15	18.38	5.82	90.83
N total	–	412	–	–	–	–

N – number of measurements; *EBIT* – earnings before interest and taxes; *ROA* – return on assets; *ROE* – return on equity; *CO2_emissions* – total CO_2 equivalent emissions to revenues; *Targets_emissions* – targets emissions score; *Policy_emissions* – policy emissions score; *Resource_policy* – resource reduction policy score; *Environmental_products* – environmental products score; *Targets_diversity* – targets diversity and opportunity score; *CSR_sustainability* – corporate social responsibility (CSR) sustainability reporting score; *CSR_strategy* – CSR strategy score; *CSR_sustainability_audit* – CSR sustainability external audit score; *Bribery_corruption_policy* – policy bribery and corruption score; *Bribery_corruption_fraud* – bribery, corruption and fraud controversies score; *Compensation_committee* – compensation committee independence score; *Board_size* – board size; *Board_gender_diversity* – board gender diversity; *Turnover_employees* – turnover of employees; *Number_employees* – number of employees; *ESG_score* – environmental, social, governance score

Source: Authors' elaboration according to data from Thomson Reuters (2021) Eikon database

https://doi.org/10.17221/286/2021-AGRICECON

resource reduction policy score (*Resource_policy*), environmental products score (*Environmental_products*);
- ESG measures (scores from 1 to 100): targets diversity and opportunity score (*Targets_diversity*), policy bribery and corruption score (*Bribery_corruption_policy*), CSR sustainability reporting score (*CSR_sustainability*), bribery, corruption and fraud controversies score (*Bribery_corruption_fraud*), CSR strategy score (*CSR_strategy*), CSR sustainability external audit score (*CSR_sustainability_audit*), ESG score (*ESG_score*);
- Board characteristics and human capital indicators: board size (*Board_size*) (number of people), board gender diversity (*Board_gender_diversity*) (%), compensation committee independence score (*Compensation_committee*), turnover of employees (*Turnover_employees*) (%), number of employees (*Number_employees*) (number of people).

Data were extracted from the Thomson Reuters (2021) Eikon database, for one fiscal year (2020). As stated in Table 1, the descriptive statistics of the variables included in the econometric procedures reveal that the mean value of economic profitability (*ROA*) is positive for all agricultural companies, while financial profitability (*ROE*) is negative. The mean ESG score for all companies is over 55, and of the environmental products, over 28 (both of the range of 1–100).

The research methodology consists of two modern and advanced econometric procedures, namely multifactorial models of robust regression and SEM. These two different methods are being employed in current research to ensure robust estimates, as well as to better capture *i*) the direct impact of ESG measures undertaken, along with specific characteristics of human capital (board and employees) on the financial performance of public agricultural firms (through the multifactorial models of robust regression) and *ii*) to assess the global implications (total, direct and indirect) of ESG dimensions and human capital characteristics on the financial performance of companies in the fields associated with agriculture (by applying *SEM)*. Robust regression better weights the observations, detects influential observations and eliminates the outliers, thus providing robust estimates that are not affected by violations of assumptions (Simpson and Montgomery 1998), while SEM complements regression models by modelling measurement errors and unexplained variances, and simultaneously testing the complex relationship arising in terms of global influences between considered agricultural credentials, thus linking various perspectives and better fitting the model based on theory development (Yuan and Lu 2008).

The configuration of the multifactorial models of robust regression with Huber and biweight iterations is highlighted in Equation (1), in which we considered as dependent variables the indicators of financial performance (*FP_IND*: *EBIT*, *ROA*, *ROE*), and as explanatory variables, the set of specific indicators detailed above, thus generating 3 econometric models.

SEM, processed through the MLE method, are graphically introduced in Figure 1.

Based on previous findings in the literature related to the CSR implications, mainly the ESG coordinates on the financial performance of agricultural companies, such as the ones entailed by Resmi et al. (2018),

$$\begin{aligned} EBIT\ /\ ROA\ /\ ROE = {} & \alpha_0 + \alpha_1 CO2\_emissions + \alpha_2 Targets\_emissions + \alpha_3 Policy\_emissions + \\ & + \alpha_4 Target\_diversity + \alpha_5 Resource\_policy + \alpha_6 Evironmental\_products + \\ & + \alpha_7 CSR\_sustainability + \alpha_8 CSR\_sustainability\_audit + \alpha_9 Bribery\_corruption\_policy + \\ & + \alpha_{10} Bribery\_corruption\_fraud + \alpha_{11} Compensation\_comittee + \alpha_{12} CSR\_strategy + \\ & + \alpha_{13} Board\_size + \alpha_{14} Board\_gender\_diversity + \alpha_{15} Turnover\_employees + \\ & + \alpha_{16} Number\_employees + \alpha_{17} ESG\_score + \theta_i + \varepsilon \end{aligned} \quad (1)$$

where: *EBIT* – earnings before interest and taxes; *ROA* – return on assets; *ROE* – return on equity; *CO2_emissions* – total CO_2 equivalent emissions to revenues; *Targets_emissions* – targets emissions score; *Policy_emissions* – policy emissions score; *Targets_diversity* – targets diversity and opportunity score; *Resource_policy* – resource reduction policy score; *Environmental_products* – environmental products score; *CSR_sustainability* – corporate social responsibility (CSR) sustainability reporting score; *CSR_sustainability_audit* – CSR sustainability external audit score; *Bribery_corruption_policy* – policy bribery and corruption score; *Bribery_corruption_fraud* – bribery, corruption and fraud controversies score; *Compensation_committee* – compensation committee independence score; *CSR_strategy* – CSR strategy score; *Board_size* – board size; *Board_gender_diversity* – board gender diversity; *Turnover_employees* – turnover of employees; *Number_employees* – number of employees; *ESG_score* – environmental, social, governance score; θ_i – variable that captures the country effects; ε – error term (residual variable).

https://doi.org/10.17221/286/2021-AGRICECON

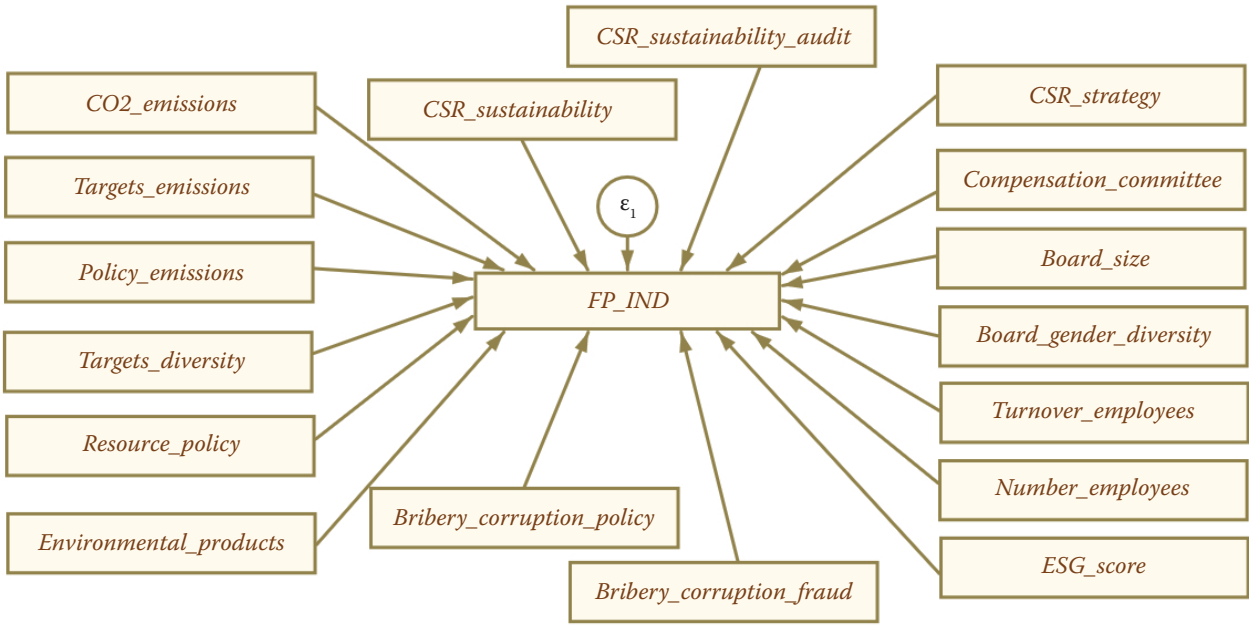

Figure 1. General SEM configuration

SEM – structural equation modelling; *FP_IND* – financial performance indicators (namely, *EBIT* – earnings before interest and taxes; *ROA* – return on assets; *ROE* – return on equity); *CO2_emissions* – total CO_2 equivalent emissions to revenues; *Targets_emissions* – targets emissions score; *Policy_emissions* – policy emissions score; *Targets_diversity* – targets diversity and opportunity score; *Resource_policy* – resource reduction policy score; *Environmental_products* – environmental products score; *CSR_sustainability* – corporate social responsibility (CSR) sustainability reporting score; *CSR_sustainability_audit* – CSR sustainability external audit score; *Bribery_corruption_policy* – policy bribery and corruption score; *Bribery_corruption_fraud* – bribery, corruption and fraud controversies score; *CSR_strategy* – CSR strategy score; *Compensation_committee* – compensation committee independence score; *Board_size* – board size; *Board_gender_diversity* – board gender diversity; *Turnover_employees* – turnover of employees; *Number_employees* – number of employees; *ESG_score* – environmental, social, governance score; ε – error term

Source: Own contribution

Ika et al. (2021) and Buallay (2021) that evidenced weaker linkages with main financial performance indicators, yet considering an empirical analysis performed on relatively older data (e.g. 2015–2017, 2011–2013, 2008–2017), our research hypotheses seek to target both direct influences of CSR-ESG dimensions (H_1) and overall interlinkages with the financial performance of firms in agricultural fields (H_2), thus bringing new empirical evidence for 2020 that strengthens the knowledge in this scientific field. The importance of the human capital dimension is also acknowledged in our research (both research hypotheses) following the main findings of Roudaki (2018) and Knežević et al. (2017) that proved weaker relationships of main human capital features with the financial performance.

Consequently, the research hypotheses (H) are:

H_1: There are significant and favorable direct influences of the ESG dimensions and human capital characteristics on the financial performance (absolute and relative) of firms in agricultural fields.

H_2: There are significant and favorable global influences (direct, indirect, total) of the ESG dimensions and specific characteristics of human capital on the financial performance (absolute and relative) of firms in agricultural fields.

RESULTS AND DISCUSSIONS

Multifactorial models of robust regression. The results of multifactorial models of robust regression (Table 2) reveal a very good association among variables, meaning that the dependent variables can be explained by the considered independent variables to a very large extent, highlighted by R^2 values near to 1 (*EBIT*, Model 1, R^2 = 0.984; *ROA*, Model 2, R^2 = 0.989). Good associations were also registered in the case of the direct influence of all the variables considered on the financial performance measured by financial profitability (*ROE*, Model 3, R^2 = 0.593), however, the direct influences obtained of the explanatory variables are not sta-

https://doi.org/10.17221/286/2021-AGRICECON

Table 2. Results of multifactorial models of robust regression

Variables	Model 1	Model 2	Model 3
	EBIT	*ROA*	*ROE*
CO2_emissions	37.2200000*** (0.1260000)	0.0533000*** (0.0019100)	0.1720000 (0.1530000)
Targets_emissions	–18.8000000*** (0.09450000)	–0.0033300 (0.0018000)	–0.1200000 (0.1440000)
Policy_emissions	17.3500000*** (0.6940000)	0.0920000*** (0.01230000)	0.1340000 (0.9830000)
Targets_diversity	–17.5300000*** (0.0793000)	0.0082600*** (0.0014800)	–0.0642000 (0.1180000)
Resource_policy	–1 146.0000000*** (8.4060000)	–2.2740000*** (0.1560000)	–4.7390000 (12.5500000)
Environmental_products	32.7800000*** (0.1010000)	0.0084300*** (0.0014700)	–0.1020000 (0.1180000)
CSR_sustainability	–786.4000000*** (2.6460000)	0.1220000** (0.0358000)	–0.5300000 (2.8750000)
CSR_sustainability_audit	40.3800000*** (0.1440000)	0.0036800 (0.0024600)	–0.0473000 (0.1970000)
Bribery_corruption_policy	–198.9000000*** (0.6460000)	0.1250000*** (0.0045800)	0.3290000 (0.3670000)
Bribery_corruption_fraud	54.4500000*** (0.1620000)	–0.0110000*** (0.0021600)	–0.0703000 (0.1740000)
Compensation_committee	33.7800000*** (0.1310000)	0.0550000*** (0.0022700)	0.0119000 (0.1820000)
CSR_strategy	25.9200000*** (0.1840000)	0.0500000*** (0.0033200)	0.3980000 (0.2670000)
Board_size	–561.4000000*** (1.4330000)	–0.2130000*** (0.0186000)	–1.9920000 (1.4890000)
Board_gender_diversity	–55.6100000*** (0.1630000)	–0.0019300 (0.0023600)	–0.0703000 (0.1890000)
Turnover_employees	–247.1000000*** (0.5850000)	0.0007550 (0.0096600)	–0.7250000 (0.7740000)
Number_employees	0.0177000*** (0.0000477)	–0.0000078*** (0.0000007)	0.0000271 (0.0000639)
ESG_score	107.2000000*** (0.3430000)	–0.0218000** (0.0062800)	–0.0117000 (0.5040000)
cons	138 229.3000000*** (671.9000000)	146.0000000*** (12.0400000)	388.6000000 (965.4000000)
R^2	0.984	0.988	0.593

Standard errors (SE) in parentheses: *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$; *EBIT* – earnings before interest and taxes; *ROA* – return on assets; *ROE* – return on equity; *CO2_emissions* – total CO_2 equivalent emissions to revenues; *Targets_emissions* – targets emissions score; *Policy_emissions* – policy emissions score; *Targets_diversity* – targets diversity and opportunity score; *Resource_policy* – resource reduction policy score; *Environmental_products* – environmental products score; *CSR_sustainability* – corporate social responsibility (CSR) sustainability reporting score; *CSR_sustainability_audit* – CSR sustainability external audit score; *Bribery_corruption_policy* – policy bribery and corruption score; *Bribery_corruption_fraud* – bribery, corruption and fraud controversies score; *Compensation_committee* – compensation committee independence score; *CSR_strategy* – CSR strategy score; *Board_size* – board size; *Board_gender_diversity* – board gender diversity; *Turnover_employees* – turnover of employees; *Number_employees* – number of employees; *ESG_score* – environmental, social, governance score; *cons* – constant (intercept)

Source: Authors' elaboration according to data from Thomson Reuters (2021) Eikon database

https://doi.org/10.17221/286/2021-AGRICECON

tistically significant for this dependent variable [as also stated by Buallay (2021), and opposite to Resmi et al. (2018) that found strong links among CSR and *ROE*].

In terms of absolute financial performance (Table 2), assessed by *EBIT* (Model 1), this is favorably influenced (positive and statistically significant coefficients) by the concrete ESG measures applied from the environmental pillar, namely emissions of CO_2 to revenues (*CO2_emissions*), policy emissions (*Policy_emissions*), environmental products (*Environmental_products*), but also by general ESG measures [CSR sustainability external audit (*CSR_sustainability_audit*), bribery, corruption and fraud controversies (*Bribery_corruption_fraud*), CSR strategies (*CSR_strategy*) and the overall ESG score (*ESG_score*)] and human capital characteristics [compensation committee (*Compensation_committee*) and the employees' number (*Number_employees*)]. In the cases of targets emissions score (*Targets_emissions*), resource reduction policy (*Resource_policy*), CSR sustainability reporting (*CSR_sustainability*), policy bribery and corruption score (*Bribery_corruption_policy*), targets diversity and opportunity score (*Targets_diversity*), on the one hand, and board size (*Board_size*), its gender diversity (*Board_gender_diversity*) and the turnover of employees (*Turnover_employees*), as human capital characteristics, the influences on *EBIT* (Model 1) obtained by the agricultural companies were unfavorable (negative and statistically significant coefficients). The explanations for these negative implications may consist in the fact that these policies, targets and measures as ESG actions could generate increased expenses of the agricultural companies in order to support them, and as much inducing lower-income (earnings), on the one hand, but also the number of board members (with a mean of 10.07 members) (Table 1), gender diversity (women participation on the boards of companies is lower than 50%) (Table 1) and low turnover of employees (a mean of 16.25%, compared to the maximum value of 81.00), on the other hand. The results are opposite to Knežević et al. (2017) that showed a positive relationship between board gender diversity and financial performance measured by economic profitability (*ROA*). The same negative interlinkages between board gender diversity and financial performance were proved by Roudaki (2018) for the agricultural companies from New Zealand, while board compensation had no impact on financial performance (different to our results that revealed favorable connections).

Regarding the financial performance in relative size, assessed by economic profitability (*ROA*, Model 2), this was favorably influenced (positive and statistically significant coefficients) by the emissions of CO_2 to revenues (*CO2_emissions*), policy emissions (*Policy_emissions*) and environmental products (*Environmental_products*), as CSR measures from the environmental pillar, but also by specific CSR coordinates [such as targets diversity and opportunity (*Targets_diversity*), CSR sustainability reporting (*CSR_sustainability*), policy bribery and corruption (*Bribery_corruption_policy*) and CSR strategies (*CSR_strategy*)] and board characteristics, namely compensation committee (*Compensation_committee*) (Table 2). As regards board compensation, Roudaki (2018) revealed no impacts on financial performance. Unfavorable influences on economic profitability were induced by resource reduction policy (*Resource_policy*), for the environmental measures, and controversies on bribery, corruption and fraud (*Bribery_corruption_fraud*), ESG score (*ESG_score*), board size (*Board_size*) and the employees' number (*Number_employees*). These negative implications on economic profitability (*ROA*) could have been induced even by reducing the net profit, or by increasing the value of assets, due to inadequate policies and measures for the environmental pillar, but also by increasing acts of bribery, corruption and frauds, the number of boards members and employees, with direct impact on human expenses and companies' turnover. These results are opposite to Resmi et al. (2018) and Buallay (2021), which have not found any significant interlinkages among ESG measures and profitability related to assets.

Thereby, first hypothesis [H_1: There are significant and favorable direct influences of the ESG dimensions and human capital characteristics on the financial performance (absolute and relative) of firms in the agricultural fields] is partially fulfilled, with differentiated impact on absolute (*EBIT*) or relative (*ROA* and *ROE*) financial performance, being registered also unfavorable implications, for which specific strategies are recommended.

Models of structural equations (SEM). To assess the global implications of the ESG dimensions and human capital characteristics on the financial performance of companies from agricultural fields (hypothesis H_2), we built 3 SEM for each of the dependent variables considered, namely, *EBIT* (Figure 2), economic profitability and financial profitability (Figure 3).

SEM models are estimated using MLE, with missing values, as some of the indicators do not have values for all companies considered. To validate SEM results, we firstly applied a series of specific tests (like goodness-of-fit tests, Wald test for equations, Cronbach's Alpha for scale reliability). The results of these tests are pre-

https://doi.org/10.17221/286/2021-AGRICECON

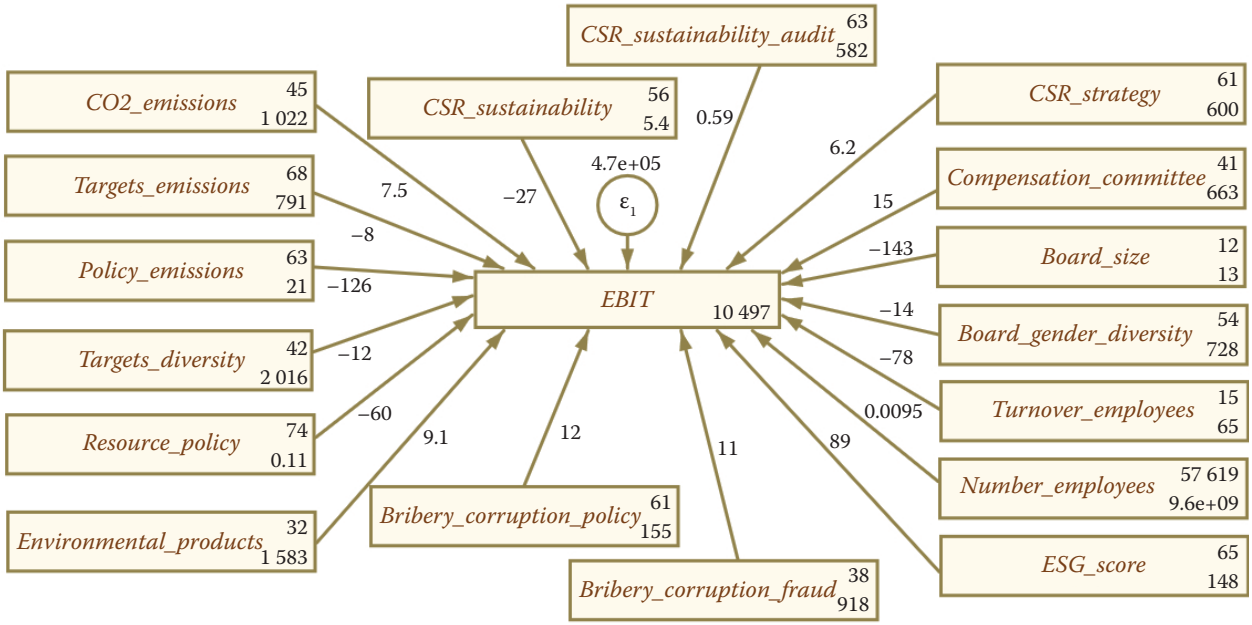

Figure 2. SEM results for *EBIT*

SEM – structural equation modelling; *EBIT* – earnings before interest and taxes; *CO2_emissions* – total CO_2 equivalent emissions to revenues; *Targets_emissions* – targets emissions score; *Policy_emissions* – policy emissions score; *Targets_diversity* – targets diversity and opportunity score; *Resource_policy* – resource reduction policy score; *Environmental_products* – environmental products score; *CSR_sustainability* – corporate social responsibility (CSR) sustainability reporting score; *CSR_sustainability_audit* – CSR sustainability external audit score; *Bribery_corruption_policy* – policy bribery and corruption score; *Bribery_corruption_fraud* – bribery, corruption and fraud controversies score; *CSR_strategy* – CSR strategy score; *Compensation_committee* – compensation committee independence score; *Board_size* – board size; *Board_gender_diversity* – board gender diversity; *Turnover_employees* – turnover of employees; *Number_employees* – number of employees; *ESG_score* – environmental, social, governance score; ε – error term

Source: Authors' elaboration according to data from Thomson Reuters (2021) Eikon database

sented in Table S1 in electronic supplementary material (ESM; for the ESM see the electronic version) and entail that the models passed the robustness check, hence the results are suitable for a proper economic interpretation.

The results are statistically significant (as shown in Table S2 in ESM; for the ESM see the electronic version) and emphasize that the financial performance expressed in absolute size is significantly influenced by all considered variables, overall, in their tight interdependence. Thus, *EBIT* (Figure 2) are favorably influenced by the quantitative component of human capital – number of employees (*Number_employees*), and by the total ESG score (*ESG_score*), sustained by statistically positive and significant coefficients (0.00952, $P < 0.01$, respectively 88.79, $P < 0.001$). Unfavorable influences on *EBIT* are globally induced by policies from the environmental pillar (*Policy_emissions*), but also by targets diversity and opportunity (*Targets_diversity*), as specific CSR measures, and the turnover of employees (*Turnover_employees*), as human capital output measures (negative coefficients, statistically significant).

The financial performance of agricultural firms (Figure 3), captured in relative size and measured by economic profitability and financial profitability, is similarly and favorably influenced (positive and statistically significant coefficients) by the concrete ESG measures applied from the environmental pillar, namely emissions of CO_2 to revenues (*CO2_emissions*), but also by general ESG measures – CSR strategies (*CSR_strategy*) and policy bribery and corruption score (*Bribery_corruption_policy*). Unfavorable influences are manifested by the quantitative component of companies' management, namely the board size (*Board_size*), both in the case of economic profitability and financial profitability (Figure 3 and Table S2 in ESM; for the ESM see the electronic version). The results are opposite to those obtained by Buallay (2021) and Resmi et al. (2018) that revealed no significant interlinkages among ESG measures, profitability related to assets and equity.

In addition, only for the economic profitability of firms in the agricultural field (*ROA*), there is a positive influence from the board characteristics component, namely

https://doi.org/10.17221/286/2021-AGRICECON

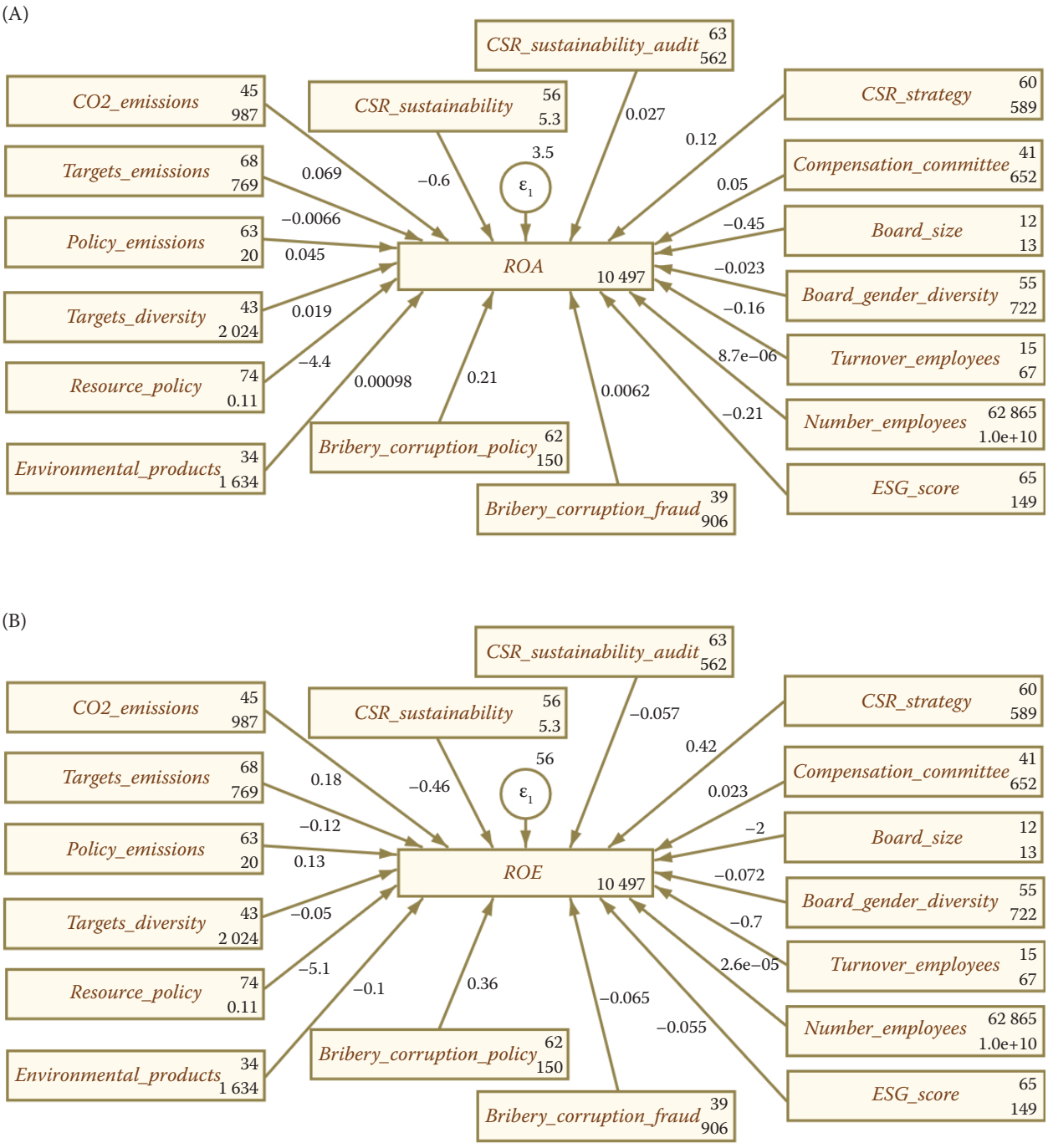

Figure 3. SEM results for (A) *ROA* and (B) *ROE*

SEM – structural equation modelling; *ROA* – return on assets; *ROE* – return on equity; *CO2_emissions* – total CO_2 equivalent emissions to revenues; *Targets_emissions* – targets emissions score; *Policy_emissions* – policy emissions score; *Targets_diversity* – targets diversity and opportunity score; *Resource_policy* – resource reduction policy score; *Environmental_products* – environmental products score; *CSR_sustainability* – corporate social responsibility (CSR) sustainability reporting score; *CSR_sustainability_audit* – CSR sustainability external audit score; *Bribery_corruption_policy* – policy bribery and corruption score; *Bribery_corruption_fraud* – bribery, corruption and fraud controversies score; *CSR_strategy* – CSR strategy score; *Compensation_committee* – compensation committee independence score; *Board_size* – board size; *Board_gender_diversity* – board gender diversity; *Turnover_employees* – turnover of employees; *Number_employees* – number of employees; *ESG_score* – environmental, social, governance score; ε – error term

Source: Authors' elaboration according to data from Thomson Reuters (2021) Eikon database

https://doi.org/10.17221/286/2021-AGRICECON

compensation committee (*Compensation_committee*) – opposite to Roudaki (2018) that showed no impacts of board compensation on financial profitability – and an unfavorable influence by resource reduction policy (*Resource_policy*), for the environmental measures, and by the ESG score (*ESG_score*), as overall specific CSR measure.

Therefore, second hypothesis [H_2: there are significant and favorable global influences (direct, indirect, total) of the ESG dimensions and the characteristics of human capital on the financial performance (absolute and relative) of firms in the agricultural fields], is also partially fulfilled, with differentiated implications amongst considered models [for absolute (*EBIT*), and relative financial performance (*ROA* and *ROE*)], and unfavorable or insignificant impacts.

Consequently, this hypothesis (H_2) revealed that, in terms of global interdependencies, at the level of public companies in the fields of agriculture, there are risks related to the sustainability of the financial performance of companies, determined by: policies and targets of the environmental pillar (for *EBIT*), policies of resource reduction and ESG general measures (for economic profitability), and the dimension of the board (for profitability related to assets and equity). Further, we propose distinct policies and tailored strategies to mitigate these potential risks.

CONCLUSION

In this paper, we assessed the impacts (direct and overall) of the ESG dimensions and human capital characteristics (board and employees) on the financial performance of public companies from the fields of agriculture. Financial performance was explored by EBIT, economic and financial profitability. The research outputs have both theoretical and practical implications. They strengthen the literature in this scientific field, through accounting that the CSR actions and sustainability of the agricultural sector is essential for boosting its profitability. They contribute to eradicating extreme poverty, since the sector is being severely challenged and in peril due to climate change (Florea et al. 2020). The research increases the awareness of managers of agriculture companies in measures of CSR, especially on environmental directions and human capital recognition, in order to enhance the financial performance of companies.

As a result of the research conducted in this paper, we propose several strategies for companies operating in agricultural fields in order to enhance profitability by CSR measures. As a topical interest for the stakeholders, but also for consumers and government (Roudaki 2018), we propose continuosly keeping the transparency in financial reporting and non-financial disclosures.

Since CSR reporting is stated by regulation, governments should set clear regulations about what items should be disclosed in the annual report, increasing the extent of CSR reporting should be done (Ika et al. 2021).

In order to heighten environmental performance, constantly applying the technological and digital innovation are vital to enhance resource reduction, and adjusting policies and targets for the environmental pillar (Moreno-Moreno et al. 2018; Panait et al. 2020).

Although agriculture represents 'the male dominated sector', more women on board can improve the agricultural financial performance, since having women in the board means better decision making process, different attitude toward risk and more diversified skills used (Knežević et al. 2017).

Our results also attested an unfavorable influence of board diversity on the financial performance of considered agricultural companies, suggesting that additional efforts are needed on these lines to significantly improve women participation in management committees with benefit spillovers on firm financial outcomes.

There are a few limitations of the study performed within this paper arising from reduced availability of data for longer time series that would be more accurate in revealing the shaping and deterring factors of agricultural firms' profitability. Moreover, we are aware of many other factors that may influence the financial profitability of agricultural companies, like public/state support of these companies, demographic characteristics of human capital, education, weather or animal pandemic disease, which may affect our results. Since the analysis of our research is aimed at large companies in the agricultural sector due to their considerable impact on CSR behavior (only these being included in the Thomson Reuters Eikon database), another limitation of our research direction may consist in our sample composition that does not include small organic farms (although they are highly connected on sustainability issues), which are not reporting non-financial measures.

Future research is focused on ESG bidirectional implications on agricultural firms' size and the implications of the COVID-19 outbreak, along with demographic characteristics of human capital on the financial performance of agribusiness companies.

https://doi.org/10.17221/286/2021-AGRICECON

REFERENCES

Andrei J.V., Ion A.R., Popescu G.H., Nica E., Zaharia M. (2016): Implications of agricultural bioenergy crop production and prices in changing the land use paradigm – The case of Romania. Land Use Policy, 50: 399–407.

Boffo R., Marshall C., Patalano R. (2020): ESG Investing: Environmental Pillar Scoring and Reporting. OECD Paris. Available at www.oecd.org/finance/esg-investing-environmental-pillar-scoring-and-reporting.pdf (accessed July 22, 2021).

Brzozowska A., Bubel D., Kalinichenko A., Nekrasenko L. (2017): Transformation of the agricultural financial system in the age of globalisation. Agricultural Economics – Czech, 63: 548–558.

Buallay A. (2021): Sustainability reporting and agriculture industries' performance: Worldwide evidence. Journal of Agribusiness in Developing and Emerging Economies (in press).

European Commission (2011): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A Renewed EU Strategy 2011–14 for Corporate Social Responsibility. Available at https://op.europa.eu/en/publication-detail/-/publication/ae5ada03-0dc3-48f8-9a32-0460e65ba7ed/language-en (accessed July 20, 2021).

Florea N.M., Bădîrcea R.M., Pîrvu R.C., Manta A.G., Doran M.D., Jianu E. (2020): The impact of agriculture and renewable energy on climate change in Central and East European countries. Agricultural Economics – Czech, 66: 444–457.

Grófová Š., Srnec K. (2012): Food crisis, food production and poverty. Agricultural Economics – Czech, 58: 119–126.

Ika S.R., Akbar F.A., Puspitasari D., Sumbodo, B.T., Widagdo A.K. (2021). Corporate social responsibility reporting of agriculture companies: Evidence from Indonesia. In: IOP Conference Series: Earth and Environmental Science, International Conference on Sustainable Utilization of Natural Resources (Vol. 800, No. 1), Indonesia, Nov 28, 2020: 1–7.

Jeníček V. (2010): World population – Development, transition. Agricultural Economics – Czech, 56: 1–15.

Khan S.A.R., Yu Z., Panait M., Janjua L.R., Shah A. (2021): Global Corporate Social Responsibility Initiatives for Reluctant Businesses. Hershey, Pennsylvania, USA, IGI Global: 25–146.

Knežević G., Pavlović V., Bojičić R. (2017): Does the board gender diversity impact financial performance in agriculture? Case of Serbian agriculture companies listed on Stock Exchange. Custos e Agronegocio, 13: 2–20.

Levkivska L., Levkovych I. (2017): Social responsibility in Ukrainian agriculture: The regional issue. Eastern Journal of European Studies, 8: 97–114.

Moreno-Moreno J., Velasco Morente F., Sanz Díaz M.T. (2018): Assessment of the operational and environmental efficiency of agriculture in Latin America and the Caribbean. Agricultural Economics – Czech, 64: 74–88.

Panait M., Erokhin V., Andrei J.V., Gao T. (2020): Implication of TNCs in agri-food sector: Challenges, constraints and limits: Profit or CSR? Strategic Management, 25: 33–43.

Resmi S.I., Begum N.N., Hassan, M.M. (2018): Impact of CSR on firm's financial performance: A study on some selected agribusiness industries of Bangladesh. American Journal of Economics, Finance and Management, 4: 74–85.

Roudaki J. (2018): Corporate governance structures and firm performance in large agriculture companies in New Zealand. Corporate Governance, 18: 987–1006.

Simpson, J.R., Montgomery, D. (1998): A performance-based assessment of robust regression methods. Communications in Statistics Part B: Simulation and Computation, 27: 1031–1049.

Song A.K. (2019). The digital entrepreneurial ecosystem – A critique and reconfiguration. Small Business Economics, 53: 569–590.

Subić J., Jeločnik M. (2018): Economic-energetic parameters of biomethane production from the agricultural plant biomass. In: Thematic Proceedings, Sustainable Agriculture and Rural Development in Terms of the Republic of Serbia Strategic Goals Realization within the Danube Region: Support Programs for the Improvement of Agricultural and Rural Development, Serbia, Dec 14–15, 2017: 300–317.

Thomson Reuters (2021): 2020 Eikon. [Dataset]. Thomson Reuters. Available at https://eikon.thomsonreuters.com/index.html (accessed May 20, 2021).

Tomchuk O., Lepetan I., Zdyrko N., Vasa L. (2018): Environmental activities of agricultural enterprises: Accounting and analytical support. Economic Annals-XXI, 169: 77–83.

Udayasankar K. (2008): Corporate social responsibility and firm size. Journal of Business Ethics, 83: 167–175.

Vrabcová P., Urbancová H. (2021): Approaches of selected organisations in the Czech Republic to promoting the concept of sustainable development and corporate social responsibility. Agricultural Economics – Czech, 67: 255–265.

Yuan K.-H., Lu L. (2008): SEM with missing data and unknown population using two-stage ML: Theory and its application. Multivariate Behavioral Research, 62: 621–652.

Received: August 18, 2021
Accepted: November 3, 2021