ENTREPRENEURIAL ACTIVITY AS A FUNCTION OF SUSTAINABLE DEVELOPMENT: PANEL ANALYSIS[1]

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A B S T R A C T

The paper studies the impact of entrepreneurial activity on three components of sustainable development: economic, social and environmental. Three distinct variables, i.e. new businesses, established businesses, and ambitious entrepreneurs, represent entrepreneurial activity. Variables, GDP growth rate, modified human development index and carbon dioxide emissions are used to observe sustainable development. The aim of the paper is to determine whether entrepreneurship affects sustainable development and, if yes, in what form. There are three econometric panel models created for research purposes. A panel analysis was performed on a sample of 35 countries over ten years. The results indicated a contradictory impact of the variables used to measure the level of entrepreneurial activity, while none of them showed an effect on overall sustainable development.

1. INTRODUCTION

In modern society, dominated by problems such as the access to drinking water, the increase in the number of people living below the poverty line, the increase in the number of people with chronic diseases, growing urbanization, endangering the environment, etc., it is not enough to monitor only economic prosperity. Sustainable development models, started emerging in the 1970s, combine economic, social and environmental components, i.e. they promote economic progress without endangering society or the environment. In recent decades, emphasis has been placed on the role of entrepreneurship as a mechanism that can bring solutions to social and environmental problems.

From a theoretical perspective, the relationship between entrepreneurship and economic development can be explained through several approaches. Schumpeter (1934) emphasizes the role of entrepreneurs as innovators who drive economic growth through a process of creative destruction. In contrast, Kirzner emphasizes the role of entrepreneurs in recognizing and exploiting market opportunities. In addition, the theory of endogenous growth (Romer, 1990) suggests that human capital, knowledge and innovation, often driven by entrepreneurial activity, are key determinants of long-term economic growth. These theoretical approaches provide a basis for understanding the potential impact of entrepreneurship on development.

In this paper, the subject of research is the examination of the impact of entrepreneurial activity on sustainable development. The aim of the work is to determine whether encouraging the development of entrepreneurship will lead to a triple final effect - economic growth that does not harm society and the environment. Also, the goal is to determine whether there is a collision between some types of entrepreneurship, i.e. whether they indicate conflicting impacts on different components of sustainable development. More specifically, new businesses are a very complex indicator of entrepreneurial activity. It includes opportunity-entrepreneurship and necessity-entrepreneurship as well as businesses founded with the intention of growth and those started to try one's luck. Bearing in mind such a structure of new businesses, it can be expected that they have the opposite effect on the components of sustainable development in relation to other indicators of entrepreneurial activity or that they do not have a statistically significant impact.

The hypotheses were tested using unbalanced panel models on a sample of 35 countries[2], in the period from 2011 to 2020. Three models were tested, where the first evaluates the impact of entrepreneurship on the economic dimension of sustainable development. The second model evaluates the impact of entrepreneurship on the social dimension of sustainable development, and the third model evaluates the impact of entrepreneurship on the ecological dimension of sustainable development.

H1: Different forms of entrepreneurial activity have heterogeneous effects on economic growth; among new businesses, established businesses, and ambitious entrepreneurs, the last ones have the strongest positive impact.

2 The countries included in the sample are Austria, Croatia, Cyprus, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Panama, Uruguay, Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Qatar, Iran, China, India, Indonesia, Thailand, Egypt and the Republic of South Africa.

H2: Entrepreneurial activity positively affects the social aspect of sustainable development.

H3: Entrepreneurship may contribute to the reduction of environmental pollution, particularly in the case of new businesses, thus leading to a positive impact on the ecological component of sustainable development.

The paper, in addition to the introduction and conclusion, consists of three chapters: empirical literature, materials and methods, and results and discussions. The *Empirical Literature* delivers a brief overview of studies dealing with a similar topic, i.e. the impact of entrepreneurship on sustainable development or only on some its component. In the chapter *Materials and Methods* a tabular presentation of all used variables and their sources is presented. It is explained how and why the index of human development was corrected. Also, the methodology used to test the set hypotheses was explained. The *Results and Discussion* chapter contains the test results and their interpretation.

2. EMPIRICAL LITERATURE

The relationship between entrepreneurship and development is based on several key economic theories. Schumpeter (1934) views entrepreneurship as an innovative process that radically changes the market order. Romer (1990) through the endogenous growth theory begins to view knowledge as a factor that explicitly explains economic growth. Unlike traditional factors of production, the role of knowledge is particularly significant due to the possibility of spillovers and use by other enterprises. However, knowledge spillovers do not occur automatically; mechanisms are needed to facilitate them. Acs, Audretsch, Braunerhjelm and Carlsson (2011) identified entrepreneurship as a mechanism for the commercialization of knowledge. They examined the role of knowledge and entrepreneurship in stimulating economic growth. The results of a panel analysis conducted on a sample of 18 countries showed that entrepreneurship, measured as the self-employment rate, contributes positively to economic growth.

A review of empirical literature reveals the various variables used by authors to measure entrepreneurial activity level. Among the authors who dealt with this topic, some employed direct measures of the level of entrepreneurial activity, while others used proxy variables. Some authors used the number of patent applications as a productive entrepreneur measure (Salgado-Banda, 2007) since entrepreneurship is often associated with innovation and innovation is sometimes expressed by the number of patents. The limitation of this approach is reflected

in the fact that many patents do not go through the commercialization phase, i.e. they do not enter the market but remain at the invention level. Some authors use the research and development variable as a proxy for the level of entrepreneurial activity (Armeanu, Vintila & Gherghina, 2017). Its primary disadvantage is that it can be a measure of innovative activities, but this does not imply it will lead to inventive results.

The percentage of the population that has started or is in the process of starting their own business, the percentage of businesses initiated out of necessity, the percentage of businesses started to seize an opportunity, the number of start-ups, the percentage of businesses with the intention of growth and employment, youth entrepreneurship, growth rate of the number of entrepreneurs in the total number of employees and others are used as direct measures of the entrepreneurial activity level (for more details see Audretsch & Keilbach, 2008; Pinillos & Reyes, 2009; Stam et al, 2010; Linan & Fernandez-Serrano, 2013; Fotoyi & Ncwadi, 2025; Molnar, Josipović & Baškot, 2024). Research on a sample of 43 countries observed in nine years (2004-2012) confirmed that opportunity-driven entrepreneurship positively affects economic growth (Aparicio, Urbano & Audretsch, 2015). The following year, the authors expanded the number of independent variables. Therefore, along with opportunity entrepreneurship, they observed necessity entrepreneurship and the percentage of new businesses. Using the same sample, they proved that the total percentage of new businesses and opportunity entrepreneurship positively influence growth (Urbano & Aparicio, 2016).

Another group of authors used the "growth-oriented entrepreneurs" (ambitious entrepreneurs) variable to denote entrepreneurs with medium and high growth ambitions (Stam et al, 2006). The research employed cross-sectional data (2002), and the sample included 36 countries. Regression analysis indicated that ambitious entrepreneurship contributes to growth more than the percentage of new businesses.

Most of the research papers discovered a positive connection between entrepreneurship and economic growth in samples dominated by developed countries. Yet, negative or statistically insignificant results are present in countries with a lower income level. Regression and cluster analysis applied to a sample of 56 countries of different levels of development revealed a negative relationship between entrepreneurship and growth (Linan & Fernandez-Serrano, 2013). To measure entrepreneurship, the authors utilised the percentage of new businesses, necessity entrepreneurship, and opportunity entrepreneurship. The research of the second group of authors on the example of 43 economies of

different development levels from 2009 to 2013, with the application of the fixed effects model, showed that none of the three observed types of entrepreneurship (percentage of new businesses, innovation-based entrepreneurship and opportunity-driven entrepreneurship) does not affect the GDP growth rate (Ferreira et al, 2016).

The most common explanation for the aforementioned results is the inhomogeneity of the observed samples, which is reflected in the final result. The structure of entrepreneurial businesses varies depending on the level of economic development. Opportunity entrepreneurship prevails in developed countries, while necessity entrepreneurship prevails in less developed ones. Entrepreneurs who start a business as the only form to ensure existence for themselves and their families are often insufficiently prepared to navigate the market, and a higher percentage of such businesses fail. The authors' 2016 research approach clarifies the mentioned results in more detail (Prieger et al, 2016). There is no "missed" growth in developed countries because entrepreneurship is almost at the optimum. In developing countries, the optimal rate of entrepreneurship is higher, which is why they have "penalties" for growth. Considering that the Global Entrepreneurship Monitor data show that less developed countries have higher rates of new businesses, higher rates of necessity entrepreneurship and lower rates of opportunity entrepreneurship, the conclusion is that entrepreneurs in those countries are less efficient. As possible reasons, the authors cite market success attained through cooperation with the political elite, not by fighting the competition.

The 2015 United Nations Conference on sustainable development encouraged the actualization of the sustainable development issue. The Global Development Program until 2030, better known as Agenda 2030, was adopted then, containing 17 Sustainable Development Goals (SDGs). It encouraged some authors to examine the link between entrepreneurship and the components of sustainable development (Dhahri & Omri, 2018). They point out that the sustainable development challenges are similar to the *prisoner's dilemma* problem because environmentally conscious behaviour creates a gap between personal and collective goals. They confirmed this on a sample of 20 developing countries, covering a 12-year period. By applying a co-integration analysis, the authors concluded that entrepreneurship contributes positively to economic and social dimensions of sustainable development, but the impact on the environment is negative. The mentioned results display the insufficient environmental awareness of entrepreneurs in developing countries and the preference for individual rewards as opposed to collective sustainability goals. A similar type of research was conducted in 2022 on the example of Slovenia, Croatia, Hungary and Latvia

(period 2006-2016). The results showed that entrepreneurship contributes to the economic and social aspect of sustainable development, but not to the ecological one (Almhamad, 2022).

Other authors also point to the connection between entrepreneurship and sustainable development. Zhu, Jia & Lin (2019) point out that entrepreneurship has a key role in promoting the circular model in developing countries, while Markman et al. (2019) explains in more detail the role of entrepreneurship in solving socio-ecological challenges by distinguishing social, ecological and sustainable entrepreneurship. Social entrepreneurship is aimed at solving issues of poverty, unequal opportunities and other social problems. Environmental entrepreneurship deals with solving problems with pollution, climate change and other environmental problems. Sustainable entrepreneurship is a hybrid form of social and ecological entrepreneurship and aims to solve both groups of problems. It is also known as impact entrepreneurship.

3. MATERIALS AND METHODS

The impact of entrepreneurial activity on the sustainable development components in the 2011-2020 period was tested for this paper. The observed sample includes 35 countries, and its size was determined by data availability, primarily for variables measuring the level of entrepreneurial activity. They are collected from the Global Entrepreneurship Monitor (GEM) study. What hindered the research was the fact that only a few countries constantly cooperate with the study publishers, while other countries cooperate only periodically, so no data are available for each year of observation. Thus, an unbalanced panel model was used to test the hypotheses.

Three models were tested. Each one observed a single component of sustainable development as a dependent variable. Three independent variables measure the entrepreneurial activity level (percentage of new businesses, established businesses, and ambitious entrepreneurs). They are the same in all models. However, the choice of the dependent variable determines the control variables. New businesses show the percentage of the adult population (18 to 64 years old) who are starting their own business or have owned and operated a business for 3.5 years or less. This is a composite indicator because it shows the sum of nascent entrepreneurs and newly registered businesses up to 3.5 years old, so it is often called total early-stage entrepreneurial activity (TEA). Established businesses represent the percentage of the adult population that owns and runs an established business, i.e. a business that has been paying salaries/remunerations

to owners for more than 3.5 years. Ambitious entrepreneurs are those oriented towards their business growth and represent the percentage involved in new businesses with the expectation to employ six or more people in the following five years.

The first model studies the impact of entrepreneurship on the economic component of sustainable development, expressed by the GDP growth rate. The control variable is gross investments. Investments are used as a control variable because they represent one of the key drivers of economic growth through increasing production capacity, productivity, and employment. The second model tests the impact of entrepreneurship on the social component of sustainable development. The dependent variable is the *Human Development Index* (HDI), taken from *the Human Development Indicators* database, with previous corrections. The HDI is a composite measure of average achievement in three essential human development dimensions, i.e. a long and healthy life, education, and a satisfactory standard of living. A separate sub-index is calculated for each of the mentioned dimensions. The composite index is then calculated by aggregating the previously described three values according to the geometric mean principle. Since the first model already evaluated the impact of entrepreneurship on the GDP growth rate, it is necessary to eliminate the economic dimension from the human development index to avoid overlapping and to obtain a "fully" social component. Hence, the standard of living sub-index was excluded from the human development index, and the square root of the health and education sub-index was calculated instead of the third root of the three sub-indices. The human development index corrected in this way is called the *Modified Human Development Index* (MHDI). The control variable is current health expenditures. The third model examines the impact of entrepreneurship on the ecological dimension of sustainable development, expressed by carbon dioxide emission. Due to the high values of the CO_2 variable, its natural logarithm was used in the model in order to reduce the asymmetry of the distribution and stabilize the variance of the data. The control variables are gross investments and consumption of renewable energy. The data sources for testing the model are the GEM report and the World Development Indicators (WDI) database, edited by the World Bank. A more detailed overview of the variables used is in Table 1.

Table 1: Overview of the variables used in the research

Variable		Abbreviation	Source
Independent Variable	New businesses (total early-stage entrepreneurial activity)	TEA	GEM
	Established Business Ownership Rate	EBOR	GEM
	Percentage of ambitious entrepreneurs	AMB	GEM
Model 1			
Dependent Variable	GDP growth rate	BDP	WDI
Control Variable	Gross investments	Inv	WDI
Model 2			
Dependent Variable	Modified Human Development Index	MHDI	HDI (author's calculations)
Control Variable	Current health expenditure	Health	WDI
Model 3			
Dependent Variable	Carbon Dioxide Emission	CO_2	WDI
Control Variable	Gross investments	Inv	WDI
	Renewable energy consumption	Obn	WDI

Source: author

The stationarity of the variables was tested using the *Fisher panel unit root test* based on *augmented Dickey–Fuller regressions* with an included drift term (Table 2). Given the unbalanced nature of the panel, *Fisher-type panel unit root tests* were considered more appropriate. The results indicated that the variables are stationary at levels, allowing standard panel estimation techniques.

Table 2: Stationarity of the variables

Variable	P (χ^2)	Pm	Conclusion
TEA	197.4193***	11.0976***	Stationary at level
EBOR	220.1124***	13.0435***	Stationary at level
AMB	208.5711***	12.4092***	Stationary at level
BDP	113.3089***	3.6603***	Stationary at level
MHDI	120.4872***	4.2669***	Stationary at level
CO2	202.0375***	11.1592***	Stationary at level
Inv	412.9836***	28.9874***	Stationary at level
Zdravlje	166.4577***	8.1522***	Stationary at level
Obn	163.2140***	8.1645***	Stationary at level

Note: The reported values are *Fisher test* statistics based on augmented *Dickey–Fuller* (*ADF*) tests. The null hypothesis assumes the presence of a unit root in all panels. Asterisks indicate levels of statistical significance: *** $p < 0.01$

Source: author's calculation

The *Modified Wald test* indicates the presence of heteroscedasticity (χ^2=1827.08 for the first model, χ^2=1702.51 for the second model and χ^2=23741.5187 for the third model). Also, the *Wooldridge test* for autocorrelation in panel data was performed. It shows the absence of autocorrelation in the first model (F=1.959) and presence of autocorrelation in the second and third model (F=75.217 and F=33.242, respectively). The results of the *Pesaran CD test* indicate the presence of cross-sectional dependence in all models suggesting that countries are not fully independent. To address heteroscedasticity, autocorrelation and cross-sectional dependence, cluster-robust standard errors at the country level are employed.

Multicollinearity was tested using the *Variance Inflation Factor* (*VIF*). The obtained *VIF* values range from 1.09 to 1.44 for the first model, from 1.05 to 1.35 for the second model, and from 1.06 to 1.52 for the third model, indicating that there is no evidence of multicollinearity among the explanatory variables.

Potential endogeneity may arise due to reverse causality between entrepreneurship and sustainable development indicators, as well as omitted variable bias. In all three models, the *Durbin-Wu-Hausman test* showed the presence of endogeneity, which influenced the choice of instrumental variables model for assessing the impact of entrepreneurship on the components of sustainable development. Although dynamic panel estimators were considered, diagnostic tests and sample characteristics (small T and insufficient observations) indicated that such specifications were not appropriate for the data.

The first model is represented by the equation:

$$BDP_{it} = \beta_0 + \beta_1 TEA_{it} + \beta_2 EBOR_{it} + \beta_3 AMB_{it} + \beta_4 Inv_{it} + u_{it}$$

Due to the endogeneity of the new businesses (TEA), the model is estimated using the instrumental variables method, where TEA is instrumented by its lagged value:

$$TEA_{it} = \alpha_0 + \alpha_1 TEA_{i,t-1} + \alpha_2 EBOR_{it} + \alpha_3 AMB_{it} + \alpha_4 Inv_{it} + \upsilon_{it}$$

The form of the second model is given below:

$$MHDI_{it} = \beta_0 + \beta_1 TEA_{it} + \beta_2 EBOR_{it} + \beta_3 AMB_{it} + \beta_4 Health_{it} + u_{it}$$

and the model that shows the most robust results is the one in which new businesses and established businesses (TEA and EBOR) are instruments:

$$TEA_{it} = \alpha_0 + \alpha_1 TEA_{i,t-1} + \alpha_2 AMB_{it} + \alpha_3 Health_{it} + \upsilon_{it}$$

$$EBOR_{it} = \gamma_0 + \gamma_1 EBOR_{i,t-1} + \gamma_2 AMB_{it} + \gamma_3 Health_{it} + \varepsilon_{it}$$

The final form of the third model is represented by the equation:

$$CO_{2it} = \beta_0 + \beta_1 TEA_{it} + \beta_2 EBOR_{it} + \beta_3 AMB_{it} + \beta_4 Inv_{it} + \beta_5 Obn_{it} + u_{it}$$

and the most robust results are with variables Inv and Obn as instruments:

$$Inv_{it} = \alpha_0 + \alpha_1 Inv_{i,t-1} + \alpha_2 TEA_{it} + \alpha_3 EBOR_{it} + \alpha_4 AMB_{it} + \upsilon_{it}$$

$$Obn_{it} = \gamma_0 + \gamma_1 Obn_{i,t-1} + \gamma_2 TEA_{it} + \gamma_3 EBOR_{it} + \gamma_4 AMB_{it} + \varepsilon_{it}$$

4. RESULTS AND DISCUSSIONS

Table 3 displays the test results for the three models:

Table 3: Test results

	Model 1		Model 2		Model 3
Observations	207		162		181
Number of countries	33		34		35
Wald $\chi 2$	23.15		49.71		36.48
Probability > $\chi 2$	0.0001		0.0000		0.0000
Root MSE	3.8646		0.0594		1.4337
R-squared	0.1239		0.4196		0.3119
TEA	-0.096*	TEA	-0.0046***	TEA	-0.0812**
Std. Err	0,058	Std. Err	0.0016	Std. Err	0.0354
EBOR	0.070	EBOR	0.0005	EBOR	0.0940*
Std. Err	0.059	Std. Err	0.0019	Std. Err	0.0543
AMB	0.113***	AMB	0.0003	AMB	-0.0050
Std. Err	0.026	Std. Err	0.0004	Std. Err	0.1523
Inv	0.102	Health	0.018***	Inv	0.1200***
Std. Err	0.066	Std. Err	0.0041	Std. Err	0.0394
				Obn	-0.0333**
				Std. Err	0.0166
First-stage results					
Partial R^2 (TEA)	0.7175	**Partial R^2 (TEA)**	0.7122	**Partial R^2 (Inv)**	0.8476
		Partial R^2 (EBOR)	0.7086	**Partial R^2 (Obn)**	0.9867

Note: Models are estimated using the instrumental variables (*2SLS*) approach. Instrumental variables (TEA, EBOR, Inv and Obn) are instrumented by their lagged values. Standard errors are clustered at the country level. ***, ** and * denote statistical significance at the 1%, 5% and 10% level.

Source: author's calculation based on data from GEM (2011-2020) and World Bank Group (2011-2020)

In all three models, the *partial* R^2 value is very high (from 0.7086 to 0.9867), which shows a strong relationship between the instrument and the endogenous variable and confirms the relevance of the selected instrument.

Model 1

The results of the instrumental variables (*2SLS*) estimation with cluster-robust standard errors indicate that statistically significant variables in the model are TEA (new businesses) and AMB (ambitious entrepreneurs). The coefficient value for new businesses is -0.096 (with a risk level of 10%), which means that one percent increase in new businesses leads to a decrease of approximately 0.096 percentage points in GDP growth, ceteris paribus. On the other hand, coefficient value for ambitious entrepreneurs has a positive sign (β_3=0.113). Specifically, a one percent increase in ambitious entrepreneurs leads to an increase of approximately 0.113 percentage points in GDP growth, ceteris paribus. Lagged TEA is used as an instrument under the assumption that past entrepreneurial activity affects current growth only through current TEA. The first-stage results confirm the strong relevance of the instrument. The *partial R-squared* is high (0.7175), confirming the strong explanatory power of the instrument. Since the model is exactly identified, the validity of the instrument relies on theoretical considerations. The lagged variables were selected as instruments following common practice in panel IV estimation, assuming correlation with the endogenous regressors and no direct effect on the dependent variable. Therefore, the credibility of the results depends on the theoretical assumption that past entrepreneurial activity affects current economic growth only through its impact on current entrepreneurial activity.

The value of the coefficients with new businesses and ambitious entrepreneurs is expected. Ambitious entrepreneurs intend to grow their business by employing six or more people in the following five years. This result indicates the relation between growth at the microeconomic and macroeconomic levels: the aggregated growth of individual businesses causes growth at the entire economic level. Entrepreneurs oriented towards the growth of their own businesses contribute positively to the growth of the gross domestic product (Marjanović, 2023, 70).

New businesses have a negative influence on GDP growth. Such a result can be explained by the structure of the countries in the sample and the structure of the started businesses. The sample represents a combination of developed and developing countries (the range of GDP per capita for the year 2020 for the included countries varies from $1,900 to $116,000). On the other hand, the motive for entrepreneurs to start their business can be opportunity or necessity.

The opportunity can be solving a social problem, doing a job the entrepreneur likes, realizing one's idea, the need for self-affirmation, etc. Necessity entrepreneurship is usually an alternative solution in case of unemployment and inability to find a job. It boils down to starting one's own business to provide the existential needs of the entrepreneurs and their family members. In developed countries, opportunity prevails as a motive, and in developing countries, necessity prevails. This can be seen in the rates of new businesses. Data from the GEM (2020) indicate that the percentage of new businesses is low in most developed countries (Austria: 6.2%, Germany: 4.8%, Italy: 1.9%, Luxembourg: 8%, Netherlands: 11.5%, Sweden: 7.3%), and developing countries show the highest rates (Brazil: 23.4%, Chile: 25.9%, Colombia: 31.1 %, Togo: 32.9%, Uruguay: 21.9%, etc.). Hence, developed economies offer their residents enough opportunities to work and do what they love, so those who start a business are presumably motivated by opportunity. On the other hand, developing countries do not offer as many opportunities, so the population has to start businesses for self-employment, i.e. motivated by necessity. They often lack the knowledge and skills to run a business.

The results obtained by evaluating the first model and their analysis revealed that the paper's first hypothesis can be confirmed. Of the three variables used to measure the level of entrepreneurial activity, ambitious entrepreneurs have an essential influence on the GDP growth rate. Their influence is positive and statistically most significant (risk level 1%). Thus, entrepreneurs oriented towards their businesses' growth and development, have a decisive influence on economic growth.

Model 2

The results in the Model 2 indicate that new businesses (TEA) have a negative and statistically significant effect on human development (β_1= -0.0046). This indicates that higher levels of new businesses are associated with lower levels of human development (MHDI). Specifically, a one percent increase in new businesses leads to decrease of approximately 0.005 percentage points in MHDI. Other variables measuring entrepreneurial activity do not show statistically significant effects. Health has a strong and positive impact on MHDI. Both TEA and EBOR are treated as endogenous variables and instrumented using their lagged values. The first-stage results confirm that the instruments are strong, with high *partial R-squared* values. As in the previous model, the credibility of the results depends on the theoretical assumption that past entrepreneurial activity affects current modified human development index only through its impact on current entrepreneurial activity.

This result suggests that not all forms of entrepreneurship contribute positively to human development. In particular, the increase in new businesses does not necessarily contribute to the improvement of human development, especially in economies dominated by necessity entrepreneurship and entrepreneurship with low productivity and innovation.

The analysis of the second model results indicates that the paper's second hypothesis cannot be accepted, considering that the only statistically significant variable measuring entrepreneurial activity is new businesses and its influence on modified human development index is negative.

Model 3

The results in the Model 3 indicate that investments significantly increase CO_2 emissions, while renewable energy has a mitigating effect. Among the variables measuring the level of entrepreneurial activity, new businesses and established businesses have a statistically significant impact, but with different directions of impact. New businesses (TEA) are associated with lower CO_2 emissions (β_1= -0.0812), suggesting that one percent increase in new businesses leads to decrease of 0.0812 percentages in CO_2 emissions. On the other hand, a one percent increase in established businesses leads to an increase of 0.0940 percentages in CO_2 emissions. Lagged values of the control variables (investments and renewable energy sources) were used as instruments, and their validity was confirmed by the very high values of *partial* R^2 (0.8476 and 0.9867), indicating the absence of a weak instruments problem.

These findings highlight a potential trade-off between economic expansion and environmental sustainability, while also indicating that entrepreneurship may play a role in facilitating a greener transition. Namely, the reduction in pollution caused by new businesses can be explained by the fact that they increase energy efficiency or develop less polluting activities. On the other hand, established businesses imply greater industrial activity and greater use of energy, especially from fossil fuels.

Such a result implies the acceptance of the third hypothesis and shows that new businesses solve the prisoner's dilemma by prioritizing collective rather than individual goals. Bearing in mind that the United Nations adopted the 2030 Agenda as an umbrella document promoting the goals of sustainable development, it is conceivable to expect that entrepreneurs will use the offered incentives for the development of ecological entrepreneurship. This contribution may include launching ventures contributing to reducing pollution, recycling

waste, improving agricultural practices, and the like, which Markman et al. (2019) also wrote about.

5. CONCLUSIONS

The results of all three models evaluated in this paper show that the only variable that measures the level of entrepreneurial activity and shows a statistically significant impact on each component of sustainable development is new businesses. However, its effects are contradictory: it reduces economic growth and human development, but has a positive effect on the environment (reduces CO_2 emissions). On the other hand, established businesses have a significant impact only on the environment, but it is negative (increases CO_2 emissions), and ambitious entrepreneurs have a significant impact only on growth, and with a positive sign. The analysis conducted shows that none of the variables measuring the level of entrepreneurial activity can be claimed to have an impact on overall sustainable development. These findings could highlight a potential trade-off between economic expansion and environmental sustainability and lead to the conclusion that a triple bottom line effect is not possible. However, limitations of the observed sample and the data used should be kept in mind.

The sample used in this study includes 35 countries with different levels of development; therefore, future research is recommended to use a more homogeneous sample in order to determine the consistency of the results. This would allow for a more precise discussion of new businesses, as the influence of necessity-driven entrepreneurship would be less pronounced. Furthermore, one of the limitations of this study is the unbalanced nature of the panel data, which may affect the statistical significance of the observed variables. In addition, lagged values were used as instruments in the instrumental variables estimation. Although the first-stage results indicate satisfactory instrument relevance, their validity cannot be fully verified in exactly identified models, but is primarily based on theoretical assumptions regarding the relationship between past and current values of the endogenous variables. It should also be noted that sustainable development was not observed through a single composite indicator, but through separate economic, social and environmental dimensions, which may limit the interpretation of the overall effects of entrepreneurial activity on sustainable development. Finally, the relatively low coefficient of determination in the first model suggests that a considerable share of GDP growth variation is influenced by factors not included in the specification. However, this does not reduce the relevance of the estimated coefficients, particularly in the context of instrumental variables estimation and macroeconomic panel data. Future studies

may obtain higher explanatory power by extending the model with additional explanatory variables and broader institutional or macroeconomic indicators.

Conflict of interests

The authors declare that there are no financial or non-financial conflicts of interest related to this manuscript.

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ПРЕДУЗЕТНИЧКА АКТИВНОСТ У ФУНКЦИЈИ ОДРЖИВОГ РАЗВОЈА: ПАНЕЛ АНАЛИЗА

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САЖЕТАК

Овај рад испитује утицај предузетничке активности на три компоненте одрживог развоја: економску, социјалну и еколошку. Предузетничка активност је представљена са три различите варијабле: нови бизниси, уходани бизниси и амбициозни предузетници. Одрживи развој се посматра преко варијабли стопа раста БДП-а, модификовани индекс људског развоја и емисија угљен-диоксида. Циљ рада је да се утврди да ли предузетништво и у ком облику утиче на одрживи развој. За потребе истраживања креирана су три економетријска модела панела. Спроведена је панел анализа на узорку од 35 земаља и у периоду од десет година. Резултати су указали на контрадикторан утицај варијабли којима се мјери ниво предузетничке активности и да ниједна од њих нема ефекат на цјелокупни одрживи развој.

Кључне ријечи: *предузетничка активност, нови бизниси, уходани бизниси, амбициозни предузетници, одрживи развој*