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Assessment of the impact of the usage of derivatives on the company's value

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Abstract. *During periods of increased uncertainty, financial market participants are looking for ways to manage risk. The derivatives can be considered as one of the potential instruments for hedging risk. There is no consensus in the scientific literature on whether the application of derivatives has an impact on a value of a company. Thus, the main purpose of this paper is to quantitatively assess the impact of the application of derivatives on the value of a company. The research hypothesis is formulated as follows: the use of derivatives increases the company's value, i.e. the application of derivatives has a statistically significant positive impact on the value of the company. Seeking to achieve the main purpose and test the hypothesis, besides the analysis of relevant academic literature, the method of panel data analysis (linear multiple regression) is used to quantitatively assess the effect the application of derivatives has made on the company's value. 28 companies (constituents of EURO STOXX 50 ESG Index) are analyzed in the period of 2005-2020. The results of the research allow stating the effect of derivatives on the value of companies has proven to be statistically significant and positive.*

Keywords: derivatives; risk management; company's value.

JEL Classification: G32, G10, G30.

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Introduction

In recent years, the world has been constantly facing various situations related to increased uncertainty: related to health care, as well as natural, political, and other challenges. This inevitably affects the prices of commodities, thus resulting in changes related to inflation, interest rates, etc. Undoubtedly, this uncertainty is also reflected in the financial markets. For example: (i) at the end of 2019, World Uncertainty Index had risen to a record level of 5 while during the crisis of 2008, an increase of only up to 0.4 was recorded, (ii) the US Equity Market Volatility Index had risen to 63 in 2020 (Economic policy…, 2020; World uncertainty…, 2019). Thus, due to the increase in volatility and uncertainty, financial market participants are looking for ways to manage risk. The derivatives can be considered as one of the potential instruments for hedging risk.

Generally speaking, there is no consensus in the scientific literature on whether derivatives affect the value of a company. Some authors (for example, Bachiller et al. (2021) and others) claim that this effect is significant. Other authors (for example, Frensidy and Mardhaniaty (2019), Firmansyah and Purnama (2020), and others) provide different results stating that the relationship between the application of derivatives and the value of a company is insignificant. In addition, the literature often analyzes traditional derivatives and their effects on hedging risks (for example, X. Chang et al., (2019); Trespalacios et al., (2021); Vitali and Moriggia, (2021); L. Wang et al., (2021) and others), while the research analyzing the impact of the application of derivatives strategies in the value of a company are still scarce.

Whereas there is little research on the previously discussed effect, the main purpose of this paper is to evaluate the impact of the application of derivatives on the value of a company. Seeking to achieve the main purpose of the paper, the following hypothesis is formulated: the use of derivatives increases the company's value, i.e. the application of derivatives has a statistically significant positive impact on the value of the companies Seeking to achieve the main purpose, besides the analysis of relevant academic literature, the method of panel data analysis (linear multiple regression) is used to quantitatively assess the effect the application of derivatives has made on the company's value. For our research, 28 companies (constituents of EURO STOXX 50 ESG Index) were analyzed in the period of 2005-2020.

The rest of the paper is structured as follows: (i) in Section 2 the analysis of academic literature is conducted, (ii) in Section 3 the design of the research is described, (iv) in Section 4 the results of the assessment of the impact of the application of derivatives on the value of a company discussed; and (v) the conclusions and directions for future research are presented.

1. Literature review

Seeking the main purpose of this research, it is very important to identify the main channels through which derivatives affect different market participants. Figure 1 shows the three main groups of participants and transmission channels of the impact of the derivatives.

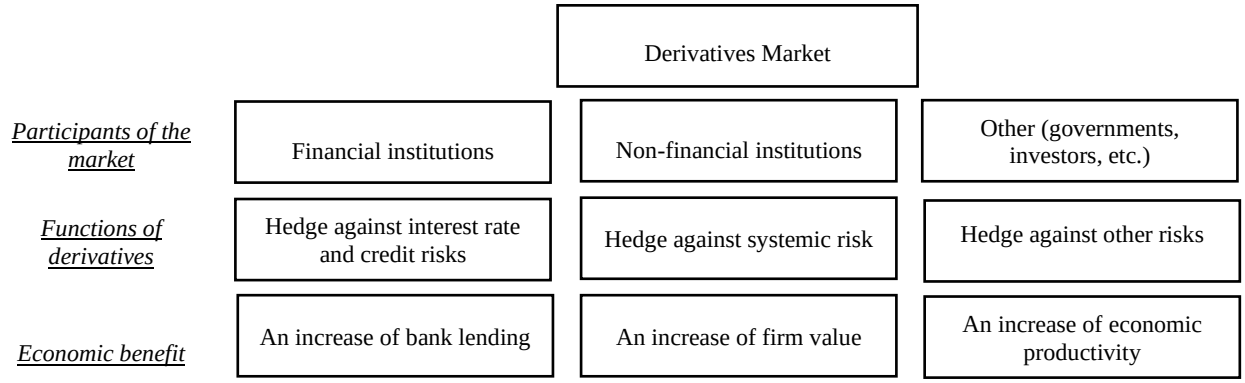

Figure 1. Derivatives channels of impact.
Source: prepared by the authors based on Prabha ir kt., 2014, Infante ir kt., 2018 Sahoo ir Sahoo, 2020.

The first group of participants affected by derivatives consists of financial institutions. As it is stated by Infante et al. (2018), banks participate in the derivatives market to hedge against unexpected changes in economic variables, trading, and broker-dealer activities. The main risks hedged by financial institutions using derivatives include interest rate risk and credit risk. Moreover, derivatives are sometimes specified as an alternative for capital and liquidity hedging (Infante et al., 2018). Generally speaking, banks in emerging markets can reduce volatility by using derivatives (Bazih and Vanwalleghem, 2021). Beyhaghi et al. (2017) found an equilibrium where loans to riskier borrowers are more likely to be sold ex-ante, while loans to safer borrowers are hedged using CDS (Beyhaghi et al., 2017). According to Keffala (2021), the use of options and swaps has a positive effect on the performance of the banks. However, the results also show that the use of forward contracts reduces the performance of the banks, and futures contracts have not any significant effect (Keffala, 2021). Taking this into account, it can be stated that, in the case of financial institutions, the application of derivatives contributes to risk reduction, which can lead to an increased level of bank lending. For example, Abugri and Osah (2021) identified that, based on Diamond's systematic risk mitigation theory, the use of derivatives is positively related to lending growth (Abugri and Osah, 2021).

However, Hasan and Wu (2021) provide a contrary view and claim that net CDS exposures and lending status are not related (Hasan and Wu, 2021).

The second group of participants affected by derivatives consists of companies (corporations). As it is stated by Hartono et al. (2020), Sobti (2020), Wan and Fan (2021), Wybieralski (2020), the role of derivatives in corporations of mostly related to hedging. According to Sahoo and Sahoo (2020), a company, which uses derivatives can transfer unwanted or excess risk to a counterparty, which is willing to take that risk or can compensate it in other ways (Sahoo and Sahoo, 2020). For example, Wybieralski (2020), in a paper on the application of cross-currency-interest rate swaps in long-term currency risk management, emphasized that the analyzed measure meets expectations in the context of the company's (manufacturer's) cash flow hedging, and can also generate additional benefits due to the still-existing interest rate differential (Wybieralski, 2020). S. Wang et al. (2018) examine the effectiveness of an option contract for production optimization in the Emissions Trading System. The flexibility afforded by options allows the producer to benefit more from higher demand risk, even in a tightly constrained emissions market. A lower selling price helps the manufacturer better hedge against the risk of higher demand. In addition, sound emission and option pricing are vital for the regulator to implement its low-carbon policy (S. Wang et al., 2018).

Moreover, some researchers (for example, Bessler et al. (2019), Bachiller et al. (2021), Frensidy and Mardhaniaty (2019), Firmansyah and Purnama (2020) and others) discuss the relationship between the application of derivatives and a value of a company. Bessler et al. (2019) find out that a relatively higher company's value is primarily associated with hedging foreign exchange risk (Bessler et al., 2019). Bachiller et al. (2021) state that the use of foreign currency derivatives alone or in combination with other types of derivatives positively affects a company's value. The authors also argue that hedging provides an economic advantage to all companies, especially in developed countries (Bachiller et al., 2021).

Other authors provide less unambiguous results. Prabha et al. (2014) state that the impact of derivatives on non-financial companies' value is positive, but statistically and economically significant only during the crisis and subsequent recession, clearly demonstrating a risk management function. According to Frensidy and Mardhaniaty (2019), derivative hedging is modestly related to a company's value, while foreign exchange hedging has a significant positive relationship with a company's value. The authors also indicate that there is no correlation between interest rate and commodity price risk hedging and the company's value (Frensidy and Mardhaniaty, 2019). Zamzamin et al. (2021) state that the derivatives contribute significantly to the firm's value and that there is a non-linear (U-shaped) relationship between foreign exchange derivatives and firm value (Zamzamin et al., 2021). Finally, somewhat contradictory are the results of Firmansyah and Purnama (2020) stating that the application derivatives is not related to the company's value. Taking into account these ambiguous results of previous efforts in the field, it is worth analyzing more deeply the relationship between the use of derivative financial instruments and company values.

Finally, the third group includes the rest of the market participants potentially affected by derivatives – governments, government institutions, investors, etc. It is agreed that derivatives provide significant benefits to users in both the private and public sectors. Firstly, for these participants, the derivatives are useful for reducing borrowing costs and improving the performance of the investment portfolio. Secondly, derivatives provide a low-cost and efficient way for consumers to hedge and manage their interest exposures, giving investors and issuers a wider range of management tools (Manjushree, 2020). According to Hao et al. (2020), a more developed foreign exchange derivatives market appeared to be significantly related to the increase in industry-level investment in research and development, especially in emerging economies (when average daily instrument turnover, which measures the development of this market, increases by one standard deviation, industry-level R&D spending increases by 27% in the following year). This effect is particularly important for industries with higher foreign exchange risk (Hao et al., 2020). Thus, it can be stated that the derivatives market can potentially affect both the general economic situation and each market participant separately.

Taking into account what has been previously stated, it can be said that the effect of derivatives on different market participants through three different transmission channels is confirmed by the research conducted. Usually, it is stated that the application of derivatives has a positive effect on market participants, but there are also contradicting results, especially talking about the second impact transmission channel. Thus, further research is focused on the second impact transmission channel and aims to determine and quantitatively assess the impact of derivatives on company value. In the next section, the design of this research is discussed.

2. Research methodology

Taking into account that some of the scientific studies have proven the significant impact of derivatives in achieving the growth of a company, this research aims to answer the question of whether derivatives can significantly contribute to the growth of a company's value. Seeking to achieve the main purpose of this research, i.e. to evaluate the impact of the application of derivatives on the value of a company, research consisting of several steps is conducted. Further, these steps are discussed in detail.

Hypothesis. Seeking to achieve the main purpose of the paper, the following hypothesis is formulated: *H:* the use of derivatives increases the company's value, i.e. the application of derivatives has a statistically significant positive impact on the value of the companies (constituents of the EURO STOXX 50 ESG index).

Selection of variables. To test the research hypothesis, the value of the company is selected as a dependent variable. The sample consists of the companies included in the EURO STOXX 50 ESG index. After analyzing the activity in derivatives markets in different European countries, it was noticed that the highest activity can be observed in Sweden, Germany, and France derivative markets. Taking this into account and noticing that most of the companies included in the EURO STOXX 50 ESG index are operating in the previously mentioned countries, the EURO STOXX 50 ESG index and its constituent companies were chosen. Certain companies, such as banks or insurance companies, were excluded from the list due to differences in business model, financial reporting and regulation, and different assessment aspects and indicators (for financial companies different evaluation methods could be more suitable (Prabha et al., 2014)). Thus, for further research 28 companies are chosen (the list of selected companies is provided in Table 1 (in italics)). According to Prabha et al. (2014) and Zamzamin et al. (2021), Tobin's Q (FV) is selected as a proxy of a company's value.

Table 1. The list of components of "EURO STOXX 50 ESG" index

	Company	Sector	The code of country
1.	*Adidas*	Consumer Products & Services	DE
2.	*Akzo Nobel*	Chemicals	NL
3.	Allianz	Insurance	DE
4.	*Anheuser-Busch Inbev*	Food, Beverages & Tobacco	BE
5.	*ASML HLDG*	Technology	NL
6.	AXA	Insurance	FR
7.	*Bayer*	Health Care	DE
8.	*BASF*	Chemicals	DE
9.	*BMW*	Automobiles & Parts	DE
10.	BNP Paribas	Banks	FR
11.	*Carrefour*	Personal care, drug & grocery stores	FR
12.	*CNH Industrial NV*	Industrial Goods & Services	IT
13.	*Danone*	Food, Beverages & Tobacco	FR
14.	Deutsche Boerse	Financial services	DE
15.	Deutsche Post	Industrial Goods & Services	DE
16.	Deutsche Telekom	Telecommunications	DE
17.	*ENI*	Energy	IT
18.	*Hermes International*	Consumer Products & Services	FR
19.	*Iberdrola*	Utilities	ES
20.	*Industria de Diseno Textil SA*	Retail	ES
21.	*Infineon Technologies*	Technology	DE
22.	ING GRP	Banks	NL
23.	Intesa Sanpaolo	Banks	IT
24.	*Kering*	Consumer Products & Services	FR
25.	Kone	Industrial Goods & Services	FI
26.	*Linde*	Chemicals	DE
27.	*L'Oréal*	Consumer Products & Services	FR
28.	*LVMH Moet Hennessy*	Consumer Products & Services	FR
29.	Mercedes-Benz Group	Automobiles & Parts	DE
30.	*Merck*	Health Care	DE
31.	*Michelin*	Automobiles & Parts	FR
32.	Muenchener Rueck	Insurance	DE
33.	*Philips*	Health Care	NL
34.	*Ryanair*	Travel & leisure	IE
35.	*Sanofi*	Health Care	FR

Table 1 (cont.). The list of components of "EURO STOXX 50 ESG" index

36.	*SAP*	Technology	DE
37.	Schneider Electric	Industrial Goods & Services	FR
38.	*Siemens*	Industrial Goods & Services	DE
39.	*Totalenergies*	Energy	FR
40.	*Vinci*	Construction and materials	FR

Source: Components of EURO STOXX 50® ESG, 2022.

Based on the research conducted by Prabha et al. (2014), Bessler et al. (2019), and Rose et al. (2021), the following variables are chosen as the independent ones: (i) debt to equity ratio (D/E) (as a measure of the solvency of a company); (ii) return on assets (ROA) (as a measure of the profitability of a company); (iii) quick ratio (QR) (as a measure of the liquidity of a company); (iv) total assets (TA) (as a measure of a company's size); (v) capital expenditure to sales (CAPEX) (as a measure of company's growth potential); and (vi) derivatives (DER) (dummy variable, when 0 means that the company is not using any type derivatives to manage risk, and 1 means that the company is using any type derivatives). Variables, their abbreviations, and measurement units are provided in Table 2.

Table 2. Description of Selected Variables

Abbreviation	Variable	Description	Measurement unit
FV	„Tobin's Q"	Capitalization/Assets	%
D/E	Debt to equity ratio	Liabilities/Ownership	%
ROA	Return on assets	Net Profit/Assets	%
QR	Quick ratio	Cash/Current liabilities	%
TA	Firm size	Total assets	units
CAPEX	Capital expenditure	Capital expenditure on sales	units
DER	Derivatives		Dummy variable
β_0	Constant		
μ	Residuals		

Source: prepared by the authors based on the research.

Data. The data is retrieved from Refinitiv Eikon. Subject to data availability, the sample covers the period from the year 2005 to 2020 (yearly data).

Model. After analyzing the descriptive statistics of the variables selected, checking the data for normal distribution (Jarque-Bera test; data logarithmated if necessary) and stationarity (Levin-Lin-Chu test; data differentiated if necessary), and assessing the correlation between variables, the research hypothesis is tested using panel data models (multiple regression models with constant, fixed, and random effects). Statistical characteristics of these models allow for confirming or rejecting the hypothesis (t statistics, p-value) as well as choosing the most appropriate model (F-test, Hausman test). The regression technique was also used by other authors analyzing the impact of derivatives (for example, Prabha et al. (2014), Alareeni and Hamdan (2020), Consigli et al. (2020), Firmansyah and Purnama (2020), Scholer-Iordanashvili (2020, Vitali and Moriggia (2021)). The research model thus can be described using the following equation (Equation 1):

$$FV_{i,t} = \beta_0 + \beta_1 D/E_{i,t} + \beta_2 ROA_{i,t} + \beta_3 QR_{i,t} + \beta_4 TA_{i,t} + \beta_5 CAPEX_{i,t} + \beta_6 DER_{i,t} + \mu_{i,t} \quad (1),$$

where i stands for a company (i =1 to 28), t – for a period (t = 1 to 15), β – for coefficients, and μt – for residual.

It is important to mention, that the choice of panel data models is also based on the fact that, in the situation of relatively short data series, these modes allow for obtaining more accurate research results by using more data than studying only cross-sectional or time-series models (Karpuškienė and Lastauskas, 2012) (including cross-sectional data from 28 companies in 15 years they give 420 observations). This improves the analysis in that it is possible to study variation both within a group and between groups (Karpuškienė and Lastauskas, 2012).

Further, the main results of the research are presented.

3. Results and discussion

In this section, the impact of the application of derivatives on the value of a company is evaluated and the results are discussed.

In Table 3 the descriptive statistics of research variables is provided. In Table 3 indicators of the normal distribution are also provided. Following Alareeni and Hamdan (2020), the Jarque-Bera test p-value shows

that, with a confidence level of 95%, the data is not normally distributed. Thus, the data of all variables except the dummy variable are logarithmated.

Table 3. Descriptive Statistics and Normality Tests of Selected Variables

Variable	Descriptive statistics				Normality tests		
	Max	Min	Mean	Standard deviation	Skewness	Kurtosis	Jarque-Bera
Dependent variable:							
TQ	27,462	0,140	1,480	1,917	6,747	80,128	0,000
Independent variables:							
D/E	12,610	0,000	0,758	0,836	6,872	91,883	0,000
ROA	0,955	-0,420	0,064	0,082	3,663	44,281	0,000
QR	9,354	0,000	0,527	0,663	6,642	77,189	0,000
TA	302438	1898	62554	61905	1,575	5,127	0,000
CAPEX	29748	71	2566	3906	3,792	20,035	0,000
DER	Dummy variable						

Source: prepared by the authors based on the research.

Table 4. "Levin-Lin-Chu" Test of Data Stationarity

Variable	Level		1 difference		2 difference	
	Statistic	Probability	Statistic	Probability	Statistic	Probability
TQ	-5,435	0,000	-	-	-	-
D/E	1,335	0,909	-1,262	0,103	-11,901	0,000
ROA	-7,791	0,000	-	-	-	-
QR	-1172,080	0,000	-	-	-	-
TA	2,765	0,997	-5,368	0,000	-	-
CAPEX	-1,331	0,092	-4,913	0,000	-	-
DER	Dummy variable					

Source: prepared by the authors based on the research.

Following Osinowo et al. (2021) and using the test of Levin-Lin-Chu, the assessment of data stationarity is conducted, and results are provided in Table 4. The results revealed that: (i) only three variables (Tobin's Q (FV), return on assets (ROA), and quick ratio (QR)) are stationary; (ii) two variables (total assets (TA), and capital expenditure to sales (CAPEX)) are stationary at the first difference, and one (debt to equity ratio (D/E)) is stationary at the second difference. The dummy variable (DER) is not differentiated.

Table 5. Selected Variables Correlation Matrix

	TQ	D/E	ROA	QR	TA	CAPEX
TQ						
Correlation	**1,000**					
t-statistic	-					
Probability	-					
D/E						
Correlation	-0,4177	**1,000**				
t-statistic	-4,5977	-				
Probability	0,0000	-				
ROA						
Correlation	0,7366	-0,4022	**1,000**			
t-statistic	10,8897	-4,3925	-			
Probability	0,0000	0,0000	-			
QR						
Correlation	0,3790	-0,1174	0,3413	**1,000**		
t-statistic	4,0956	-1,1818	3,6309	-		
Probability	0,0001	0,2401	0,0004	-		
TA						
Correlation	-0,4064	0,4405	-0,3740	-0,0748	**1,000**	
t-statistic	-4,4481	4,9061	-4,0328	-0,7498	-	
Probability	0,0000	0,0000	0,0001	0,4551	-	
CAPEX						
Correlation	-0,1976	0,0619	-0,1149	-0,3227	0,3621	**1,000**
t-statistic	-2,0167	0,6203	-1,1572	-3,4098	3,8840	-
Probability	0,0464	0,5365	0,2500	0,0009	0,0002	-

Source: prepared by the authors based on the research.

Further, the correlation between variables is assessed (Table 5). The results show that: (i) in most cases (9 out of 15) the relationship is negative; (ii) the strongest negative correlation appeared to be between the company's value (FV) and debt-to-equity ratio (D/E); (iii) the strongest positive correlation appeared to be between company's value (FV) and return on assets (ROA). To sum up, the strongest correlation is observed between the dependent variable and independent variables.

Further, according to Equation 1 and using the method of least squares the panel multiple regression models are created. The results of the primary model are provided in Table 6. Seeking to ensure data stationarity and normal distribution, certain values of variables are eliminated; causing the number of observations to decrease to 220. The R-squared of the primary model shows that almost 69% of the variation in the dependent variable is explained by the independent variables. With a confidence level of 95%: (i) three variables (return on assets (ROA), quick ratio (QR), and the application of derivatives (DER)) appeared to have a statistically significant positive effect on the company's value; while (ii) one variable (total assets (TA)) has demonstrated statistically significant negative impact on a company's value; and (iii) the rest of variables appeared to be statistically insignificant.

Table 6. Summary of Multiple Linear Regression Model Results

	Coefficient	Std. Errors	t-statistic	Probability	Significance
Constant	0,2308	0,2237	1,0316	0,3034	Insignificant
D/E	-0,0089	0,0594	-0,1502	0,8807	Insignificant
ROA	19,0936	1,0316	18,5085	0,0000	
QR	0,3025	0,1191	2,5388	0,0118	
TA	$-5{,}20*10^{-6}$	$1{,}92*10^{-6}$	-2,7098	0,0073	
CAPEX	$5{,}35*10^{-6}$	$3{,}33*10^{-5}$	0,1606	0,8726	Insignificant
DER	0,6211	0,1829	3,3967	0,0008	
R-squared	0,6852				
F-statistic	77,2706				
Cross-sections included	28				
Periods included	14 (adjusted period 2007 – 2020)				
Total panel observations	220				

Source: prepared by the authors based on the research.

Further, the primary model is modified, and the possible existence of both fixed and random effects is checked. Following Nazir et al. (2021) and according to the results of the F test and Hausman test (Hausman test p-value=0.0058), it is identified that the fixed-effects model is the most appropriate in this case.

The results of the fixed-effects model are provided in Table 7. The R-squared of the fixed-effects model shows that about 77% of the variation in the dependent variable is explained by the independent variables. With a confidence level of 95%: (i) two variables (return on assets (ROA) and the application of derivatives (DER)) appeared to have a statistically significant positive effect on the company's value, while (ii) the rest of variables appeared to be statistically insignificant.

Table 7. Summary of Fixed Effects Model Results

	Coefficient	Std. Errors	t-statistic	Probability	Significance
Constant	0,4956	0,3198	1,5497	0,1229	Insignificant
D/E	0,0901	0,0642	1,4045	0,1618	Insignificant
ROA	17,0366	1,0639	16,0129	0,0000	
QR	0,0053	0,1370	0,0385	0,9694	Insignificant
TA	$-1{,}81*10^{-6}$	$4{,}11*10^{-6}$	-0,4410	0,6597	Insignificant
CAPEX	$2{,}94*10^{-5}$	$6{,}03*10^{-5}$	0,4872	0,6267	Insignificant
DER	0,5894	0,2042	2,8871	0,0043	
R-squared	0,7714				
F-statistic	19,0185				

Source: prepared by the authors based on the research.

These results require a more detailed discussion. Firstly, the return on asset as a measure of a company's profitability proved to have a significant positive effect on the company's value (a 1% increase in return

increases the value of the company by about 17%). The growth of the company's (net) profit indicates that the chosen strategy of the company is appropriate. A profitable company is possibly productive and efficient, which indicates the further growth of the company, and positive prospects, which promotes the growth of the company's value.

Secondly, the dummy variable – derivatives also proved to have a significant positive effect on the company's value (the application of derivatives in the company leads to an increase in its value by 0.6%). So, this allows stating that the application of derivatives can have a positive effect on the value of a company. So, the hypothesis stating that the use of derivatives increases the company's value, i.e. the application of derivatives has a significant impact on the value of the companies is confirmed by the results of this research.

These results are at least partially consistent with the results obtained by Prabha et al. (2014) who indicated that companies with higher profits (return on assets) may have higher enterprise value and the impact of derivatives on non-financial company's value is positive, but significant only during periods of the crisis and subsequent recession. In our research, this effect appeared to be statistically significant during the whole period analyzed. Our results also coincide with the conclusions made by Hartono et al. (2020), Sobti (2020), Wan and Fan (2021), and Wybieralski (2020), which confirm the influence of derivatives on the value of the company. Regardless of whether companies use derivatives for hedging or speculative purposes, their influence has been found to be significant.

Conclusions, limitations, and implications for future research

Based on the results of the study, a statistically significant positive effect of derivatives on the value of companies was proven (the research hypothesis was confirmed). Based on the results of the Hausman test, the fixed-effects model appeared to be the most appropriate.

From all independent variables, only two variables (return on assets and the application of derivatives) appeared to have a statistically significant positive effect on the company's value, while the rest of the variables appeared to be statistically insignificant.

One of the key study limitations is that the use of derivatives is a dummy variable. This limitation allows us to indicate the existence of the relationship, but the intensity of the effect cannot be measured. Another limitation is related to the fact that in this research the impact of different types of strategies of derivatives has not been studied. These might be the directions for future research.

Further research could examine the effects of derivatives for other listed companies, such as those listed in emerging markets or for specific industries in the Euro Area. Further, it would be interesting to examine the moderating role of some factors on the relationship between derivatives and firms' performance, not only the company's value.

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