ARGUMENTA OECONOMICA
No 1 (40) 2018
PL ISSN 1233-5835

**I. ARTICLES**

*Jacek Mizerka**, *Agnieszka Stróżyńska-Szajek**

# FACTORS INFLUENCING THE USE OF DERIVATIVES IN POLAND

Taking into account the ambiguous results of research concerning the impact of the use of derivatives on a firm's value, we propose a more complex approach that would better explain the role of derivatives. We investigate the factors influencing derivatives usage by 308 non-financial firms listed on the Warsaw Stock Exchange for the period of 2008-2011. We also test the hypothesis saying that there are differences in the factors influencing the use of derivatives by companies in developed economies and by companies operating in transition economies. To examine the direction of the influence of certain factors on derivatives usage and the significance of that influence, we use a logit model. To explore the impact of a specific group of factors, we construct 47 different logit models using a combination of variables reflecting firm's size, default risk, debt service costs, liquidity constraints, and growth options. Owing to specific time-series cross-sectional data, we used a method of building a model based on panel data. The results of our analysis indicate that such factors as company size, risk of default and debt usage have a significant positive effect on derivatives usage. According to our results there is no permanent, statistically significant relationship between derivative usage by Polish companies and liquidity ratios. In all models, considering an option to develop, this factor has a significant negative impact on derivative usage. In general, we have obtained results showing the similarity of the factors that affect the use of derivatives by companies operating in Polish and foreign markets.

**Keywords:** derivatives, risk management, hedging
**JEL Classifications:** G3, G32
**DOI:** 10.15611/aoe.2018.1.01

## 1. INTRODUCTION AND BACKGROUND

Nance, Smith and Smithson (1993) identified three main reasons for the use of derivatives by companies in order to increase their value. They are as follows: reducing expected taxes, reducing expected costs of financial distress or other agency costs. A positive impact of derivative usage on a firm's value, which could be proxied by Tobin's Q, can be treated as a testable hypothesis. There is a group of researchers who confirm the occurrence of the positive impact of derivatives used by companies on their

* Corporate Finance Department, Poznań University of Economics and Business.

value. Allayannis and Weston (2001) examined the use of foreign currency derivatives (FCDs) in a sample of 720 large U.S. nonfinancial firms between 1990 and 1995, and its potential impact on firm's value. They found a positive relationship between firm's value and the use of FCDs. Bartram, Brown and Conrad (2011) used a large sample of nonfinancial firms from 47 countries. Having examined the effect of derivatives use on firm risk and value, they found strong evidence that the use of financial derivatives reduces both total risk and systematic risk; thus, the effect of derivatives use on firm's value is positive. Nelson, Moffitt and Affleck-Graves (2005) used a sample of 1,308 publicly-traded US corporations from 1995 to 1998 and found that firms using derivatives generally have abnormal returns of about 4% per year. Kapitsinas (2008) used a sample consisting of 81 Greek non-financial companies listed on the Athens Stock Exchange with exposure to financial risks, and had their annual reports published according to the International Financial Reporting Standards (IFRS) for the years 2004-2006. It was found that the value of companies using derivatives is, on average, higher by 4.6% than the value of companies that do not use these instruments.

However, the effect of empirical studies is twofold. In contrast to the positive valuation effects discussed above, other studies report either no valuation effects or only conditional positive or negative valuation effects associated with derivative usage. According to Guay and Kothari (2003), who created a sample consisting of 234 large non-financial corporations using derivatives, the possible gains from derivative usage by non-financial firms are minimal compared to changes in equity prices and cash flows. Also Khediri (2010), who used a sample of 250 non-financial firms from the French market over the period 2000-2002, takes the view that the decision to use derivatives has no effect on firm's valuation. However, the extent of derivatives use is associated with a lower firm value, thus Khediri believes that French investors do not assign a premium value to derivatives use. Jin and Jorion (2006), who studied the hedging activities of 119 U.S. oil and gas producers from 1998 to 2001 and evaluated their effect on firm's value, found no relationship between the use of derivatives and firm's value. An important role was played by the research conducted by Fauver and Naranjo (2011), who used data on over 1,746 firms headquartered in the U.S. from 1991 through 2000 and found that firms with greater agency and monitoring problems (i.e. firms that are less transparent, face greater agency costs, have weaker corporate governance, larger information asymmetry problems, and overall poorer monitoring) exhibit a negative association between Tobin's Q and derivative usage.

The ambiguous findings about the impact of the use of derivatives on a firm's value may lead to changes in the approach to research. The results obtained by Bartram, Brown, Fehle (2009) suggest that research should examine more complex models of firm's risk that can better explain the role of derivatives. In their study, the authors examined the use of derivatives by 7,319 firms in 50 countries that together comprise about 80% of the global market capitalization of non-financial companies. Their analysis showed that derivatives use is significantly related to other important characteristics such as company size, leverage, debt maturity, holdings of liquid assets, dividend policy, and operational hedges. This finding suggests the need for further theoretical and empirical analysis that would incorporate the use of derivatives into broader models of financial management. A similar approach was also applied by Takao and Lantara (2009), who investigated the patterns of derivatives use by Japanese insurance companies, and examined firms' factors determining their decision to use derivatives. Afza and Alam (2011) attempted to investigate factors influencing derivatives usage by 105 non-financial firms listed on the Karachi Stock Exchange for the period of 2004-2008.

Through our research we try to find an answer to the question whether the same factors as those in developed economies (USA, Japan, Western Europe) affect the use of derivatives by listed companies in a country whose economy is classified as an emerging one in the region of Central and Eastern Europe. The results of a similar survey of Pakistan (Afza and Alam, 2011) did not show significant differences in factors affecting the derivatives usage. However, the research carried out by Sprcic (2007) revealed that the explored hedging rationales have little predictive power in explaining financial risk management decisions in both Croatian and Slovenian companies. The author found that the decision to use derivatives in Croatian non-financial companies is related only to the investment expenditures-to-assets ratio, which controls for the costly external financing hypothesis, while the decision to use derivatives in Slovenian companies depends only on the size of the company. Sprcic suggests that a similar conclusion regarding risk management in the Slovenian and Croatian companies could be reached for countries like Poland, the Czech Republic, Slovakia, Hungary, Rumania, Bulgaria and Serbia.

Anticipating that the situation in Polish companies in terms of the factors influencing the use of derivatives is more like the situation in companies operating in developed countries, we try to define factors influencing the use of derivatives by non-financial Polish companies listed on the Warsaw Stock Exchange (WSE) in the period 2008-2011. In our paper we test the following general hypotheses concerning the usage of derivatives:

H1. The use of derivatives depends on the size of a company (measured by sales revenues and total assets); the larger the company, the more likely it is to use derivatives.

H2. The use of derivatives is related to the probability of financial distress. The higher the probability of financial distress, the more likely the usage of derivatives.

H3. Companies using derivatives have greater agency problems; according to Fauver and Naranjo (2010), we treat asset turnover ratio as an agency problem proxy, and P/BV as a measure of an underinvestment problem. We ask whether companies that use derivatives are characterized by a lower asset turnover ratio and higher P/BV in comparison with companies which do not use derivatives.

## 2. DATA

We have obtained data from financial reports of companies listed on the WSE. The financial reports are available on-line from the websites of WSE-listed companies. The samples from the period 2008-2011 consist of 308 different companies, which have been listed on the Warsaw Stock Exchange for at least one full year within the period analyzed. The sample contains 1,028 individual observations. We exclude firms in the financial sector and foreign firms owing to differences in financial disclosure rules. Other exclusions from the sample are firms whose reporting period is different from 1 January to 31 December. The quantitative and qualitative data necessary for the study was collected from the consolidated annual financial reports of companies in the research sample, and the individual annual financial reports of companies which are not subject to consolidated reporting. In addition, management reports have been used for identifying the principles of risk management of the surveyed companies. A content analysis of financial statements aims to identify primarily the surveyed companies' membership of the group of companies that use or do not use derivative instruments (during each year of the analysis) and to obtain their financial characteristics, which are explanatory variables later in the study. Belonging to one of the two groups of companies allows us to assign a dichotomous dependent variable to each of the companies (0 if the company did not use derivative instruments during the year; 1 – if the company declared the usage of derivatives). Binary variables take a positive value if the company used derivatives during the reporting year from 1 January to 31 December, at the same time declaring the use of these instruments for risk management purposes. Polish listed companies mostly use currency derivatives and less frequently

interest rate derivatives, so we do not make additional sub-groups of our research sample. Owing to time-series cross-sectional data, we used a method of model building based on panel data.

## 3. METHOD OF RESEARCH

To examine the direction of the influence of certain factors on derivatives usage and the significance of that influence, we used a logit model. A binary dependent variable takes the value of one for firms which use derivatives, otherwise that dichotomous variable takes the value of zero.

In order to conduct an analysis of identifiable factors significantly affecting the incentive of companies to use derivatives, we constructed a logit model describing this relationship. The decision to use logistic regression as a probability model is determined by the type of the dependent variable. The fact that companies use or do not use derivatives is a binary qualitative variable (a dependent variable indicating the usage of a derivative). This dichotomous dependent variable reflects the result of the choice between two opposing possibilities.

The logit model approximates probability, $P_i$ which is in the range (0,1). Logistic regression eliminates a major drawback of the linear probability model, i.e. the failure to ensure the theoretical estimates of the probabilities in the interval [0,1], by use of the logarithm of the likelihood odds ratio (logit). The figure of logit in this model is described as follows:

$$L^{-1}\left(P_i\right) = \ln\frac{P_i}{1-P_i} = \mathbf{x}_i^T\boldsymbol{\beta},$$

where $\boldsymbol{\beta}$ is a vector of parameters of the obtained model.

In our study we used logistic regression including the use of derivatives as a dependent variable. The first step was to identify the main components which may have a significant impact on the use of derivatives. This set was determined on the basis of risk management theory and previous research. To be able to test the hypotheses, we find that the use of derivatives may be related to: the size of the company, default risk, debt service costs, liquidity constraints and opportunities of growth. In this way we can formulate the first theoretical model describing the problem:

$$\begin{aligned} DerivativeUsage_i = \alpha + \beta_1\left(FIRM\ SIZE\right)_i + \beta_2\left(RISK\ DEFAULT\right)_i + \\ +\beta_3\left(DEBT\ SERVICE\ COSTS\right)_i + \beta_4\left(LIQUIDITY\ CONSTRAINTS\right)_i + \\ +\beta_5\left(GROWTH\ OPTIONS\right)_i + \varepsilon_i. \end{aligned}$$

Then within each of these groups we choose financial characteristics representing the group. These characteristics in a later part of the study are explanatory variables. The logistic regression that we estimated for the period 2008-2011 is presented below. Using this equation and the logistic regression procedure, we try to answer the question about the influence of individual, various factors known from theory and other studies. Based on the previous literature and studies, we estimate logit models in two versions because of strong correlations between variables describing the company's size.

$$\begin{aligned} DerivativeUsage_i = \alpha &+ \beta_1 \left( \ln \left( Total\ assets_{average} \right) \right)_i + \\ &+ \beta_2 \left( Equipment\ in\ net\ working\ capital \right)_i + \\ &+ \beta_3 \left( ROA \right)_i + \beta_4 \left( Asset\ turnover\ ratio \right)_i + \beta_5 \left( Debt\ ratio \right)_i + \\ &+ \beta_6 \left( Interest\ coverage\ ratio \right)_i + \\ &+ \beta_7 \left( Current\ ratio \right)_i + \beta_8 \left( Ln \left( Cash\ flow \right) \right)_i + \beta_9 \left( ROS \right)_i + \beta_{10} \left( \frac{P}{BV} \right)_i + \varepsilon_i \end{aligned}$$

$$\begin{aligned} DerivativeUsage_i = \alpha &+ \beta_1 \left( \ln \left( Sales \right) \right)_i + \\ &+ \beta_2 \left( Equipment\ in\ net\ working\ capital \right)_i + \beta_3 \left( ROA \right)_i + \\ &+ \beta_4 \left( Asset\ turnover\ ratio \right)_i + \beta_5 \left( Debt\ ratio \right)_i + \beta_6 \left( Interest\ coverage\ ratio \right)_i + \\ &+ \beta_7 \left( Current\ ratio \right)_i + \beta_8 \left( \ln \left( Cash\ flow \right) \right)_i + \beta_9 \left( ROS \right)_i + \beta_{10} \left( \frac{P}{BV} \right)_i + \varepsilon_i \end{aligned}$$

The explanatory variables are the companies' financial characteristics presented and described by the formulas in Table 1. The fourth column summarizes predictions of relationships between variables and the usage of derivatives ("+" means a positive relationship and "–" means the opposite relationship). These predictions are derived from previous research or finance theory.

It is important that we use a sequential approach to the construction of the model. The explanatory variables are grouped to test sub-hypotheses, so that it becomes possible to build models with different combinations of dependent variables and conclude. By including groups of variables in the model (no single explanatory variables), we get the answer to the question about the influence of factors on the use of derivatives. The inclusion of each group of variables is sequential. In this way we can see how particular groups affect the use of derivatives independently and in relations with other

Table 1

Definitions of variables and predictions

| Group | Variable | | Predictions | Definitions |
|---|---|---|---|---|
| **Firm size** | Sales | *LN_SAL* | + | *Sales Revenues*: Variable means logarithm value of sales in each year during the period 2008-2011. |
| | Total assets | *LN_TA* | + | $Total\ Assets_{average}$: Mean of logarithm value of assets from the year opening and year-end closing balance. |
| **Default risk** | Equipment in working capital | *EWC* | – | $\frac{Working\ capital_{average}}{Total\ Assets_{average}}$ |
| | ROA | *ROA* | – | $\frac{EBIT}{Total\ Assets_{average}}$ |
| | Assets turnover ratio | *A_TURN* | – | $\frac{Sales\ Revenues}{Total\ Assets_{average}}$ |
| **Debt service costs** | Debt ratio | *DEBrat* | + | $\frac{Liabilities_{average}}{Total\ Assets_{average}}$ |
| | Interest cover ratio | *ICratio* | – | $\frac{Gross\ profit + Interest}{Interest}$ |
| **Liquidity constraints** | Cash flow | *LN_CF* | – | Logarithm of *Operating Cash Flow* |
| | ROS | ROS | – | $\frac{EBIT}{Revenues}$ |
| | Current ratio | LIQ | + | $\frac{Current\ assets}{Current\ liabilities}$ |
| **Growth options** | P/BV | P_BV | + | $\frac{Price_{average}}{Book\ value_{average}}$ is average price of common stock in each year divided by average book value of equity. |

Source: own elaboration based on previous studies described in the literature and on available data.

groups that could have a significant impact on the use of derivatives. Therefore, we constructed 47 different logit models using all combinations of variables related to each hypothesis by examining the impact of specific groups of factors.

The main objective of the research determines the propensity interpretation of the model. A dependent variable represents the observed tendency of the individual to make certain decisions with the assigned value $y=1$. In the case of our study, this inclination concerns the tendency of Polish non-financial companies to take an informed decision to use derivatives to hedge.

## 4. RESULTS

Tables 2, 3 and 4 present the results of the logistic regression for Polish non-financial companies in the period 2008-2011. The binary dependent variable takes the value of one when a firm used derivatives, otherwise this

Table 2

Results of logit models where firm size is described by the value of assets

| | I. | | II. | | III. | | IV. | | V. | | VI. | | VII. | | VIII. | | Sign of coefficient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | |
| const | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | + |
| LN_TA | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | 0.00001 | *** | <0.00001 | *** | <0.00001 | *** | 0.00005 | *** | <0.00001 | *** | + |
| EWC | | | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | | | | | | | + |
| ROA | | | 0.37635 | | 0.52174 | | 0.20852 | | 0.27911 | | | | | | | | |
| A_TURN | | | 0.01034 | ** | 0.71984 | | 0.1702 | | 0.25059 | | | | | | | | |
| DEBrat | | | | | 0.00289 | *** | 0.00447 | *** | 0.00004 | *** | 0.71483 | | 0.03668 | ** | 0.00459 | *** | + |
| ICratio | | | | | 0.56381 | | 0.13522 | | 0.19393 | | 0.64106 | | 0.39428 | | 0.49955 | | |
| LIQ | | | | | | | 0.10005 | | 0.33063 | | | | 0.01661 | ** | 0.03885 | ** | |
| LN_CF | | | | | | | 0.60789 | | 0.62491 | | | | 0.60872 | | 0.68127 | | |
| ROS | | | | | | | 0.79025 | | 0.41714 | | | | 0.50011 | | 0.53421 | | |
| P_BV | | | | | | | | | 0.0211 | ** | | | | | 0.02182 | ** | - |

| | IX. | | X. | | XI. | | XII. | | XIII. | | XIV. | | XV. | | XVI. | | Sign of coefficient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | |
| const | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | + |
| LN_TA | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | + |
| EWC | | | | | | | <0.00001 | *** | 0.0001 | *** | | | <0.00001 | *** | 0.00006 | *** | + |
| ROA | | | | | | | 0.4135 | | 0.24376 | | | | 0.25295 | | 0.31251 | | |
| A_TURN | | | | | | | 0.82422 | | 0.00561 | *** | | | 0.55295 | | 0.40662 | | |
| DEBrat | | | | | | | | | | | 0.08216 | * | 0.00012 | *** | | | + |
| ICratio | | | | | | | | | | | 0.59618 | | 0.64049 | | | | |
| LIQ | 0.25196 | | 0.28225 | | | | 0.02433 | ** | | | | | | | 0.04662 | ** | |
| LN_CF | 0.74494 | | 0.59705 | | | | 0.5642 | | | | | | | | 0.67649 | | |
| ROS | 0.79068 | | 0.94764 | | | | 0.9207 | | | | | | | | 0.62323 | | |
| P_BV | | | 0.07454 | * | 0.05269 | * | | | 0.01465 | ** | 0.03696 | ** | 0.00858 | *** | 0.06625 | * | - |

Source: self-research based on collected data.

Table 3

Results of logit models where firm size is described by the value of sales

| | I. | | II. | | III. | | IV. | | V. | | VI. | | VII. | | VIII. | | Sign of coefficient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | |
| const | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | + |
| LN_SAL | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | 0.00002 | *** | 0.00004 | *** | <0.00001 | *** | 0.00004 | *** | <0.00001 | *** | + |
| EWC | | | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | 0.00001 | *** | | | | | | | + |
| ROA | | | 0.94143 | | 0.92889 | | 0.63748 | | 0.39029 | | | | | | | | |
| A_TURN | | | 0.00325 | *** | 0.00009 | *** | 0.00506 | *** | 0.06994 | * | | | | | | | - |
| DEBrat | | | | | 0.00791 | *** | 0.00632 | *** | 0.00132 | *** | 0.20785 | | 0.20926 | | 0.01891 | ** | + |
| ICratio | | | | | 0.39091 | | 0.13241 | | 0.15802 | | 0.43244 | | 0.22463 | | 0.2854 | | |
| LIQ | | | | | | | 0.20698 | | 0.4219 | | | | 0.01802 | ** | 0.03705 | ** | |
| LN_CF | | | | | | | 0.39096 | | 0.4211 | | | | 0.40257 | | 0.28211 | | |
| ROS | | | | | | | 0.70021 | | 0.25208 | | | | 0.14194 | | 0.26648 | | |
| P_BV | | | | | | | | | 0.00951 | *** | | | | | 0.00267 | *** | - |

| | IX. | | X. | | XI. | | XII. | | XIII. | | XIV. | | XV. | | XVI. | | Sign of coefficient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | |
| const | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | + |
| LN_SAL | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | + |
| EWC | | | | | | | 0.00002 | *** | 0.00008 | *** | | | <0.00001 | *** | 0.0002 | *** | + |
| ROA | | | | | | | 0.88189 | | 0.78425 | | | | 0.53957 | | 0.83669 | | |
| A_TURN | | | | | | | 0.04426 | ** | 0.01153 | ** | | | 0.00063 | *** | 0.32866 | | - |
| DEBrat | | | | | | | | | | | 0.4903 | | 0.0005 | *** | | | + |
| ICratio | | | | | | | | | | | 0.57295 | | 0.38397 | | | | |
| LIQ | 0.14832 | | 0.17061 | | | | 0.08525 | * | | | | | | | 0.12216 | | |
| LN_CF | 0.40441 | | 0.37435 | | | | 0.42257 | | | | | | | | 0.66578 | | |
| ROS | 0.70983 | | 0.54451 | | | | 0.39715 | | | | | | | | 0.07084 | * | |
| P_BV | | | 0.00817 | *** | 0.00547 | *** | | | 0.01655 | ** | 0.00697 | *** | 0.01093 | ** | 0.0546 | * | - |

Source: self-research based on collected data.

Table 4

Results of logit models where firm size is not included

| | I. | | II. | | III. | | IV. | | V. | | VI. | | VII. | | VIII. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | |
| const | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | 0.06315 | * | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** |
| LN_SAL | | | | | | | | | | | | | | | | |
| EWC | 0.71899 | | | | | | | | <0.00001 | ***(+) | <0.00001 | *** | 0.00039 | *** | | |
| ROA | <0.00001 | ***(+) | | | | | | | 0.9731 | | 0.40155 | | 0.00022 | *** | | |
| A_TURN | 0.10811 | | | | | | | | 0.21292 | | 0.14492 | | 0.61331 | | | |
| DEBrat | | | 0.06428 | * | | | | | <0.00001 | ***(+) | 0.00032 | *** | 0.00003 | *** | 0.01199 | ** |
| ICratio | | | 0.46564 | | | | | | 0.15635 | | 0.12263 | | 0.85016 | | 0.23687 | |
| LIQ | | | | | 0.55849 | | | | 0.21815 | | 0.0633 | *(-) | | | 0.0359 | ** (+) |
| LN_CF | | | | | <0.00001 | ***(+) | | | <0.00001 | ***(+) | <0.00001 | *** | | | <0.00001 | *** |
| ROS | | | | | 0.82642 | | | | 0.88477 | | 0.85919 | | | | 0.53207 | |
| P_BV | | | | | | | 0.00986 | ***(-) | 0.0044 | ***(-) | | | | | | |

| | IX. | | X. | | XI. | | XII. | | XIII. | | XIV. | | XV. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | | ***p-value*** | |
| const | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | <0.00001 | *** | 0.0896 | * |
| LN_SAL | | | | | | | | | | | | | | |
| EWC | | | | | <0.00001 | *** | 0.0251 | ** | 0.00007 | *** | | | 0.01846 | ** |
| ROA | | | | | 0.30921 | | 0.0001 | *** | 0.56216 | | | | <0.00001 | *** |
| A_TURN | | | | | 0.69608 | | 0.38544 | | 0.33751 | | | | 0.10187 | |
| DEBrat | 0.00038 | *** | <0.00001 | *** | | | <0.00001 | *** | | | | | | |
| ICratio | 0.3193 | | 0.41308 | | | | 0.88191 | | | | | | | |
| LIQ | 0.01251 | ** | | | 0.00898 | *** (-) | | | 0.01602 | ** | 0.6425 | | | |
| LN_CF | <0.00001 | *** | | | <0.00001 | ***(+) | | | <0.00001 | *** | <0.00001 | *** | | |
| ROS | 0.12594 | | | | 0.59486 | | | | 0.26019 | | 0.33796 | | | |
| P_BV | 0.00235 | *** | 0.00534 | *** | | | 0.00043 | *** | 0.0497 | ** | 0.02941 | ** | 0.00066 | *** |

Source: self-research based on collected data.

dichotomous variable takes zero. The first columns of these tables present all the independent variables examined (we have selected the natural log of total assets and sales revenues as variables indicating the size of the company).

Tables 2, 3 and 4 present the significance of individual explanatory variables in the logit models (constructed sequentially). The last column presents the empirical relationship between the direction of the significant explanatory variable and the use of derivatives in Poland. Table 2 presents the results of the logit models (statistically significant variables) where the size of the company is represented by the logarithm of assets (16 models). Table 3 shows the significance of variables where the size of the company is represented by the logarithm of sales (16 models). Finally, Table 4 presents the results of our logit analysis in cases where a group of variables describing the size of the company is not taken into account (15 models). In addition, we should explain that *** means significance at 1%, ** means significance at 5%, and * means significance at 10%.

## 5. DIRECT CONCLUSIONS

With the selection of variables for different groups of factors influencing the use of derivatives and estimation of logit models, it became possible to test the hypotheses. The results of an analysis using logit models indicate that there is a positive effect of company size on usage of derivatives. The impact of this factor is significant if the size of the company is described by total assets $\ln(Total\ Assets)$, as well as by sales revenues $\ln(Sales)$. This direct conclusion allows us to support the first hypothesis H1: the larger the company listed on the Warsaw Stock Exchange, the more likely the use of derivatives. In this regard, the researchers' expectations are two-fold. The first view on the impact of the company size is based on the assertion that the expected costs of financial distress are relatively high for smaller companies (Warner, 1977). Smaller companies, fearing the burden of these costs relative to the value of assets or income, are more likely to hedge using derivatives. The opposite relationship between the size of the company and the tendency to use derivatives, according to the theory of the cost of bankruptcy, is also supported by Ang et al. (1982). Using the results of their study, it is shown that smaller companies experience stronger incentives to increase the intensity of the use of derivatives (Nguyen and Faff, 2003). However, there are a lot of studies showing the opposing approach on the impact of company's size. According to the opinion of other researchers (e.g. Smith and Stulz 1985), the risk management process is characterized by

information and transaction economies of scale. Owing to economies of scale for transaction costs, large companies achieve greater benefits from the use of derivatives because they are in a better position in terms of both transaction costs and the cost of implementing a risk management program. In addition, it is very important that larger firms are more likely to organize advanced sections with specialized personnel to conduct an effective risk management process. Enlarging the size of the company and carrying out more complex operations also reflects a greater asymmetry of information between interested groups (Jensen and Meckling 1976). Nance et al. (1993) state that hedging with derivatives may be an effective mechanism to mitigate agency conflicts of larger companies. The vast majority of researchers point to the positive empirical relationship between the tendency to use derivatives and the size of the enterprise, regardless of whether the explanatory variable includes the turnover value, assets value or market value of companies (including Allayannis and Ofek 2001, Alkebäck et al. 2003, Kapitsians 2008, Berkman et al. 2009, Reynolds et al. 2009, Schiozer and Saito 2009, Takao and Lantara 2009).

In all the estimated models, considering the group of factors indicating the risk of default (regardless of the variable describing the size of the company), equipment in working capital has a significant positive impact on the analyzed issue in Poland. Empirical indications consistent with the theory give grounds for the conclusion that the risk of a financial distress situation (e.g. the emergence of the threat of bankruptcy) acts in a motivating way for the company if it comes to the use of innovative hedging tools.

Also, the return on assets demonstrates a positive impact. However, this variable has a significant impact only for models without the size of the company. These indications are inconsistent with relations resulting from the previous literature.

Variables reflecting debt show a positive influence on the usage of derivatives. This relationship is consistent with previous studies. A significant impact on the usage of these instruments is exerted by debt ratio. This conclusion allows us to support the hypothesis concerning a positive relationship between financial distress and the usage of derivatives. The probability of financial distress rises with the increased share of debt in financing and with the decreased coverage of fixed liabilities. Therefore, an increase in these financial indicators makes hedging with derivatives favorable and affecting company value to a greater extent. Froot et al. (1993) believe that the use of derivatives may reduce the likelihood of financial distress for a given level of debt. Berkman and Bradbury (1996), Nguyen

and Faff (2003), and Winata and Heaney (2005), confirmed the significant positive relationship between the share of debt in financing and the decision about the usage of derivatives. The positive relationship between the decision to use derivatives and the company's debt is also supported by Haushalter (2000) and Bartram et al. (2009). However, we have to remember that the majority of Polish companies use derivatives to manage exchange-rate risk rather than interest-rate risk.

Our models show that there is no permanent, statistically significant relationship between derivative usage by Polish companies and the current ratio. Only in some cases does the current ratio demonstrate a significant impact, but the direction of the relationship is inconsistent with the literature. The same applies to the second variable describing liquidity, namely logarithm of cash flows. Some of the earlier surveys (including New Zealand and Australian companies) show that firms characterized by higher liquidity are less likely to engage in risk management and hedge their positions using derivatives. These companies have a belief about a larger financial buffer and the ability to bear potential losses, therefore they consciously expose themselves to the risk knowing that there is an opportunity to achieve an additional profit. Our study suggests that there is a positive relationship between derivatives usage and the logarithm of cash flows in companies listed on the Warsaw Stock Exchange in Poland. This direct conclusion is inconsistent with previous literature. However, this variable has a significant impact only for models without company size.

In all the estimated models, considering the group of factors indicating a growth option, the ratio between the price of a company's stock and its book value per share has a significant negative impact on derivatives usage by non-financial firms listed on the Warsaw Stock Exchange in Poland. This direct conclusion does not allow us to corroborate the hypothesis H3 about the positive relationship between agency problem and derivatives usage. According to the theory of avoiding the underinvestment problem, not only the high level of company debt, the high probability of default and problems with covering interest, but also the company's growth opportunities are prerequisite to the use of derivatives for hedging purposes. The results of empirical studies have confirmed that companies characterized by greater growth opportunities and greater financial constraints are more likely to hedge (Froot et al. 1983). These conclusions were also supported by further empirical studies (Berkman and Bradbury 1996), but they are not supported by our research. Bartram et al. (2009) show the opposite: that the tendency to

use derivatives correlates positively with the return on assets and negatively with the market-to-book ratio, which conflicts with the problem of underinvestment.

## GENERAL CONCLUSION

According to the report of the Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity in 2007 and 2010, the year 2000 marked the beginning of the significant expansion of the global derivatives market. The financial crisis did not interfere with the derivatives market development.

Noting that this expansion is the basis for the present study, designed not only to describe how firms use derivatives but also to show the factors contributing to the company's decision to use derivatives, we attempted to ascertain the degree of derivatives use in the Polish stock market and identify those factors which influence the use of derivatives to manage risk.

The obtained results show that the significant factors which have a positive effect on the use of derivatives are: the size of a company, the use of debt, the equipment in working capital, the efficiency of using assets (only if company size is not considered). There is no reason, therefore, to reject the first two general hypotheses (H1, H2) concerning the positive relationship between derivatives usage and company size, and the positive relationship between derivatives usage and financial distress. These results are generally consistent with the results of other studies concerning developed economies. Our results do not support Sprcic's hypothesis that factors affecting the use of derivatives in developed countries do not play a significant role in risk management in countries of Central and Eastern Europe. The results of our study concerning symptoms of the agency relationship lead to the rejection of the hypothesis about the impact of agency costs on derivative usage (H3). However, it should be noted that our study dealt only with the prerequisites of the presence of the agency relationship. Therefore, it seems that the impact of the agency relationship will be an interesting topic of future research.

## REFERENCES

Afza, T., Alam, A., *Determinants of Corporate Hedging Policies: A Case of Foreign Exchange and Interest Rate Derivative Usage*, "African Journal of Business Management", Vol. 5(14), pp. 5792–5797, 2011.

Alkebäck, P., Hagelin, N., Pramborg, B., *Derivative Usage by Non-financial Firms in Sweden 1996 and 2003: What Was Changed?,* "Managerial Finance", Vol. 32, No 2, pp. 101–114, 2006.

Allayannis, G., Weston, J., *The Use of Foreign Currency Derivatives and Firm Market Value*, "Review of Financial Studies", Vol. 14, pp. 243–276, 2001.

Allayannis, G., Ofek, E., *Exchange Rate Exposure, Hedging and the Use of Foreign Currency Derivatives*, "Journal of International Money and Finance", Vol. 20, pp. 273–286, 2001.

Ang, J. S., Chua, J. H., McConnell, J. J., *The Administrative Costs of Corporate Bankruptcy: a Note*, Journal of Finance, Vol. 37, pp. 219–226, 1982.

Bartram, S, M., Brown, G, W., Conrad, J. S., *The Effects of Derivatives on Firm Risk and Value*, "Journal of Financial and Quantitative Analysis", Vol. 46, No. 4, pp. 967–999, 2011.

Bartram, S. M., Brown, G. W., Fehle, F. R., *International Evidence on Financial Derivatives Usage*, "Financial Management", pp. 185–206, 2009.

Berkman, H., Bradbury, M. E., *Empirical Evidence on the Corporate Use of Derivatives*, "Financial Management" Vol. 25, No 2, ABI/INFORM Global, pp. 5–13, 1996.

Fauver, L., Naranjo, A., *Derivative Usage and Firm Value: The Influence of Agency Costs and Monitoring Problems*, "Journal of Corporate Finance", Vol. 16, pp. 719–735, 2010.

Froot, K. A.; Scharfstein, D. S., Stein, J. C., *Risk Management: Coordinating Corporate Investment and Financing Policies*, "The Journal of Finance", Vol. 48, No 5., pp. 1629––1658, 1993.

Guay, W. R., Kothari, S. P., *How Much Do Firms Hedge with Derivatives*, "Journal of Financial Economics", Vol. 70, pp. 423–461, 2003.

Haushalter, D. G., *Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers*, "Journal of Finance", Vol. LV, No 1, pp. 107–152, 2000.

Heaney, R., Winata, H., *Use of Derivatives by Australian Companies*, "Pacific-Basin Finance Journal", Vol. 13, pp. 411–430, 2005.

Jensen, M., Meckling, W., *Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure*, "Journal of Financial Economics", Vol. 3, pp. 305–360, 1976.

Jin, Y., Jorion, P., *Firm Value and Hedging: Evidence from U.S. Oil and Gas Producers*, "The Journal of Finance", Vol. 61, No 2, pp. 893–919, 2006.

Kapitsinas, S., *The Impact of Derivatives Usage on Firm Value: Evidence from Greece*, MPRA Paper No. 10947, 2008.

Khediri, K. B., *Do Investors Really Value Derivatives Use? Empirical evidence from France.* The Journal of Risk Finance, Vol. 11, No. 1, pp. 62–74, 2010.

Nance, D. R., Smith, C. W. Jr, Smithson, C. W., *On the Determinant of Corporate Hedging,* "The Journal of Finance", Vol. 48, No. 1, pp. 269–270, 1993.

Nelson, J., Moffitt, J. S., Affleck-Graves, J., *The Impact of Hedging on the Market Value of Equity*, "Journal of Corporate Finance", Vol. 11, pp. 851–881, 2005.

Nguyen, H., Faff, R., *Further Evidence on the Corporate Use of Derivatives in Australia: The Case of Foreign Currency and Interest Rate Instruments*, "Australian Journal of Management", Vol. 28, No 3, 2003.

Reynolds, M. P., Bhabra, G. S., Boyle, G. W., *Cash Flow, Investment and Derivative Use: An Empirical Analysis of New Zealand Listed Companies*, "International Research Journal of Finance and Economics", Issue 32, pp. 72–82, 2009.

Schiozer, R. F., Saito, R., *The Determinants of Currency Risk Management in Latin American Nonfinancial Firms*, "Emerging Markets Finance and Trade", Vol. 45, Issue 1, pp. 49–71, 2009.

Smith, C. W., Stulz, R. M., *The Determinants of Firms' Hedging Policie*s, "Journal of Financial and Quantitative Analysis", Vol. 20, No 4, pp. 391–405, 1985.

Sprcic, M. D., *The Derivatives as Financial Risk Management Instruments: The Case of Croatian and Slovenian Non-Financial Companies*, "Financial Theory and Practice", Vol. 31, No 4, pp. 395–420, 2007.

Takao, A., Lantara, W. N., *The Determinants of the Use of Derivatives in Japanese Insurance Companies.* https://ssrn.com/abstract=1494834, 2009.

Warner, J. B., *Bankruptcy Costs: Some Evidence*, "Journal of Finance", Vol. 32, pp. 337–348, 1977.

*Received: July 2013, revised:November 2017*