An impact of macroeconomic stabilization on the sustainable development of manufacturing enterprises: the case of Central and Eastern European Countries

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Abstract

Sustainable development is a socioeconomic development that respects environmental protection. It can be analyzed at a macro- and microscale. The goals of sustainable development are realized by ordinary people, politicians, organizations, and enterprises. At the enterprise level, sustainable development means an improvement in quantitative and qualitative conditions of running a business, the use of pro-ecological standards and solutions, and support of employee development. The sustainable development of enterprises depends on several factors, including macroeconomic conditions. The main aim of this paper is to show the impact of the macroeconomic stabilization on the sustainable development of the manufacturing enterprises in the Central and Eastern European Countries (CEECs). We examine only the CEECs which are the members of the European Union. Considering this, we focus on the eleven counties (i.e., Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia) in the period from 2008 to 2018. The main hypothesis is formulated as follows: Macroeconomic stabilization has a statistically significant impact on the sustainable development of manufacturing enterprises in the period from 2008 to 2018. The results of the study indicate that in all analyzed countries there is a statistically significant relationship between the indicator of sustainable development (SI_{SDE}) and the indicator of macroeconomic stabilization. The highest level of correlation was observed in Czechia, Poland, and Hungary, while the lowest in Estonia.

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1 Introduction

Sustainable development is a socio-economic development that takes into account issues related to the protection of the environment. The overall and essential goal of this concept is the long-term stability of the economy and environment. The sustainable development "meets the needs of the present, without compromising the ability of future generations to meet their own needs" (Report of the World Commission On Environment and Development: Our common feature). It is a complex and multidimensional category that requires a comprehensive approach. It can be analyzed at a macro- and microscale. The goals of sustainable development are realized by ordinary people, politicians, organizations, and enterprises.

The sustainable development of enterprises means an improvement in quantitative and qualitative conditions of running a business, the use of pro-ecological standards and solutions, and support of employee development. It seems crucial to consider the enterprise role in the implementation of the concept of sustainable development, since enterprises alongside households have a significant impact on climate change and environmental pollution. The sustainable development of enterprises depends on several factors, external and internal. Internal factors are related to the enterprise, its assets, type of activity, environmental awareness of managers. External factors should be identified with micro- and macro-environment. One of the key determinants of sustainable development is the macroeconomic stabilization (lasting economic balance), which has an impact on investment decisions of enterprises.

This paper is both, theoretical and empirical. The theoretical part describes selected problems of sustainable development and its determinants, the empirical part shows the results of the research. The main aim of this paper is to assess an impact of the macroeconomic stabilization (MSP) on the sustainable development of the manufacturing enterprises (SI_{SDE}) in the Central and Eastern European Countries (CEECs) in the period from 2008 to 2018 (the years in which the economic slowdown and recovery took place). We create the indicators of sustainable development of enterprises (SI_{SDE}) and the macroeconomic stabilization indicators (MSP). Then, we built the single-equation linear models and use the Pearson's correlation coefficient and the ordinary least squares method (OLS) to estimate them (our model satisfies the OLS assumptions for linear regression).

The research involved eleven countries from Central and Eastern Europe, which are also the member of the European Union (EU). They have many common features, including geographical location, historical experience, a level of socio-economic development. They belong to developing countries that have followed a similar path toward the transformation of economic systems. Maintaining macroeconomic stability is a challenge for the economies of CEECs. The issue of sustainable development is also gaining importance. This is due to the increase in environmental awareness and the need to comply with legal regulations in the field of environmental protection.

2 The sustainable development of enterprise: selected problems

The term "sustainable development" has become very popular in recent years. It has several meanings (Gatto 1995; Paehlke 2005; Blewitt 2008; Ciegis 2009; Barbosa et al. 2014) and there is no consensus on its purpose, undertaken activities and the effects of

these activities, or empirical assessment. The idea of sustainable development is flexible and open to interpretation (Prugh and Assadourian 2003). Most definitions underline the need for a compromise between the needs of the present and future generations (United Nations General Assembly 1987; Dernbach 2003; Stoddart 2011; Emas 2015). However, it should be emphasized that in the literature on the subject, there is a number of critical remarks about the vagueness, ambiguity, and a lack of sufficient explanation of the term "sustainable development" (Ekins et al. 2003; Newton and Freyfogle 2005; Slimane 2012).

The most popular and widespread definitions of sustainable development have ecological roots; however, some of the researchers define the subject through the prism of economic or social issues. The basis for ecological approach is the belief that it is impossible to renew certain, limited natural resources (Daly 1991; Brown et al. 2012; Burger et al. 2012).

The sustainable development is identified with such terms as change, growth, progress, improvement of the quality of life, protection of natural resources (Lele 1991; Meadows 1998; Vare and Scott 2007; Ciegis et al. 2009; Sterling 2010; Weidinger 2014). The essence of sustainable development is the coexistence of economic and social relations and environmental protection through the implementation of the following objectives (Ciegis and Zeleniute 2008; Gonzalez-Cabezas et al. 2018):

- economic, based on satisfying material human rights, creation of additional value, cost reduction (improvements and reduced energy and raw material inputs), opening and creation of a new market;
- social, ensuring a minimum subsistence, improving quality and living conditions, taking care of the health and safety of employees, providing food, health protection, culture and education, benefits to disadvantaged groups;
- ecological, stopping a degradation of the natural environment and eliminating threats related to the operation of natural forces, reducing waste and emission into environment, elimination of toxic substances, use of renewable raw materials.

Sustainable development requires the use of natural resources in accordance with accepted standards and principles of an environmental protection, development of innovations and new technologies, and harmonization of the work of different communities, ecosystems, institutions, organizations, and enterprises (Vare and Scott 2007; Marin et al. 2012; Duran et al. 2015).

The thinking of managers about the role of enterprises has been evolving in recent years. Due to climate change, it seems necessary to depart from the traditional perception of economic activity. Enterprises, apart from earning profits, should be interested in social and environmental problems. However, the concept of sustainable development is still a new idea for many business executives (the concept remains abstract and theoretical). It should be noted that "without sustainable organizations there is no sustainable development, thus, no future" (Weidinger 2014).

The sustainable development of an enterprise means that "the company is on a path toward sustainability" (Dvořáková and Zborková 2014) and it helps to gain competitive advantage and increase its market share (Liu 2000; Grabara et al. 2015). Sustainable development at the enterprise level "means adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future" (International Institute for Sustainable Development 1992). Sustainable development of an enterprise is

based on an economic, social, and environmental aspect, and it requires innovation and modern technology (Hilson and Murcka 2000). It can be considered as:

- "a living state of the enterprise by transcending enterprise increase deficiency or increase excess, transcending resource and environment protect constrained, transcending products life circle period" (Mao et al. 2016);
- "meeting the needs of a firm's direct and indirect stakeholders (…) without compromising its ability to meet the needs of future stakeholders as well" (Dyllick and Hockerts 2002);
- "achieving success today without compromising the needs of the future" (Boudreau and Ramstad 2005);
- "keep the business going", "future-proofing" (Colbert and Kurucz 2007);
- "take decisions considering the common value" (Porter and Kramer 2007);
- "life from Earth income rather than its capital" (Perković and Radenković, 2008);
- "to integrate the intangible aspect of productive resources into the concept of sustainable development and its requirements" (McIntyre et al 2009);
- "a process in which less and fewer resources are being spent to meet the needs of consumers and in which the environment is less polluted" (Drljača 2012);
- "the capability of a corporation to last in time, both in terms of profitability, productivity and financial performance, as well as in terms of managing environmental and social assets that compose its capitals" (Giovannoni and Fabietti 2013);
- "a holistic approach of thinking of business which seeks to integrate consideration of the three aspects of sustainability—social, environmental and economic" (Oželienė 2017).

Sustainable development of the company is directly related to the intellectual capital, and that makes it possible to analyze the factors of the sustainable development and the company's relationship with stakeholders (Subramaniam and Youndt 2005; Ciasullo and Troisi 2011). It is important to take responsibility for companies actions, keep up with innovation, use resource effectively, reduce emissions, protect the environment, improve the quality of working conditions, take care of the external environment. Sustainable entrepreneurship brings competitive advantage to business ventures (Dixon 2003; Bansal 2005; Ruzevicius and Serafinas 2007; Grybaite and Tvaronaviciene 2008; Weidinger 2014; Bocken et al 2014).

It is important to incorporate all dimensions of sustainability (social, economic, ecological) into the subject's activities. From an economic perspective, companies are focused on increasing productivity, profitability, product quality, economic growth, value-added, return on investment. In the social dimension, basic activities are the increase in the level of customer satisfaction, strengthening of the brand, welfare, respect of human rights, health protection, social security, employee satisfaction. The most important goals from the ecological perspective are reduction of emissions and pollution, smart use of resources, biodiversity, security ecosystems, protection of natural resources, recycling, the use of environmentally friendly production (Grudzewski et al. 2010; Grabara et al. 2015).

Sustainable development of an enterprise depends on several factors that can be divided into two groups (Lorenc and Sorokina 2015):

- macroeconomic conditions such as: level of the country's economic development, macroeconomic stability, stability of legal regulations, support for pro-ecological activities, ecological awareness of people;

- microeconomic conditions such as: financial situation of enterprises, profitability, productivity, product quality, environmental awareness of the management staff, type of business activity, opportunities and prospects for further operations, accumulated human capital, innovation, information technologies.

3 Macroeconomic stabilization and sustainable development of enterprises-literature review

In the literature on the subject, the issue of the impact of macroeconomic conditions on the sustainable development of enterprises is poorly recognized. Researchers focus on theoretical considerations, while empirical research is limited. (Models of sustainable development of enterprise are relatively underdeveloped.) The macroeconomic factors are the main challenge and the principal matter of survival and development of an enterprise. This is because external factors affect not only the company but also its stakeholders (Peeters 2003; Najam and Cleveland 2003; Ibarrarán et al. 2009; Avtorhanov et al. 2018).

Achieving ecological goals requires finding some compromise relations between ecological costs and the rate of economic and social growth. In the short term, efforts to improve the quality of ecosystems can lead to a reduction in the rate of economic and social growth. In the long run, it can be assumed that an increase in prosperity will lead to an increase in environmental awareness. The quality of the environment will become a priority over other material goods. Ecological development is one of the factors determining economic growth (Kryk 2003).

There is a consensus that determinants such as the inflation rate, the unemployment rate, the dynamics of the gross domestic product and the exchange rate have an impact on the development of enterprises (Burdina et al. 2017; Dewi et al. 2019). Also, the researchers distinguish various macroeconomic causal variables affecting the development of the organization, including financial environment (Carter and Shaw 2006; Ferraro and Goldstein 2011; Moritz et al. 2016), government policy (Carree et al. 2007; Stevenson and Lundstrom 2007), fiscal policy (Klapper et al. 2006; Salman 2014; Arin et al. 2015), government support programs for enterprises (Yang and Li 2011), education and training for entrepreneurship (Shah and Pahnke 2014; Tsai et al. 2016), R&D transfer (Acs et al. 2008), legal infrastructure (Li et al. 2012), physical infrastructure (Ghani et al. 2014), social development and cultural norms (Isenberg 2010).

Macroeconomic stabilization is a dynamic macroeconomic system characterized by sustainability streams and resources. It can be understood as an appropriate configuration of economic indicators that best meet the conditions of sustainable economic growth (Dornbusch and Fischer 1990; Kołodko 2007; Malina and Mierzwa 2013). Macroeconomic stabilization is about creating such political conditions, institutional and structural, in which not only the price mechanism works smoothly, but also the fullest use of economic resources (Kołodko 1993).

The impact of macroeconomic stabilization on the sustainable development of the enterprise is poorly recognized (Matinaro et al. 2019). It should be noted that the benefits resulting from macroeconomic stability are undeniable (Kołodko 1993; Misala and Siek 2007; Ibarrarán et al. 2009). Macroeconomic stability eliminates uncertainty in business, increases the investment attractiveness of the country, as well as increases the likelihood of future business growth (Perry et al. 2008; Brenes and Haar 2012; Urbanowicz 2018).

Macroeconomic stability is conducive to making investments and consequently improving the competitive potential of the economy (Kekre 2016; Harting 2019).

Macroeconomic stabilization seems to be favorable to the sustainable development of enterprises. Research results indicate that Gross Domestic Product (GDP) is positively related to the sustainable development of enterprise. Low inflation and low unemployment rate, as well as high economic activity, increase confidence and improve the economic environment of the business, and consequently improve their growth and investment decisions in socially and ecologically responsible activities (Campbell 2007; Smith 2010; Krajnakova et al. 2018). In the case of inflation, research results are not clear. In the case of the relative stability of inflation, there may be a slight positive relationship between it and business development. It was also noted that the unemployment rate from a previous period had an impact on the current development of enterprises (Sipos-Gug and Badulescu 2015). Sustainable development is also influenced by the interest rate changes, government expenditure, and foreign investments (Barkauskas et al. 2015).

External factors affecting the environmental development of enterprises include competition, consumer expectations, and legal regulations in the field of environmental protection (both at the national and international level), achievements in science and technology, economic and social progress and changes in the environment (Drucker 1992; Jaraite et al. 2012).

Active and especially well-implemented policy economic state has the right to interfere in management processes, including individual ones, management functions, functions of production, demand, and supply, as well as alternative dependencies, internal factors and external, affecting the making process decisions (Almeida et al. 2014; Raczkowski 2016).

The level of sustainable development of enterprises depends on several macroeconomic issues. It seems to us that it is determined by the level of social awareness, adopted regulations in the field of environmental protection, and the political climate that supports the protection of natural resources, the structure of the economy, forms of obtaining energy, and the level of use of fossil fuels. Sustainable enterprise development is a derivative of economic development, education, and human consciousness. It seems to us that the more economically and socially developed the country is, the greater pressure on companies to comply with standards in the care of the environment and social issues.

4 Sustainable development of enterprises in Central and Eastern Europe

The Central and Eastern European Countries (CEECs) are characterized by a lower level of socio-economic development compared to Western European countries. In the further part of the study, we analyze countries from Central and Eastern Europe that are members of the European Union, including Estonia, Latvia, Lithuania, Czechia, Slovakia, Poland, Hungary, Slovenia, Romania, Bulgaria, Croatia (World Bank 2008).

These countries share many common features, including geographical proximity, common history, a similar level of socio-economic development, and a similar structure of the industry. The CEECs have the ambition to catch-up with developed industrialized economies of the West. In a relatively short period, these countries underwent a transformation this regard. The transformation of economies led to a change in the conditions for doing business and an increase in the level of competitiveness.

The Central and Eastern European Countries face similar difficulties in realizing their ambitions. These include negative demographic trends, a gradual increase in labor costs, and its relatively low productivity. The weakness of these economies is associated with low levels of innovation and low expenditure of research and development. The CEECs should use their geographical location between the West and East of Europe and try to create a strategy for promoting the region or interregional projects accelerating sustainable development.

The accession of Central and Eastern European countries to the EU structures affects not only the economic sphere but also the social development and the state of environmental protection of the studied areas (Chadee et al. 2014; Cieślik et al. 2015). After the accession to the EU, there was a moderate improvement in the state of the natural environment in some countries. The targets of the Europe 2020 strategy in the field of renewable energy were achieved by six countries surveyed (Latvia stood out against the EU). The main problem is the structure of acquiring renewable energy (low innovative share of wind, solar, or water technologies). CEECs are characterized by a high degree of energy intensity of the economy, low energy efficiency, hazardous waste sites in residential areas, urban air pollution, deteriorating water and sewage systems (www.unepfi.org). Expenditure on environmental protection is increasing in Bulgaria, Latvia, and Slovenia. The share of expenditure on environmental protection in the other analyzed countries is lower (lack of focus on environmental issues in economic policy) (Czupich 2017).

It is necessary to modify many production factors of enterprises in Central and Eastern Europe toward ecologically clean production, without excessive use of natural resources and destruction of the environment (Firlej 2011).

Integration with the EU is accompanied by phenomena and processes that run differently in each of the member countries. This differentiation can be justified by the existing disproportions in the broadly defined structure of economies and the pace of their development.

5 Methodology of the research

The research has been conducted on a sample of manufacturing enterprises from Central and Eastern Europe. We examine only the CEECs which are the members of the European Union. Considering this, we focus on the eleven counties (i.e., Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia) in the period from 2008 to 2018. The reason for focusing on those countries is their common political and economic history, as well as a need to examine the sustainable development of companies in the terms of macroeconomic stabilization of the CEECs since the last economic crisis in 2008. We choose manufacturing companies for the research sample due to their large and key importance for the enterprise sector and economic development in the analyzed countries.

The main aim of the research is to show the impact of macroeconomic stability level on the sustainable development of manufacturing enterprises. In connection with this, the hypothesis is formulated as follows: "Macroeconomic stabilization has a statistically significant impact on the sustainable development of manufacturing enterprises in Central and Eastern Europe in the period from 2008 to 2018". We also formulate the sub-hypotheses as follows:

- *H1* The indicator of sustainable development of enterprises (SIsde) in the Central and Eastern European Countries (CEECs) shows the positive dynamics in the years 2008–2018;
- *H2* The average value of the indicator of economic development (SI_{econ}) is higher than the average value of the indicator of social (SI_{soc}) and average value of the indicator of environmental development (SI_{env});
- *H3* The macroeconomic stability indicator (MSP) in the Central and Eastern European Countries increases in the period from 2008 to 2018;
- *H4* The macroeconomic stabilization pentagon (internal factors) indicator (MSP_1) is higher than the macroeconomic stabilization pentagon (internal factors) indicator (MSP_2) in the CEECs;
- *H5* Internal factors of macroeconomic stabilization (MSP1) have a greater impact on the sustainable development of industrial enterprises than external factors (MSP2) in the period from 2008 to 2018.

To verify our research hypothesis, we create indicators for the sustainable development of manufacturing enterprises (SI_{dte}) by normalizing diagnostic variables, and macroeconomic stabilization indicators (MSP) by creating the macroeconomic stabilization pentagon model. Then, we built a single-equation linear model. The variables used in the model are quantitative (no qualitative variables were used). This approach to the study is related to the lack of access to qualitative data for manufacturing enterprises in Central and Eastern Europe and is a serious limitation.

We use the ordinary least square (OLS) procedure which is the most common method for linear model and creates the best possible estimates (our model satisfies the OLS assumptions for linear regression such as the regression model is linear in the coefficients and the error term; (b) the error term has a population mean of zero; (c) all independent variables are uncorrelated with the error term; (d) the observations of the error term are uncorrelated with each other; (e) the error term has a constant variance (no heteroscedasticity); (f) no independent variable is a perfect linear function of other explanatory variables; (g) the error term is normally distributed (this assumption is optional) (Wilcox 2009). The OLS estimator is compliant, unencumbered and the most effective in the class of linear estimators (our dependent variable is in the range (0 to 1 > (we assume that it cannot be zero).

Our research consists of five stages. First, we form a indicator of sustainable development of enterprises, which is a sum of standardized sub-indices. To calculate the indicator of sustainable development of enterprises (SI_{sde}), we use the following formula:

$$SI_{sde} = SI_{econ} + SI_{soc} + SI_{env}$$

where SI_{econ} is the indicator of economic development; SI_{soc} means the indicator of social development; SI_{env} is the indicator of environmental development.

To calculate the indicators of economic, social and environmental development, we use 32 explanatory variables, which have met the statistical, substantial and formal criteria (Podogrodzka 2011). We conduct the preliminary analysis of variables in terms of the degree of correlation to eliminate those variables that contain repeated information. As the threshold value, we adopt the Pearson's correlation coefficient at |0.75| (Dziekański 2014). The selection of variables is based on the literature, as well as results from the data availability. The variables used in our model are presented in Table 1.

Table 1 Diagnostic variables used in the model. *Source*: Own study on the basis of Eurostat (https://ec.europa.eu/Eurostat). Access: 14.11.2018

Indicator	Diagnostic variable	Description of the variable	Stimulant	Destimulant
Indicator of economic development (SI_{econ})	x_1	Total number of companies in a country	x	
	x_2	Turnover or gross premiums (million euro)	x	
	x_3	Production value (million euro)	x	
	x_4	Value added at factor cost (million euro)	x	
	x_5	Gross operating surplus (million euro)	x	
	x_6	Total purchases of goods and services (million euro)	x	
	x_7	Gross investment in tangible goods (million euro)	x	
	x_8	Investment rate (investment/value added at factors cost) (%)	x	
	x_9	Share of personnel costs in production (%)		x
	x_{10}	Average personnel costs (thousand euro)		x
Indicator of social development (SI_{soc})	x_{11}	Wages and Salaries (million euro)	x	
	x_{12}	Social security costs (million euro)	x	
	x_{13}	Total number of employees in a country	x	
	x_{14}	Turnover per person employed (thousand euro)	x	
	x_{15}	Apparent labour productivity (thousand euro)	x	
	x_{16}	Gross value added per employee (thousand euro)	x	
	x_{17}	Growth rate of employment (%)	x	
	x_{18}	Number of persons employed per enterprise	x	
	x_{19}	Investment per person employed (thousands euro)	x	
	x_{20}	Personnel costs (million euro)		x

Table 1 (continued)

Indicator	Diagnostic variable	Description of the variable	Stimulant	Destimulant
Indicator of environmental development (SI_{env})	x_{21}	Carbon dioxide emission (tons)		x
	x_{22}	Methane emission (tons)		x
	x_{23}	Nitrous oxide emission (tons)		x
	x_{24}	Sulphur oxides emission (tons)		x
	x_{25}	Ammonia emission (tons)		x
	x_{26}	Carbon monoxide emission (tons)		x
	x_{27}	Nitrogen oxides emission (tons)		x
	x_{28}	Generation of total waste (tons)		x

Then, we transform the explanatory variables to unify their measuring scales using the following formulas (Strahl and Walesiak 1997; Aivazian 2005; Szanduła 2014):

- for the stimulants:

$$z_{ij} = \frac{x_{ij} - \min_i\{x_{ij}\}}{\max_i\{x_{ij}\} - \min_i\{x_{ij}\}}, \quad z_{ij} \in (0;1>;$$

- for the destimulants:

$$z_{ij} = \frac{\max_i\{x_{ij}\} - x_{ij}}{\max_i\{x_{ij}\} - \min_i\{x_{ij}\}}, \quad z_{ij} \in (0;1>$$

where z_{ij} stands for the normalized value of the j-th variable in the i-th year; x_{ij} is the value of the j-th variable in the i-thyear; $\min_i\{x_{ij}\}$ is the lowest value of the j-th variable in the i-th year; $\max_i\{x_{ij}\}$ is the highest value of the j-th variable in the i-th year.

To calculate the indicator of sustainable development of enterprises (SI_{sde}), as well as its sub-indices (SI_{econ}, SI_{soc} and SI_{evn}), we assume the same impact of different indices on the aggregate measure. We use the following formula:

$$SI_i = \frac{1}{n}\sum_{j=1}^{n} z_{ij}, \quad (i = 1, 2, \ldots, n)$$

where SI_i stands for the indicator in the i-year; n is the number of metrics; others as above.

Second, to describe the macroeconomic situation of the CEECs we adopt a concept of macroeconomic stabilization pentagon (*MSP*). This approach is derived from the concept of the so-called magic quadrangle which is a method of analysis of the economy implemented by Mundell and Phillips (Żuchowska 2013). Their model presents the economic situation of a country in terms of rapid growth, full employment, low inflation and external balance. In Poland, this concept was developed in 1990 at the Foreign Trade Research Institute. They extended the magic quadrangle model by adding criterion (state budget). In 1993, the macroeconomic stabilization pentagon model was developed by Polish economist, Deputy Prime Minister and Minister of Finance in the years 1994–1997 and 2002–2003—Grzegorz W. Kołodko (Kołodko 1993). Since that time this approach has been used many times to examine the macroeconomic stabilization in different countries, e.g.: in the transition economies (Misala and Bukowski 2003; Matkowski et al. 2005; Rapacki et al. 2011), in the Southern Euro Area Countries (Hurduzeu and Lazăr 2015), in the Central and Eastern Countries (Żuchowska 2013; Ionita 2015; Pera 2016), in the EU countries (Pera 2016), the Eurozone countries (Gotz 2012) and in the European countries of low-and-middle-income economies.

The macroeconomic stabilization pentagon and the scales at the appropriate macroeconomic values are shown in Fig. 1.

The idea of macroeconomic stabilization pentagon model is based on the appropriate scaling and analyzing of five indicators of macroeconomic stabilization, i.e., (compare: Braşoveanu and Braşoveanu 2011; Tosheva 2013; Kubiszewska 2017; Jurkowska and Boda 2018):
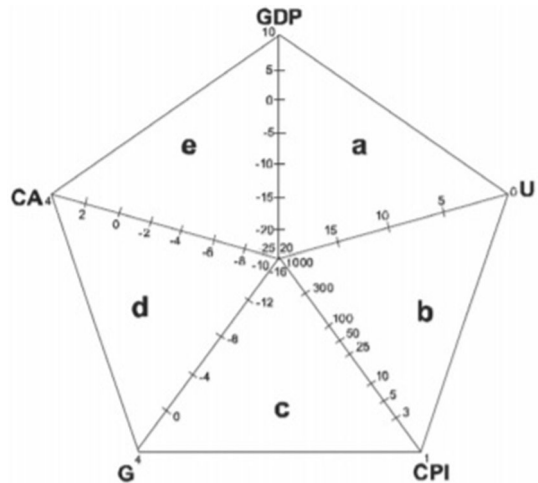
- rate of economic growth (ΔGDP), which expresses the level of economic development in a country as well as the wealth of its citizens;
- unemployment rate (U) measured as the ratio of labor resources able to take up employment to the number of employees;
- inflation rate measured as Consumer Price Index (CPI) (due to the data availability, in our model we use Harmonized Index of Consumer Prices (HICP) which is an indicator of inflation and price stability compiled according to a methodology that has been harmonized across EU countries);
- sovereign debt ratio (G) measured as a ratio of budget balance to GDP;
- current account balance (CA) which is measured as a ratio of government deficit/surplus to GDP.

The above indicators must be properly scaled or—saying more precisely—included in five vertices of the macroeconomic stabilization pentagon.

The vertices of the pentagon are scaled in such a way that if the levels of indicators are better, the points representing them are further from the center of the pentagon. The macroeconomic stabilization pentagon consists of the sum of five fields of the triangles representing both internal and external balance of a country. To calculate the total field of MSP we use the following formula (Kołodko 1993; Lyulyov 2018):

$$MSP = a + b + c + d + e$$
$$MSP = [(\Delta GDP * U) + (U * HICP) + (HICP * G) + (G * CA) + (CA * \Delta GDP)] * k$$

where $a = \Delta GDP * U * k$ presents triangle area called the real sphere triangle and characterizes the relation between the rate of economic growth and unemployment rate; $b = U * HICP * k$ stands for the stagflation triangle which depends on the unemployment rate and inflation rate; $c = ICP * G * k$ is defined as the budget and inflation triangle; $d = G * CA * k$ is called the financial equilibrium triangle and depends on the budget and the current account balance; $e = CA * \Delta GDP * k$ means the external sector triangle and shows the variability of current account balance and rate of economic growth; the value of coefficient is calculated as $k = \frac{1}{2}\sin 72° = 0.475$; other designations as above.

An important characteristics of the macroeconomic stabilization pentagon model is the ability to distinguish between the endogenous and exogenous factors that have an impact on the macroeconomic stabilization of a given country. This can be expressed using the following equation (Lyulyov 2018):

$$MSP = MSP_1 + MSP_2$$

where $MSP_1 = a + b + c$ measures the impact of endogenous factors on the macroeconomic stabilization of a country and determines the formation of the inner sphere; $MSP_2 = d + e$ indicates the impact of exogenous factors and represents the sphere dependent on external factors (Żuchowska 2013).

Third, we examine the strength and direction of a linear relationship between the macroeconomic stabilization of the studied countries (MSP_1, MSP_2, MSP) and the sustainable development of enterprises (SI_{sde}). To do this, we use the Pearson's correlation coefficient given by the formula (Ahlgren et al. 2003; Asuero et al. 2006; Engle 2009):

$$r_{xy} = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^{n} (y_i - \bar{y})^2}}, \quad \Delta r_{xy} \in [-1;1]$$

where r_{xy} stands for the Pearson's correlation coefficient; n is the sample size; x_i, y_i are the individual sample points indexed with i; $\bar{x}, \bar{y}$ are the sample means. In order to provide details concerning the correct interpretation of correlation results, we adopt the ranges of correlation strength that were suggested by Evans (1996): $|r_{xy}|=0$—no correlation; $0 < |r_{xy}| \le 0.19$—very weak; $0.20 \le |r_{xy}| \le 0.39$—weak; $0.40 \le |r_{xy}| \le 0.59$—moderate; $0.60 \le |r_{xy}| \le 0.79$—strong; $0.80 \le |r_{xy}| \le 1.00$—very strong. Moreover, we adopt statistical significance at 0.05.

Fourth, in order to assess the links between the sustainable development of enterprises and macroeconomic stabilization, we apply a regression analysis. The simple linear regression of y on x is given by the following formula (Eye and Schuster 1998; Freund et al. 2006; Yan and Su 2009; Schmidheiny 2019):

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$$

where y_i is an dependent variable; x_i is an independent variable; β_0 is the intercept, β_1 is the slope; ε_i denotes the i-th residual; I is an observation index.

The estimated model is given by equation:

$$y_i = \hat{\beta}_0 + \hat{\beta}_1 x_i + e_i = \hat{y}_i + e_i$$

so the residual for each observation is as follows:

$$e_i = y_i - \hat{y}_i = y_i - \left(\hat{\beta}_0 + \hat{\beta}_1 x_i \right)$$

For regression analysis, we use the most common estimation method for linear models called the ordinary least squares (OLS) regression. The OLS procedure minimizes the sum of squared residuals (Raykov and Marcoulides 2013):

$$s\left(\hat{\beta}_0, \hat{\beta}_1\right) = \sum_{i=1}^{n} e_i^2 = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2 = \sum_{i=1}^{n} \left(y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i \right)^2 \to \min$$

Solving the minimization problem results in the following expressions (Freund et al. 2006; Yan and Su 2009):

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n} (x_i - \bar{x})^2} = \frac{\sum_{i=1}^{n} (x_i y_i - n\overline{xy})}{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}.$$

6 The result of research

The research is based on manufacturing enterprises operating in Central and Eastern Europe in the period from 2008 to 2018. In 2008, there were 562 599 enterprises, and in 2018: 703 024. The number of manufacturing enterprises increased by 140,425 in the period from 2008 to 2018 (Table 2).

In the CEECs countries, the average value of the indicator of economic development of manufacturing enterprises (SI_{econ}) is in the range of 0.39–0.64, the indicator of social development of manufacturing enterprises (SI_{soc}) is in the range of 0.40–0.60 and the indicator of environmental development of manufacturing enterprises (SI_{env}) is in the range of 0.44–0.74. The maximum value of the indicator of economic development of manufacturing enterprises in the CEECs is observed in Estonia (2018: 0.94), while the minimum value in Czechia (2009: 0.13). The maximum value of the indicator of social development of manufacturing enterprises is observed in Hungary (2018: 0.91), while the minimum value in Romania (2009: 0.12). The maximum value of the indicator of environmental development of manufacturing enterprises is observed in Slovakia (2018: 0.98), while the minimum value in Romania (2008: 0.01).

The average value of the indicator of sustainable development of manufacturing enterprises in the of CEECs in the period between 2008 and 2018 is in the range of 0.52–0.62. The average value of the indicator of sustainable development of manufacturing enterprises increased in: Bulgaria by 0.25 (from 0.45 to 0.70), Croatia by 0.25 (from 0.57 to 0.82), Czechia by 0.43 (from 0.42 to 0.85), Estonia by 0.13 (from 0.50 to 0.63), Hungary by 0.39 (from 0.45 to 0.84), Latvia by 0.19 (from 0.50 to 0.69), Lithuania by 0.32 (from 0.41 to 0.73), Poland by 0.23 (from 0.47 to 0.70), Romania by 0.28 (from 0.47 to 0.75), Slovakia by 0.52 (from 0.36 to 0.88), Slovenia by 0.16 (from 0.52 to 0.68). The maximum value of the indicator of sustainable development of manufacturing enterprises is observed in Slovakia (2018—0.88), while the minimum value in Czechia (2009—0.24). The indicators of economic, social, environmental, sustainable development are presented in Table 3.

In all CEECs, the indicator of sustainable development of manufacturing enterprises presents a positive trend. The highest factor before the variable time (t) occurs in Slovakia ($\alpha_1 = 0.054$). Parameters for equating the trend line for the indicator of sustainable development of manufacturing enterprises are presented in Table 4.

In the years 2008–2018, the average value of MSP_1 indicator is in the CEECs in the range from 0.24 to 0.32, while MSP_2 indicator ranges from 0.14 to 0.26. The maximum value of MSP_1 indicator in the CEECs is observed in Estonia (2018: 0.38), while the minimum value is in Latvia (2009: 0.14). The maximum value of MSP_2 indicator is observed in Slovenia (2018: 0.40), while the minimum value in Lithuania (2008: −0.07) (see Table 5).

The average value of MSP indicator in CEECs in the period from 2008 to 2018 ranges from 0.44 to 0.54. The average value of MSP indicator increased in: Bulgaria by 0.30 (from

Table 2 Research sample. *Source:* Own study on the basis of Eurostat (https://ec.europa.eu/Eurostat). Access: 30.11.2019

Country	Number of manufacturing enterprises										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bulgaria	30,288	32,177	30,728	30,135	29,715	30,091	30,374	30,879	31,323	31,272	31,491
Croatia	24,071	25,351	23,809	22,216	21,330	20,673	20,087	19,716	19,475	19,539	19,768
Czechia	151,753	156,209	167,344	173,519	173,889	167,688	170,041	172,054	175,425	175,894	179,059
Estonia	5478	5441	5468	5563	5927	6381	6613	7053	7259	7507	7686
Hungary	56,346	52,710	52,163	51,521	49,798	47,475	47,614	49,310	49,951	50,809	51,086
Latvia	7488	7521	7872	7737	8981	9537	9806	10,523	11,090	10,921	11,011
Lithuania	15,768	12,849	12,485	13,729	15,133	16,120	17,975	19,398	19,969	20,268	20,855
Poland	56,346	52,710	52,163	51,521	49,798	47,475	47,614	49,310	49,951	50,809	51,086
Romania	189,636	175,758	176,384	179,138	174,700	174,414	180,639	187,374	196,067	198,757	233,944
Slovakia	8081	8044	70,271	70,294	66,683	63,208	64,297	63,969	68,413	72,563	75,506
Slovenia	17,344	17,172	17,113	17,012	17,182	18,148	18,561	18,853	19,074	19,376	19,514
Total	562,599	545,942	615,800	622,385	613,136	601,210	613,621	628,439	647,997	657,715	703,024

Table 3 Indicators of economic (SI_{econ}), social (SI_{soc}), environmental (SI_{env}) and sustainable development of manufacturing enterprise (SI_{sde}) in the period from 2008 to 2018.

Source: Own study on the basis of Eurostat (https://ec.europa.eu/Eurostat). Access: 30.11.2019

Country	Indicator	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Mean	Mediana	Min	Max	SD
															Descriptive statistics		
Bulgaria	SI_{econ}	0.63	0.29	0.31	0.46	0.51	0.59	0.60	0.64	0.61	0.66	0.68	0.54	0.60	0.29	0.68	0.13
	SI_{soc}	0.55	0.20	0.26	0.37	0.41	0.49	0.57	0.64	0.67	0.67	0.71	0.50	0.55	0.20	0.71	0.17
	SI_{env}	0.17	0.83	0.71	0.59	0.79	0.69	0.62	0.59	0.58	0.69	0.70	0.63	0.69	0.17	0.83	0.17
	SI_{sde}	**0.45**	**0.44**	**0.43**	**0.47**	**0.57**	**0.59**	**0.60**	**0.62**	**0.62**	**0.67**	**0.70**	**0.56**	**0.59**	**0.43**	**0.70**	**0.09**
Croatia	SI_{econ}	0.93	0.40	0.25	0.27	0.17	0.15	0.15	0.31	0.50	0.56	0.63	0.39	0.31	0.15	0.93	0.23
	SI_{soc}	0.70	0.27	0.23	0.27	0.24	0.25	0.28	0.45	0.76	0.45	0.46	0.40	0.28	0.23	0.76	0.18
	SI_{env}	0.08	0.39	0.42	0.53	0.64	0.92	0.95	0.87	0.90	0.94	0.98	0.69	0.87	0.08	0.98	0.29
	SI_{sde}	**0.57**	**0.35**	**0.30**	**0.36**	**0.35**	**0.44**	**0.46**	**0.54**	**0.72**	**0.78**	**0.82**	**0.52**	**0.46**	**0.30**	**0.82**	**0.18**
Czechia	SI_{econ}	0.62	0.13	0.37	0.57	0.57	0.54	0.70	0.78	0.75	0.82	0.87	0.61	0.62	0.13	0.87	0.21
	SI_{soc}	0.62	0.15	0.33	0.51	0.50	0.49	0.57	0.69	0.73	0.72	0.76	0.55	0.57	0.15	0.76	0.18
	SI_{env}	0.02	0.43	0.63	0.61	0.69	0.82	0.77	0.81	0.77	0.85	0.92	0.67	0.77	0.02	0.92	0.24
	SI_{sde}	**0.42**	**0.24**	**0.45**	**0.56**	**0.59**	**0.62**	**0.68**	**0.76**	**0.75**	**0.80**	**0.85**	**0.61**	**0.62**	**0.24**	**0.85**	**0.18**
Estonia	SI_{econ}	0.48	0.14	0.28	0.60	0.69	0.78	0.71	0.69	0.74	0.88	0.94	0.63	0.69	0.14	0.94	0.23
	SI_{soc}	0.53	0.19	0.27	0.52	0.59	0.64	0.65	0.66	0.71	0.78	0.83	0.58	0.64	0.19	0.83	0.19
	SI_{env}	0.48	0.86	0.91	0.58	0.52	0.43	0.37	0.20	0.26	0.17	0.11	0.44	0.43	0.11	0.91	0.25
	SI_{sde}	**0.50**	**0.40**	**0.48**	**0.56**	**0.60**	**0.62**	**0.58**	**0.52**	**0.57**	**0.61**	**0.63**	**0.55**	**0.57**	**0.40**	**0.63**	**0.07**
Hungary	SI_{econ}	0.61	0.16	0.43	0.64	0.56	0.53	0.66	0.73	0.70	0.76	0.80	0.60	0.64	0.16	0.80	0.17
	SI_{soc}	0.54	0.12	0.34	0.52	0.50	0.54	0.66	0.78	0.81	0.85	0.91	0.60	0.54	0.12	0.91	0.22
	SI_{env}	0.21	0.70	0.65	0.57	0.72	0.78	0.64	0.60	0.71	0.78	0.81	0.65	0.70	0.21	0.81	0.16
	SI_{sde}	**0.45**	**0.33**	**0.47**	**0.58**	**0.59**	**0.62**	**0.66**	**0.70**	**0.74**	**0.79**	**0.84**	**0.62**	**0.62**	**0.33**	**0.84**	**0.15**
Latvia	SI_{econ}	0.65	0.13	0.28	0.51	0.59	0.62	0.63	0.69	0.67	0.72	0.75	0.55	0.63	0.13	0.75	0.19
	SI_{soc}	0.65	0.24	0.31	0.49	0.54	0.58	0.63	0.67	0.73	0.74	0.76	0.56	0.63	0.24	0.76	0.16
	SI_{env}	0.21	0.61	0.56	0.55	0.57	0.64	0.49	0.47	0.50	0.52	0.56	0.51	0.55	0.21	0.64	0.11
	SI_{sde}	**0.50**	**0.33**	**0.38**	**0.51**	**0.57**	**0.61**	**0.58**	**0.61**	**0.64**	**0.66**	**0.69**	**0.54**	**0.58**	**0.33**	**0.69**	**0.11**

Table 3 (continued)

Country	Indicator	Year											Descriptive statistics				
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Mean	Mediana	Min	Max	SD
Lithuania	SI_{econ}	0.57	0.16	0.32	0.61	0.66	0.65	0.63	0.66	0.61	0.73	0.77	0.58	0.63	0.16	0.77	0.17
	SI_{soc}	0.58	0.25	0.35	0.54	0.54	0.54	0.58	0.65	0.68	0.70	0.73	0.56	0.58	0.25	0.73	0.14
	SI_{env}	0.08	0.70	0.74	0.54	0.58	0.69	0.71	0.49	0.52	0.66	0.68	0.58	0.66	0.08	0.74	0.18
	SI_{sde}	**0.41**	**0.37**	**0.47**	**0.56**	**0.59**	**0.63**	**0.64**	**0.60**	**0.60**	**0.70**	**0.73**	**0.57**	**0.60**	**0.37**	**0.73**	**0.11**
Poland	SI_{econ}	0.60	0.15	0.28	0.51	0.44	0.48	0.59	0.72	0.74	0.74	0.79	0.55	0.59	0.15	0.79	0.19
	SI_{soc}	0.62	0.24	0.36	0.45	0.48	0.52	0.66	0.74	0.77	0.77	0.82	0.58	0.62	0.24	0.82	0.18
	SI_{env}	0.19	0.87	0.67	0.43	0.51	0.52	0.46	0.49	0.52	0.51	0.50	0.52	0.51	0.19	0.87	0.15
	SI_{sde}	**0.47**	**0.42**	**0.44**	**0.46**	**0.48**	**0.51**	**0.57**	**0.65**	**0.68**	**0.67**	**0.70**	**0.55**	**0.51**	**0.42**	**0.70**	**0.10**
Romania	SI_{econ}	0.80	0.25	0.38	0.50	0.53	0.46	0.57	0.55	0.53	0.52	0.52	0.51	0.52	0.25	0.80	0.13
	SI_{soc}	0.59	0.14	0.31	0.52	0.52	0.50	0.60	0.63	0.72	0.71	0.76	0.55	0.59	0.14	0.76	0.17
	SI_{env}	0.01	0.63	0.65	0.65	0.70	0.88	0.91	0.87	0.87	0.95	0.96	0.74	0.87	0.01	0.96	0.26
	SI_{sde}	**0.47**	**0.34**	**0.44**	**0.56**	**0.59**	**0.61**	**0.69**	**0.68**	**0.71**	**0.73**	**0.75**	**0.60**	**0.61**	**0.34**	**0.75**	**0.13**
Slovakia	SI_{econ}	0.51	0.16	0.49	0.61	0.63	0.62	0.67	0.78	0.76	0.85	0.91	0.64	0.63	0.16	0.91	0.20
	SI_{soc}	0.48	0.21	0.35	0.39	0.41	0.46	0.57	0.70	0.70	0.71	0.76	0.52	0.48	0.21	0.76	0.17
	SI_{env}	0.10	0.56	0.62	0.50	0.70	0.79	0.82	0.74	0.71	0.92	0.98	0.68	0.71	0.10	0.98	0.23
	SI_{sde}	**0.36**	**0.31**	**0.49**	**0.50**	**0.58**	**0.63**	**0.69**	**0.74**	**0.72**	**0.83**	**0.88**	**0.61**	**0.63**	**0.31**	**0.88**	**0.17**
Slovenia	SI_{econ}	0.81	0.18	0.37	0.53	0.44	0.47	0.59	0.64	0.71	0.64	0.67	0.55	0.59	0.18	0.81	0.17
	SI_{soc}	0.61	0.22	0.35	0.48	0.45	0.44	0.55	0.60	0.71	0.65	0.68	0.52	0.55	0.22	0.71	0.14
	SI_{env}	0.14	0.55	0.56	0.69	0.76	0.61	0.45	0.57	0.56	0.66	0.69	0.57	0.57	0.14	0.76	0.16
	SI_{sde}	**0.52**	**0.31**	**0.43**	**0.57**	**0.55**	**0.51**	**0.53**	**0.60**	**0.66**	**0.65**	**0.68**	**0.55**	**0.55**	**0.31**	**0.68**	**0.10**

The bold values are statistically significant at $p < 0.05$

Dependent variable (SI_{sde})	OLS	Coefficient	SD	P value	R^2
Bulgaria	Constant	0.392	0.018	<0.0001***	0.926
	Time	0.028	0.003	<0.0001***	
Croatia	Constant	0.261	0.081	0.0105**	0.587
	Time	0.043	0.012	0.0060***	
Czechia	Constant	0.230	0.042	<0.0001***	0.887
	Time	0.053	0.006	<0.0001***	
Estonia	Constant	0.461	0.034	<0.0001***	0.501
	Time	0.015	0.005	0.0148**	
Hungary	Constant	0.349	0.030	<0.0001***	0.919
	Time	0.045	0.004	<0.0001***	
Latvia	Constant	0.377	0.040	<0.0001***	0.731
	Time	0.029	0.006	0.0008***	
Lithuania	Constant	0.385	0.031	<0.0001***	0.837
	Time	0.031	0.005	<0.0001***	
Poland	Constant	0.366	0.025	<0.0001***	0.883
	Time	0.031	0.004	<0.0001***	
Romania	Constant	0.373	0.034	<0.0001***	0.864
	Time	0.037	0.005	<0.0001***	
Slovakia	Constant	0.286	0.025	<0.0001***	0.960
	Time	0.054	0.004	<0.0001***	
Slovenia	Constant	0.390	0.043	<0.0001***	0.646
	Time	0.026	0.006	0.0029***	

Table 4 Parameters for equating the trend line for the indicator of sustainable development of manufacturing enterprises in the CEECs: $y = \alpha_0 + \alpha_1 t$. *Source*: Own study on the basis of Eurostat (https://ec.europa.eu/Eurostat). Access: 30.11.2019

Asterisks indicate statistical significance at $p < 0.05$

0.35 to 0.65), Croatia by 0.32 (from 0.31 to 0.62), Czechia by 0.14 (from 0.48 to 0.62), Estonia by 0.40 (from 0.28 to 0.68), Hungary by 0.39 (from 0.34 to 0.72), Latvia by 0.42 (from 0.20 to 0.62), Lithuania by 0.44 (from 0.22 to 0.65), Poland by 0.20 (from 0.37 to 0.56), Romania by 0.36 (from 0.27 to 0.62), Slovakia by 0.17 (from 0.38 to 0.55), Slovenia by 0.23 (from 0.41 to 0.64). The maximum value of MSP indicator is observed in Hungary (2018: 0.72), while the minimum value in Latvia (2008: 0.20) (see Table 5).

In all the countries of CEECs, the MSP indicator presents a positive trend. The highest factor before the variable time (t) occurs in Lithuania ($\alpha_1 = 0.039$). Parameters for equating the trend line for the MSP indicator in the CEECs are presented in Table 6.

The Pearson's correlation coefficient between SI_{sde} and MSP indicators is statistically significant in all analyzed countries ($p < 0.05$). The highest level of correlation is recorded in Czechia (0.99), while the lowest is in Estonia (0.65) (see Fig. 2).

In most of the CEECs, the MSP_1 and MSP_2 indicators have a positive impact on the sustainable development of manufacturing enterprises and a significant relationship between the variables studied. The exceptions are two countries, Estonia and Latvia, where the ratio before the MSP_2 indicators are -0.276 and -0.088. The highest impact of MSP_1 indicator (the degree of dependence of a given country's economy on internal factors) on the sustainable development of manufacturing enterprises is observed in Croatia (4.088), while the lowest impact of MSP_1 indicator on the sustainable development of manufacturing

Table 5 MSP_1, MSP_2, MSP indicators in the period from 2008 to 2018. *Source:* Own study on the basis of Eurostat (https://ec.europa.eu/Eurostat). Access: 30.11.2019

Country	Indicator	Year											Descriptive statistics				
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Mean	Median	Min	Max	SD
Bulgaria	MSP_1	0.35	0.26	0.28	0.29	0.29	0.30	0.26	0.32	0.34	0.31	0.31	0.30	0.30	0.26	0.35	0.03
	MSP_2	0.00	0.03	0.17	0.21	0.18	0.22	0.23	0.21	0.26	0.31	0.34	0.20	0.21	0.00	0.34	0.10
	MSP	**0.35**	**0.29**	**0.44**	**0.49**	**0.47**	**0.52**	**0.49**	**0.52**	**0.61**	**0.62**	**0.65**	**0.50**	**0.49**	**0.29**	**0.65**	**0.10**
Croatia	MSP_1	0.29	0.22	0.24	0.22	0.22	0.23	0.24	0.26	0.31	0.26	0.27	0.25	0.24	0.22	0.31	0.03
	MSP_2	0.02	0.08	0.17	0.18	0.18	0.21	0.23	0.29	0.26	0.33	0.36	0.21	0.21	0.02	0.36	0.10
	MSP	**0.31**	**0.30**	**0.41**	**0.39**	**0.40**	**0.44**	**0.47**	**0.56**	**0.57**	**0.59**	**0.62**	**0.46**	**0.44**	**0.30**	**0.62**	**0.11**
Czechia	MSP_1	0.31	0.26	0.29	0.30	0.27	0.31	0.33	0.37	0.36	0.36	0.37	0.32	0.31	0.26	0.37	0.04
	MSP_2	0.17	0.13	0.13	0.16	0.16	0.18	0.21	0.22	0.24	0.24	0.25	0.19	0.18	0.13	0.25	0.04
	MSP	**0.48**	**0.39**	**0.42**	**0.46**	**0.43**	**0.49**	**0.54**	**0.59**	**0.60**	**0.60**	**0.62**	**0.51**	**0.49**	**0.39**	**0.62**	**0.08**
Estonia	MSP_1	0.26	0.23	0.28	0.32	0.31	0.31	0.34	0.34	0.34	0.37	0.38	0.31	0.32	0.23	0.38	0.04
	MSP_2	0.02	0.17	0.24	0.25	0.17	0.21	0.22	0.24	0.25	0.28	0.30	0.21	0.24	0.02	0.30	0.07
	MSP	**0.28**	**0.39**	**0.51**	**0.57**	**0.48**	**0.52**	**0.56**	**0.57**	**0.58**	**0.65**	**0.68**	**0.53**	**0.56**	**0.28**	**0.68**	**0.11**
Hungary	MSP_1	0.28	0.23	0.26	0.26	0.27	0.29	0.32	0.33	0.33	0.34	0.35	0.30	0.29	0.23	0.35	0.04
	MSP_2	0.06	0.15	0.20	0.22	0.22	0.28	0.24	0.26	0.33	0.35	0.37	0.24	0.24	0.06	0.37	0.09
	MSP	**0.34**	**0.39**	**0.46**	**0.47**	**0.48**	**0.57**	**0.56**	**0.59**	**0.66**	**0.69**	**0.72**	**0.54**	**0.56**	**0.34**	**0.72**	**0.12**
Latvia	MSP_1	0.24	0.14	0.18	0.24	0.28	0.30	0.30	0.31	0.32	0.35	0.37	0.27	0.30	0.14	0.37	0.07
	MSP_2	− 0.04	0.24	0.22	0.15	0.13	0.15	0.17	0.20	0.23	0.23	0.25	0.18	0.20	− 0.04	0.25	0.08
	MSP	**0.20**	**0.38**	**0.39**	**0.39**	**0.41**	**0.45**	**0.47**	**0.50**	**0.55**	**0.58**	**0.62**	**0.45**	**0.45**	**0.20**	**0.62**	**0.11**
Lithuania	MSP_1	0.29	0.15	0.21	0.21	0.27	0.29	0.31	0.32	0.33	0.34	0.36	0.28	0.29	0.15	0.36	0.06
	MSP_2	− 0.07	0.15	0.17	0.12	0.18	0.22	0.27	0.16	0.19	0.27	0.29	0.18	0.18	− 0.07	0.29	0.10
	MSP	**0.22**	**0.30**	**0.39**	**0.32**	**0.45**	**0.51**	**0.59**	**0.47**	**0.52**	**0.61**	**0.65**	**0.46**	**0.47**	**0.22**	**0.65**	**0.13**
Poland	MSP_1	0.30	0.25	0.25	0.28	0.27	0.28	0.32	0.32	0.32	0.32	0.33	0.30	0.30	0.25	0.33	0.03
	MSP_2	0.07	0.12	0.10	0.10	0.13	0.17	0.16	0.20	0.20	0.22	0.23	0.15	0.16	0.07	0.23	0.05
	MSP	**0.37**	**0.37**	**0.35**	**0.38**	**0.40**	**0.45**	**0.48**	**0.51**	**0.52**	**0.54**	**0.56**	**0.45**	**0.45**	**0.35**	**0.56**	**0.08**

Table 5 (continued)

Country	Indicator	Year												Descriptive statistics				
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Mean	Median	Min	Max	SD
Romania	MSP_1	0.30	0.20	0.23	0.27	0.29	0.31	0.33	0.34	0.33	0.35	0.36	0.30	0.31	0.20	0.36	0.05
	MSP_2	− 0.03	0.09	0.09	0.10	0.11	0.19	0.19	0.18	0.17	0.24	0.26	0.14	0.17	− 0.03	0.26	0.08
	MSP	**0.27**	**0.29**	**0.32**	**0.37**	**0.40**	**0.50**	**0.52**	**0.52**	**0.50**	**0.59**	**0.62**	**0.44**	**0.50**	**0.27**	**0.62**	**0.12**
Slovakia	MSP_1	0.30	0.21	0.24	0.25	0.25	0.27	0.28	0.30	0.30	0.30	0.30	0.27	0.28	0.21	0.30	0.03
	MSP_2	0.08	0.11	0.11	0.10	0.22	0.24	0.23	0.18	0.16	0.23	0.25	0.17	0.18	0.08	0.25	0.06
	MSP	**0.38**	**0.32**	**0.35**	**0.35**	**0.46**	**0.51**	**0.51**	**0.47**	**0.47**	**0.53**	**0.55**	**0.45**	**0.47**	**0.32**	**0.55**	**0.08**
Slovenia	MSP_1	0.31	0.23	0.25	0.23	0.24	0.14	0.24	0.27	0.29	0.24	0.24	0.24	0.24	0.14	0.31	0.04
	MSP_2	0.10	0.15	0.20	0.20	0.22	0.27	0.33	0.29	0.32	0.37	0.40	0.26	0.27	0.10	0.40	0.09
	MSP	**0.41**	**0.38**	**0.44**	**0.43**	**0.46**	**0.41**	**0.57**	**0.57**	**0.61**	**0.61**	**0.64**	**0.50**	**0.46**	**0.38**	**0.64**	**0.09**

The bold values are statistically significant at $p < 0.05$

Table 6 Parameters for equating the trend line for MSP indicators in the CEECs: $y = \alpha_0 + \alpha_1\, t$. *Source*: Own study on the basis of Eurostat (https://ec.europa.eu/Eurostat). Access: 30.11.2019

Dependent variable (MSP)	OLS	Coefficient	SD	P value	R^2
Bulgaria	Constant	0.313	0.026	<0.0001***	0.872
	Time	0.031	0.004	<0.0001***	
Croatia	Constant	0.261	0.017	<0.0001***	0.952
	Time	0.033	0.002	<0.0001***	
Czechia	Constant	0.378	0.024	<0.0001***	0.810
	Time	0.022	0.004	0.0002***	
Estonia	Constant	0.346	0.037	<0.0001***	0.778
	Time	0.030	0.005	0.0003***	
Hungary	Constant	0.319	0.013	<0.0001***	0.975
	Time	0.037	0.002	<0.0001***	
Latvia	Constant	0.249	0.025	<0.0001***	0.899
	Time	0.033	0.004	<0.0001***	
Lithuania	Constant	0.224	0.035	0.0001***	0.862
	Time	0.039	0.005	<0.0001***	
Poland	Constant	0.312	0.014	<0.0001***	0.930
	Time	0.023	0.002	<0.0001***	
Romania	Constant	0.228	0.019	<0.0001***	0.946
	Time	0.036	0.003	<0.0001***	
Slovakia	Constant	0.317	0.027	<0.0001***	0.761
	Time	0.021	0.004	0.0005***	
Slovenia	Constant	0.341	0.026	<0.0001***	0.844
	Time	0.027	0.004	<0.0001***	

Asterisks indicate statistical significance at $p < 0.05$
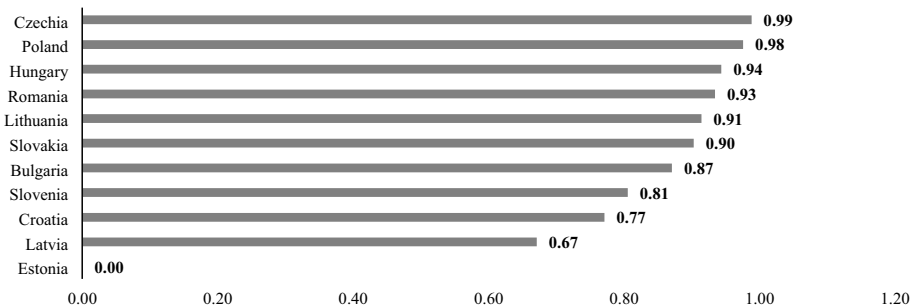
Fig. 2 The Pearson's correlation coefficient (correlations between SI_{sde} and MSP indicators, $p < 0.05$). *Source*: Own study on the basis of Eurostat (https://ec.europa.eu/Eurostat). Access: 30.11.2019

enterprises is noted in Czechia (0.614). The highest impact of MSP_2 indicator (the degree of dependence of a given country's economy on external factors) on the sustainable development of manufacturing enterprises is recorded in Czechia (3.401), while the lowest impact of MSP_2 indicator on the sustainable development of manufacturing enterprises is recorded in Romania (0.536).

The coefficient of determination (R^2) is in the range from 0.635 (relationship between the indicator of sustainable development of manufacturing enterprises in Slovenia and

MSP_1, MSP_2) to 0.954 (relationship between the indicator of sustainable development of manufacturing enterprises in Poland and MSP_1, MSP_2). The results of ordinary least squares regression of the impact of MSP_1 and MSP_2 on the sustainable development of manufacturing enterprises are presented in Table 7.

In all the CEECs, the MSP indicator has a positive impact on the sustainable development of manufacturing enterprises and a significant relationship between the variables

Table 7 Results of OLS regressions in the period from 2008 to 2018: $SI_{Sde} = \propto_0 + \propto_1 MSP_1 + \propto_2 MSP_2 + \varepsilon_i$. *Source*: Own study on the basis of Eurostat (https://ec.europa.eu/Eurostat). Access: 30.11.2019

Dependent variable (SI_{sde})	OLS	Coefficient	SD	*P* value	R^2
Bulgaria	Constant	0.174	0.176	0.351	0.76
	MSP_1	0.781	0.577	0.213*	
	MSP_2	0.772	0.162	0.0014***	
Croatia	Constant	−0.684	0.253	0.027**	0.795
	MSP_1	4.088	1.037	0.0043***	
	MSP_2	0.856	0.302	0.022**	
Czechia	Constant	−0.232	0.324	0.494	0.837
	MSP_1	0.614	1.931	0.759*	
	MSP_2	3.401	1.799	0.095*	
Estonia	Constant	0.107	0.096	0.295	0.74
	MSP_1	1.608	0.405	0.0041***	
	MSP_2	−0.276	0.245	0.294	
Hungary	Constant	−0.236	0.134	0.115	0.924
	MSP_1	2.274	0.594	0.005***	
	MSP_2	0.74	0.26	0.0215**	
Latvia	Constant	0.120	0.019	0.0002***	0.988
	MSP_1	1.625	0.064	<0.0001***	
	MSP_2	−0.088	0.054	0.1426	
Lithuania	Constant	0.185	0.064	0.0197**	0.864
	MSP_1	0.995	0.238	0.0031***	
	MSP_2	0.616	0.159	0.0047***	
Poland	Constant	−0.193	0.097	0.0823*	0.954
	MSP_1	2.002	0.408	0.0012***	
	MSP_2	0.995	0.227	0.0024***	
Romania	Constant	−0.042	0.073	0.584	0.942
	MSP_1	1.872	0.285	0.0002***	
	MSP_2	0.536	0.177	0.0165**	
Slovakia	Constant	−0.419	0.226	0.101	0.829
	MSP_1	2.619	0.883	0.018**	
	MSP_2	1.85	0.452	0.0035***	
Slovenia	Constant	0.105	0.153	0.513	0.635
	MSP_1	0.872	0.52	0.132*	
	MSP_2	0.888	0.249	0.0074***	

Asterisks indicate statistical significance at $p < 0.05$

studied. The highest impact of MSP indicator on the sustainable development of manufacturing enterprises is recorded in Czechia (2.062), while the lowest impact of MSP indicator on the sustainable development of manufacturing enterprises is noted in Estonia (0.404).

The coefficient of determination (R^2) is in the range from 0.428 (relationship between the indicator of sustainable development of manufacturing enterprises in Estonia and MSP) to 0.938 (relationship between the indicator of sustainable development of manufacturing enterprises in Poland and MSP). The results of ordinary least squares regression of the impact of MSP on the sustainable development of manufacturing enterprises are presented in Table 8.

The result of the research allows to confirm the main research hypothesis. We prove that macroeconomic stabilization has a statistically significant impact on the sustainable development of manufacturing enterprises in Central and Eastern Europe in the period from 2008–2018. The highest impact between indicators according to the Pearson's correlation coefficient is in Czechia (0.99), Poland (0.98), and Hungary (0.94).

We also confirm the first sub-hypothesis (H1), because in all the CEECs the indicator of sustainable development of enterprises (SI_{sde}) shows the positive dynamics in the period from 2008 to 2018. The highest upward trend of the indicator occurs in Slovakia

Table 8 Results of OLS regressions in the period of 2008–2018 (dependent variable: sustainable development of manufacturing enterprises in the CEECs, independent variable: MSP). *Source*: Own study on the basis of Eurostat (https://ec.europa.eu/Eurostat). Access: 30.11.2019

Dependent variable (SI_{sde})	OLS	Coefficient	SD	*P* value	*R*-squared
Bulgaria	Constant	0.176	0.074	0.0412**	0.759
	MSP	0.774	0.145	0.0005***	
Croatia	Constant	− 0.066	0.165	0.699	0.593
	MSP	1.272	0.351	0.0056***	
Czechia	Constant	− 0.442	0.163	0.0238**	0.826
	MSP	2.062	0.315	0.0001***	
Estonia	Constant	0.338	0.084	0.0029***	0.428
	MSP	0.404	0.155	0.0289**	
Hungary	Constant	− 0.020	0.077	0.7993	0.889
	MSP	1.180	0.139	<0.0001***	
Latvia	Constant	0.258	0.112	0.0461**	0.450
	MSP	0.655	0.241	0.0238**	
Lithuania	Constant	0.230	0.052	0.0016***	0.841
	MSP	0.749	0.109	<0.0001***	
Poland	Constant	− 0.049	0.052	0.3707	0.938
	MSP	1.335	0.114	<0.0001***	
Romania	Constant	0.146	0.060	0.0377**	0.870
	MSP	1.017	0.131	<0.0001***	
Slovakia	Constant	− 0.305	0.145	0.0647*	0.820
	MSP	2.061	0.322	0.0001***	
Slovenia	Constant	0.102	0.114	0.3962	0.635
	MSP	0.886	0.224	0.0033***	

Asterisks indicate statistical significance at $p < 0.05$

($\alpha_1 = 0.054$). This is a desirable phenomenon that indicates that enterprises are taking actions aimed at achieving economic, social, and environmental goals.

The second sub-hypothesis (H2) should be rejected. This is because only in Bulgaria, Estonia and Slovenia, the average value of the indicator of economic development (SI_{econ}) is higher than the average value of the indicator of social (SI_{soc}) and the average value of the indicator of environmental development (SI_{env}). Economic development is the basic pillar of the sustainable development of enterprises in these three countries. This may indicate the use of a traditional approach to doing business in which profit maximization is still the primary goal. The levels of sustainable development indicators in all countries are relatively low. Therefore, it is necessary to take measures to implement new environmental initiatives. The creation of appropriate financial programs, transfer of knowledge, and ecological innovations is crucial.

We confirm the third sub-hypothesis (H3) because the indicator of macroeconomic stabilization (MSP) in the Central and Eastern European Countries increases in the period from 2008 to 2018. The highest upward trend occurs in Lithuania ($\alpha_1 = 0.039$). Thus, the level of economic lasting balance (internal and external) increases.

A general conclusion can be made that most countries report progressive stabilization due to the improvement of the macroeconomic indicators. Particularly Poland and Slovakia duly used the examined time not only in the context of the absorption of the European Union funds but also to improve the sustainability of the economy and improving its position on the international stage. National authorities should take into account the fact that accelerating economic growth may reduce the unemployment rate, but it causes inflationary pressure and a tendency to increase foreign debt and vice versa.

The fourth sub-hypothesis (H4), the macroeconomic stabilization pentagon (internal factors) indicator (MSP1) is higher than the macroeconomic stabilization pentagon (external factors) indicator (MSP2) in the CEECs, can also be confirmed. This shows that the level of stability is largely determined by internal conditions (MSP1 > MSP2). Thus, the areas of greatest achievement are related to well-implemented internal macroeconomic policy. In turn, external factors may become a threat to the stabilization process.

We also confirm the fifth sub-hypothesis (H5), because internal factors of macroeconomic stabilization (MSP1) have a greater impact on the sustainable development of industrial enterprises than external factors (MSP2). Slovenia is an exception here, as it has a higher impact on the MSP2 indicator on the sustainable development of enterprises. The sustainable development of manufacturing enterprises (SI_{sde}) is correlated with the rate of economic growth, unemployment rate, inflation level, and the state budget.

7 Conclusion

In the era of climate changes and increasing public awareness of the negative impact of human activities on the environment, the concept of sustainable development is gaining importance. The implementation of the idea of equally perceiving economic, social and environmental development requires the involvement of all actors of social and economic life, including enterprises.

The pro-consumer orientation of enterprises and a comprehensive approach to management processes requires taking into account the principles of sustainable development. The level of environmental investments of enterprises depends on several factors that can be divided into two main groups: internal and external. Research indicates that both groups of

determinants are important. It should be emphasized that the key to ecological investments is having a stable financial and property situation. Legal regulations in the field of nature protection and macroeconomic stability are also very important. The analysis of the impact of factors on sustainable development is an extremely interesting and important research problem. Most researchers believe that the level of ecological development depends on the level of socio-economic development of the country.

The results of research indicate that the level of macroeconomic stabilization statistically significantly affects the level of sustainable development of manufacturing enterprises in the Central and Eastern European Countries. The highest level of statistical correlation between the analyzed categories occurs in Czechia (the Pearson's correlation coefficient = 0.99), Poland (0.98) and Hungary (0.94) and the lowest level in Estonia (0.65). The OLS regression gives similar results. The highest impact of MSP indicator on the sustainable development of manufacturing enterprises is recorded in Czechia ($\propto = 2.062$), while the lowest impact of MSP indicator on the sustainable development of manufacturing enterprises is noted in Estonia ($\propto = 0.404$). The indicator of sustainable development of enterprises in the countries of Central and Eastern Europe in 2008–2018 shows positive dynamics. The highest level of dynamics is in Slovakia ($\propto_1 = 0.054$). The average level of the economic indicator is higher than the social and environmental indicator only in Bulgaria, Estonia and Slovenia. The macroeconomic stabilization indicator in the Central and Eastern European Countries increases in the period from 2008 to 2018. The highest level of dynamics occur in Lithuania ($\propto_1 = 0.039$). In all of the countries the MSP_1 index (internal factors) is higher than the MSP_2 index (external factors). It is noteworthy that internal factors have a stronger impact on sustainable development than external factors.

In-depth knowledge of macroeconomic stability is essential for all entities operating in the economy. Macroeconomic stability eliminates uncertainty in economic activity, increases the country's investment attractiveness, as well as increases the economic activity in the future. The level of macroeconomic stability is the key to assessing investment risk. The greater the level of macroeconomic stability, the greater the market confidence and propensity to take risks. In the analyzed period, the level of macroeconomic stability increased, which should be clearly assessed as positive. The purpose of a stabilization policy, including a combination of fiscal and monetary policy is to alleviate fluctuations in business cycles, which is supposed to lead to lasting economic balance. However, it should be emphasized that from the point of view of sustainable development, political decisions, economic conjunction, social and ecological crises should also be taken into account.

The obtained results are determined by the selection and limited availability of analytical indicators describing the sustainable development of enterprises. It should be recognized that macroeconomic stabilization is important for the development of enterprises. The economic situation and its level in the future have a fundamental importance for economic activity. Our further research will be conducted to assess the impact of financial security on investment decisions that supporting society and the environment.

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