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# Investment and Corporate Financial Constraints: The Case of European Union Listed Companies

## Summary

The purpose of this study is to identify the factors that influence the investment decisions of companies. Particular focus is put on the direction of the relationships studied, taking into account the division between companies that may face financial constraints and those that have no problem with access to capital.

The examined entities are non-financial companies listed on stock exchanges in 26 European Union countries between 2011 and 2019. Panel data models were used to empirically identify factors influencing investment decisions.

The results indicate that factors such as cash flow size, debt, share of fixed assets in total assets, growth opportunities, operational risk, or country economic growth have a positive impact on corporate investment, while company size has a negative impact. However, when the entire research sample is divided into financially constrained and unconstrained companies, the direction of the relationship reverses in financially constrained companies for cash flow and debt.

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The study contributes to the literature with strong evidence of a change in the relationship between cash flow and investment volume depending on the financial situation of companies in European countries. Similar studies have been conducted on a countrywide basis. The presented study covers a large block of countries that are of particular importance to the global economy.

**Keywords:** corporate investment, financial constraints, European Union, listed companies

# Inwestycje a ograniczenia finansowe przedsiębiorstw: przypadek spółek notowanych na giełdach w Unii Europejskiej

## Streszczenie

Decyzje inwestycyjne przedsiębiorstw stanowią jedno z kluczowych zagadnień w ramach zarządzania finansami podmiotów gospodarczych. Celem niniejszego badania jest identyfikacja czynników wpływających na decyzje inwestycyjne przedsiębiorstw, ze szczególnym uwzględnieniem kierunku badanych zależności, biorąc pod uwagę podział na przedsiębiorstwa, które mogą napotykać ograniczenia finansowe, oraz te, które nie mają problemów z dostępem do kapitału.

Badanymi podmiotami są przedsiębiorstwa niefinansowe notowane na giełdach papierów wartościowych w krajach Unii Europejskiej w latach 2011–2019. Do empirycznej identyfikacji czynników wpływających na decyzje inwestycyjne wykorzystano modele danych panelowych.

Wyniki wskazują, że czynniki takie jak wielkość przepływów pieniężnych, dług, udział aktywów trwałych w aktywach ogółem, możliwości wzrostu, ryzyko operacyjne czy wzrost gospodarczy kraju mają pozytywny wpływ na inwestycje przedsiębiorstw, podczas gdy wielkość przedsiębiorstwa ma wpływ negatywny. Jednakże, gdy całą próbę badawczą podzieli się na przedsiębiorstwa ograniczone finansowo i nieograniczone, kierunek związku odwraca się w przedsiębiorstwach ograniczonych finansowo dla przepływów pieniężnych i długu.

Badanie wnosi do literatury mocne dowody na zmianę związku między przepływami pieniężnymi a wielkością inwestycji w zależności od sytuacji finansowej przedsiębiorstw w krajach europejskich. Podobne badania były przeprowadzane na poziomie krajowym.

**Słowa kluczowe:** inwestycje przedsiębiorstw, ograniczenia finansowe, Unia Europejska, spółki giełdowe

## Introduction

The development of companies depends to a large extent on investment, i.e., activities aimed at increasing the company's fixed assets. Contemporary corporate finance theory shows that investment decisions are always one of the most crucial problems in the management of companies (Gupta, Mahakud 2019; Ross, Westerfield, Jordan 2008).

The question of the dependence of investment expenditure on other variables has been of interest to researchers for several decades. Among others, the dependence on the financial situation of the company (*Investment-Cash Flow Sensitivity*), the size of the company or its ownership structure have been pointed out (D'Espallier, Guargilia 2011; Fazzari, Hubbard, Petersen 1988; Wu, Hua, Lu 2022).

In 1958, Modigliani and Miller (1958) already assumed that companies' investment decisions regarding, among other things, the use of external financing are not dependent on their financial situation (Zhang, Yin 2018). Their theory was developed under the assumption of a perfectly competitive capital market in which there are no transaction costs, and all capital market participants can borrow at the same interest rate and there is no asymmetry of information. In this situation, the funds needed to finance profitable investment projects are always available and sufficient. Internal and external sources of investment financing are regarded as perfect substitutes.

Fazzari et al. (1988), in one of the most important works on this subject, using the dividend payout ratio as a measure of financial constraints, analyzed investments in terms of cash flows, investment opportunities and the return to share price ratio (Wu et al. 2022). It should also be noted that in this research, the authors for the first time investigated the sensitivities between cash flows and investments under constrained or unconstrained financial conditions. Their study shows that financially constrained firms are more sensitive to investment than firms with negligible financial constraints. Fazzari et al. (1988) also conclude in opposition to Modigliani and Miller (1958) that the cost of external capital differs significantly from the cost of internal capital as a result of, among other things,

market imperfections and information asymmetries. Kaplan and Zingales (1997), on the other hand, questioned the results obtained by Fazzari et al. (1988). The results of their study show that the less influence financial constraints have on firms' investment decisions, the more sensitive they are to the firm's cash flow (Kashefi-Pour, Amini, Uddin, Duxbury 2020). Hoshi, Kashyap and Scharfstein (1991) included the relationship with banks in their analysis to measure financial constraints and showed that firms that do not have a good relationship with banks are more likely to be characterized by financial constraints. Hubbard (1998) analyzed various factors, including investment reserves, R&D, employment, firm formation and existence, valuations and corporate risk management, to determine the relationship between cash flows and investment decisions using data from the United States (Ghosh, Dutta 2021).

On the basis of theoretical considerations and empirical research to date, it can therefore be concluded that both internal sources (corporate cash flow) and external sources (debt) are important sources of financing for corporate investment. Such relationships may, however, be different for financially constrained enterprises (i.e., those with difficulties in servicing debt on time or lacking funds for investment – a precise definition for the purposes of this study in the following section). It is worth bearing in mind what factors influence these relationships, especially in all EU countries, because this issue has not been studied to our knowledge, and this is the problem we want to address in this paper. The aim of the study is to identify the determinants of investments made by companies with a particular focus on the direction of the relationships studied, taking into account the distinction between companies that may face financial constraints and those that have no problem accessing capital. The entities studied are non-financial companies listed on stock exchanges in 26 European Union countries between 2011 and 2019. Panel data models were used to empirically identify factors influencing investment decisions.

The further part of the article is structured as follows: first, the current state of empirical research is presented. In the next section, the collected research material is characterized and the methods used to analyze it are described. Next, the results of the research are presented, while the last part contains a discussion of the results and conclusions.

## Literature review and research hypotheses

The work that is widely cited is the work of Fazzari et al. (1988), who suggested that cash flows are the main source of financing for firm investment, while pointing out the various determinants of this process. There are more studies on the relationship between investment and its determinants. Hubbard's results clearly confirm

that there is an important relationship between investment and net worth change (Kashefi-Pour et al. 2020). Benito and Young (2002) showed that investment is lower when financing is obtained from external sources than when it is financed from own resources. Guariglia (2008a), on the other hand, proved a U-shaped relationship between investment and cash flow. The sensitivity of investment to the level of cash flow was higher if external constraints were high and internal constraints were low, a finding that can be noticed particularly well among new, small enterprises, which usually have the greatest difficulty in obtaining funding for growth (Guariglia 2008b; Nurhikmawaty, Isnurhadi, Widiyanti, Yuliani 2020).

The results of a study by Jangili and Kumar (2010), in turn, indicated a significant positive relationship between a firm size and investment. The same authors also noted a significant negative relationship between dividend payout ratio and investment.

Bokpin and Onumah (2009) examined micro factors, including prior investment, a firm size, investment opportunities, cash flow and growth opportunities, which influence investment decisions. The results of their study show that all factors are important (Thuy, Nhan, MiaoJian 2021).

Ruiz-Porras and Lopez-Mateo (2011) and also Džidić and Živko (2019) examined the impact of a firm size, cash flow and investment opportunities, which all have positive implications for investment decisions. However, Saquido (2004) concluded that liquidity and a firm size are not significantly related to investment. Nevertheless, there is an important relationship between investment and revenue growth and fixed capital levels (Rahmadi 2020). Aivazian, Ge and Qiu (2005) show that the relationship between leverage and investment is negative and that the effect is significantly stronger for firms with lower opportunity growth than for those with high growth.

Almost all the factors analyzed above can be categorized as microeconomic (Iona, Benedetto, Assefa, Limosani 2020). However, the amount of investment expenditure is also influenced by macro factors. Studies have also been conducted on the relationship between investment and GDP. Gardzewicz, Growiec, Hagemejer and Popowski (2010) showed that the variability of investment expenditure is more than four times greater than the variability of the GDP growth rate. These research results were also confirmed by Haque, Abid, Qamar and Asif (2019).

The subject of Manole and Spatareanu's (2009) study was the relationship between exports and investment. They concluded that exporters have a lower sensitivity of investment to cash flow – this is due to easier access to external capital.

Other variables considered were, for example, the exchange rate – results were obtained indicating that the real effective exchange rate has a significantly negative effect on investment – i.e., appreciation reduces investment (Ramesh, Sharad 2011). In the same paper, the authors concluded that inflation has no impact on investment.

The willingness to resort to loan financing described as a pro-cyclical variable has been described, among others, in studies by Jiménez and Saurina (2006), Bikker and Hu (2002), Eickmeier, Hofmann and Worms (2009), Brambilla and Piluso (2007). In contrast, the pecking order theory by Myers and Majluf (1984) suggests that firms' demand for credit to finance investment should be counter-cyclical.

Part of the research has been carried out on an international scale. Hall, Mairess, Branstetter and Crepton (1998), using panel data to examine the determinants of investment in the US, French and Japanese companies between 1979 and 1989, concluded that there is a correlation between investment, returns, sales and cash flow and that these relationships differ across countries. A few years later, these studies were confirmed by Carpenter and Guariglia (2008). In particular, they estimated an investment regression that shows the situation of firms experiencing financial constraints. They observed that cash flows cannot explain the nature of the sensitivity of investment decisions for large companies. However, the interpretability remains the same for small companies. This suggests that the validity of the cash flow variable in the investment equation may be driven by information asymmetries in capital markets.

A relatively less frequently analyzed issue is the variation in investment decisions of financially constrained and financially unconstrained firms. This article is aimed at filling this gap and presenting results of research carried out on data from ORBIS database and World Bank database. A summary of the determinants of investment by enterprises taking into account their financial situation is provided in Table 1. The issue of financial constraint is not clearly defined in the literature. It is assumed, among other things, that a financially constrained company is the one that generates too few funds to finance investment activity on its own and, at the same time, does not meet the conditions for accessing external sources of financing in the form of loans or equity or bond issues (Bartoloni, Baussola 2014).

Some attempts to define this type of company are based on one or more variables. Such an approach has been used, among others, by Asquith, Gertner and Scharfstein (1994). They indicate that a company is financially constrained if it meets one of the following conditions:

1) its interest expense is greater than its EBITDA for two consecutive years;
2) its EBITDA is less than 80 per cent of its interest expense in any year.

These conditions are essentially a description of a company's ability to service its debt in a timely manner.

A similar definition was adopted by Hovakimian and Titman (2006). They investigated the importance of financial constraints on firms' investments by looking at the relationship between investment expenditure and proceeds from voluntary asset sales. They found that funds from voluntary asset sales are an important source of funding for financially constrained firms.

Chuliá, Gupta, Uribe and Wohar (2017) proposed that a financially constrained firm is considered when:

1) for two consecutive years, revenues are lower than expenses; and
2) the net worth/total debt ratio is less than 1; and
3) the firm experiences a negative change in net worth in two consecutive years.

Platt and Platt (2006) assumed that a company becomes financially inefficient if it simultaneously meets all of the following conditions:

– negative earnings before interest on borrowings, taxes and depreciation and amortization (EBITDA);
– a negative operating profit (EBIT);
– a negative net profit.

**Table 1.** Investment determinants – a literature review

| No. | Variable | Abbreviation | Impact on companies with financial constraints | Impact on companies without financial constraints |
|---|---|---|---|---|
| 1 | Cash Flow | CF | (+) Phan, Nguyen (2020) | (+) Phan, Nguyen (2020)<br>Aivazian et al. (2005)<br>Adelegan, Ariyo (2008)<br>Ruiz-Porras, Lopez-Mateo (2011) |
| 2 | Capital structure (total debt ratio) | DR | (–) Phan and Nguyen (2020) | (+) Azzoni, Kalatzis (2006)<br>Jangili, Kumar (2010)<br>Nair (2011)<br>(–) Phan and Nguyen (2020) |
| 3 | Assets structure (tangibility) | TANG | | (+) Erickson, Whited (2000)<br>Saquido (2004)<br>Bokpin, Onumah (2009)<br>Ruiz-Porras, Lopez-Mateo (2011) |
| 4 | Growth opportunities | GROW | (+) Phan and Nguyen (2020) | (+) Erickson, Whited (2000)<br>Saquido (2004)<br>Bokpin, Onumah (2009)<br>Ruiz-Porras, Lopez-Mateo (2011)<br>Phan, Nguyen (2020) |
| 5 | Size of the enterprise | SIZE | | (+) Adelegan, Ariyo (2008)<br>Jangili, Kumar (2010)<br>Ruiz-Porras, Lopez-Mateo (2011) |
| 6 | Business risk | Bus_RISK | (–) N.H. Nguyen, Phan (2017) | (–) Pindyck (1986)<br>N.H. Nguyen, Phan (2017)<br>Yung, Root (2019)<br>Drobetz, El Ghoul, Guedhami, Janzen (2018) |
| 7 | Lagged annual growth of GDP | Lag_GDP_ Grow | | (+) Karima (2012)<br>Barakat (2016)<br>Liu, Hao, Du, Xing (2020) |

Source: own elaboration based on the review of the empirical literature.

Based on the research of the authors dealing with the determinants of investment, an extract of which can be found in Table 1, the following research hypotheses are formulated in this article (these will form the basis for the introduction of the various variables into the model under analysis:

H1: There is a positive relationship between cash flow (liquidity) and investment volume.
Research by Phan and Nguyen (2020) indicated that there is a positive relationship – they were able to show that a 1% increase in cash flow leads to a 0.58% increase in investment with other variables held constant. This type of relationship was also confirmed by Aivazian et al. (2005), Adelegan and Ariyo (2008), and Ruiz-Porras and Lopez-Mateo (2011). Investment opportunities (Net income/Average asset) are also a strongly correlated variable with the CF variable and have a positive impact on investment volume. The above relationship was confirmed by Saquido (2004), Baum, Caglayan, Stephan and Talavera (2008), Bokpin and Onumah (2009), among others. The opposite result was obtained in the study by Phan and Nguyen (2020). They explained this result by adopting a different way of assessing investment opportunities than the studies indicated earlier.

H2: There is a positive relationship between leverage and investment volume.
The next analyzed variable is leverage (Total liabilities/Total assets) – that is, the debt/asset ratio and its impact on investment. The research of Phan and Nguyen (2020) leads to the conclusion that the relationship is not very strong and negative, but most researchers point to the presence of a positive relationship (Azzoni, Kalatzis 2006; Jangili, Kumar 2010; Nair 2011).

H3: There is a positive relationship between fixed capital intensity and investment volume.
The relationship of fixed capital intensity (Fixed assets/total assets) to investment has also been the subject of research. Virtually all the studies conducted (Bokpin, Onumah 2009; Erickson, Whited 2000; Ruiz-Porras, Lopez-Mateo 2011; Saquido 2004) have shown the presence of a positive relationship, although not very strong in some studies.

H4: There is a positive relationship between sales growth and investment volume.
Phan and Nguyen (2020) indicated that a 1% increase in sales translates into a 1.12% increase in investment volume. Erickson and Whited (2000), Saquido (2004), Bokpin and Onumah (2009), Ruiz-Porras and Lopez-Mateo (2011) also reached the same conclusion regarding a strong relationship between the analyzed variables.

H5: There is a positive relationship between a firm size and investment volume.
According to the vast majority of studies, a firm size is positively related to an investment size (Adelegan, Ariyo 2008; Jangili, Kumar 2010; Ruiz-Porras, Lopez-Mateo 2011). However, some of these studies indicate that this relationship is not statistically significant.

H6: There is a negative relationship between business risk and investment volume.
This element was first described by Pindyck (1986), who indicated a negative relationship between these variables. This research has given rise to numerous works (e.g. Drobetz et al. 2018; N.H. Nguyen, Phan 2017; Yung, Root 2019) on the impact of uncertainty on investment decisions.

H7: There is a positive relationship between GDP changes and investment volume.
Studies on the relationship between GDP changes and investment (Barakat 2016; Karima 2012; Liu et al. 2020) indicate a significantly positive relationship between these variables. It can also be found that significant GDP growth may even contribute to overinvestment (Liu et al. 2020).

## Data and methods

The research data sources are ORBIS database (ORBIS 2020) (corporate financial data), World Bank database (World Bank 2021) (macroeconomic data). The period of the study is 2011–2019. The entities studied are non-financial companies (corporate sector) listed on stock exchanges in 26 EU countries (all EU countries were included in the search criteria, but the final sample, after removing missing data and outliers, does not include companies from Austria). Financial data was taken for entities for which selected financial values, such as total assets and depreciation and amortization, were available throughout the study period. It was also assumed that the equity of the studied company must be positive. The total number of examined companies is 2009 and the total number of observations is 14,933.

The study was based on variables, the definitions of which are shown in Table 2. Investment ratio was used as the dependent variable in the form of two measures. The first was calculated as the change in the value of fixed assets plus current depreciation. This is equivalent to the value of gross investment (capital expenditure), i.e., including both new investment and replacement investment. For comparability, this value has been scaled by the value of assets. The second measure of investment is based on the percentage change in fixed assets, as in Saquido (2004). The other variables in Table 1 are independent variables,

intended to verify the research hypotheses set, as used, among others, by Gomes (2001), Saquido (2004), Carpenter and Guariglia (2008), P.D. Nguyen and Dong (2013), Phan and Nguyen (2020) and others.

**Table 2.** Variables used in the study

| No. | Variable | Abbreviation | Measures |
|---|---|---|---|
| 1 | Investment (CapEx) ratio | INV_Cap | $\frac{\Delta fixed\ assets + depreciation}{total\ assets}$ |
| 2 | Saq_Investment ratio | INV_Saq | $\frac{fixed\ assets\ change\ (annual\ \%)}{100}$ |
| 3 | Cash Flow | CF | $\frac{profit\ after\ tax + depreciation}{fixed\ assets\ (previous\ year)}$ |
| 4 | Capital structure (total debt ratio) | DR | $\frac{total\ debt}{total\ assets}$ |
| 5 | Assets structure (tangibility) | TANG | $\frac{fixed\ assets}{total\ assets}$ |
| 6 | Growth opportunities | GROW | $\frac{\Delta Sales\ Revenue}{Sales\ Revenue}$ |
| 7 | Size of the enterprise | SIZE | $\ln(Sales\ Revenue)$ |
| 8 | Business risk | Bus_RISK | $\frac{\sigma(Sales\ Revenue\ (consecutive))}{mean\ (Sales\ Revenue)}$ |
| 9 | Lagged annual growth of GDP | Lag_GDP_Grow | $\frac{GDP\ growth\ (annual\ \%, previous\ year)}{100}$ |

Source: own elaboration.

The descriptive statistics of the variables used are presented in Table 3. In the case of data based on financial statements, where errors may occur among many records, values that did not fall between 0 and 1 for the DR and TANG variables were excluded and, to avoid influencing the results of outliers, the sample was truncated to values between 1 and 99% of the distribution.

**Table 3.** Descriptive statistics of all variables

| | Average | Median | Standard deviation | Minimal | Maximal |
|---|---|---|---|---|---|
| INV_Cap | 0.098 | 0.050 | 0.450 | –0.823 | 40.667 |
| INV_Saq | 0.086 | 0.022 | 0.304 | –0.529 | 2.794 |
| CF | 0.172 | 0.142 | 0.378 | –2.407 | 2.716 |
| DR | 0.514 | 0.531 | 0.194 | 0.050 | 0.929 |
| TANG | 0.532 | 0.532 | 0.224 | 0.034 | 0.981 |
| GROW | 0.061 | 0.036 | 0.246 | –0.699 | 2.252 |
| SIZE | 11.803 | 11.792 | 2.511 | 4.685 | 17.650 |
| Bus_RISK | 0.106 | 0.060 | 0.145 | 0.001 | 1.108 |
| Lag_GDP_Grow | 0.018 | 0.019 | 0.024 | –0.091 | 0.252 |

Source: own elaboration.

Pearson's linear correlation coefficients for each pair of variables were calculated to check whether collinearity would appear in the models tested (Table 4). The values of the coefficients do not indicate a strong or very strong correlation. This means that collinearity should not be a problem in the panel models analyzed and the independent variables adopted can form the basis for model estimation (Greene 2003).

**Table 4.** Pearson correlation matrix for independent variables

| CF | DR | TANG | GROW | SIZE | Bus_RISK | Lag_GDP_Grow | |
|---|---|---|---|---|---|---|---|
| 1.000 | –0.051 | –0.247 | 0.105 | 0.147 | –0.116 | 0.027 | CF |
| | 1.000 | 0.002 | –0.006 | 0.359 | –0.099 | –0.082 | DR |
| | | 1.000 | –0.031 | 0.071 | –0.028 | 0.007 | TANG |
| | | | 1.000 | –0.028 | 0.357 | 0.070 | GROW |
| | | | | 1.000 | –0.276 | –0.020 | SIZE |
| | | | | | 1.000 | 0.044 | Bus_RISK |
| | | | | | | 1.000 | Lag_GDP_Grow |

Source: own elaboration.

In the next step, the dependence of the INV variable on company-specific factors was investigated. For this purpose, an econometric model was used:

$$INV_{it} = \beta_0 + \beta_1 CF_{it} + \beta_2 DR_{it} + \beta_3 TANG_{it} + \beta_4 GROW_{it} + \\ + \beta_5 SIZE_{it} + \beta_6 Bus_{RISK\,it} + \beta_7 GDP_Growth_{t-1} + e_{it}$$

where: $e_{it}$ – error term, which may include individual effects.

The data used in the study is panel data, which means that it is information about the same units over several periods. The basic methods for modelling panel data are pooled model (OLS) estimation, fixed effects model and random effects model (Maddala 2006). Panel model estimation using the OLS method is acceptable when the individual effect is not present, and the panel is treated as a cross-sectional data set. A test to check for the presence of an individual effect is the Breusch-Pagan test. The failure to reject the null hypothesis of this test means that the addition of individual effects is unnecessary, and OLS can be used. To identify fixed or random effects, the Hausman test is used (Greene 2003).

## Results and robustness check

Table 5 presents the parameter estimation results of the multiple regression models. Heteroskedasticity (Wald test) or autocorrelation (Wooldridge test) was detected in all models. Robust HAC (Heteroskedasticity and Autocorrelation Consistent) standard errors were therefore used as standard errors (Gujarati, Porter 2009).

**Table 5.** Results of model estimations

| **Model** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
|---|---|---|---|---|---|---|---|---|---|
| Subsample | Total | Total | Ebitda < 0.8 | Ebitda < 0.8 | Ebitda < 0.8 | Ebitda < 0.8 | Ebitda > 0.8 | Ebitda > 0.8 | Ebitda > 0.8 |
| Dependent variable | INV_Cap | INV_Saq | INV_Cap | INV_Cap | INV_Saq | INV_Saq | INV_Cap | INV_Saq | INV_Saq |
| Regression type | FE | FE | FE | FE | OLS | OLS | FE | FE | FE |
| const | -0.082<br>(0.106) | -0.399$^{**}$<br>(0.165) | -0.185<br>(0.254) | -0.260$^{***}$<br>(0.059) | -0.067<br>(0.068) | -0.058$^{**}$<br>(0.026) | -0.258$^{*}$<br>(0.143) | -0.842$^{***}$<br>(0.215) | -1.148$^{***}$<br>(0.054) |
| CF | 0.156$^{***}$<br>(0.023) | 0.259$^{***}$<br>(0.029) | -0.07$^{*}$<br>(0.042) | -0.07$^{*}$<br>(0.040) | -0.050$^{*}$<br>(0.029) | -0.052$^{**}$<br>(0.025) | 0.330$^{***}$<br>(0.040) | 0.594$^{***}$<br>(0.040) | 0.587$^{***}$<br>(0.040) |
| DR | 0.253$^{***}$<br>(0.051) | 0.358$^{***}$<br>(0.051) | -0.141<br>(0.098) | -0.163$^{*}$<br>(0.094) | 0.018<br>(0.054) | | 0.357$^{***}$<br>(0.067) | 0.572$^{***}$<br>(0.054) | 0.560$^{***}$<br>(0.052) |
| TANG | 0.773$^{***}$<br>(0.049) | 1.048$^{***}$<br>(0.060) | 0.776$^{***}$<br>(0.137) | 0.758$^{***}$<br>(0.131) | 0.177$^{***}$<br>(0.051) | 0.162$^{***}$<br>(0.045) | 0.922$^{***}$<br>(0.066) | 1.447$^{***}$<br>(0.068) | 1.438$^{***}$<br>(0.068) |
| GROW | 0.135$^{***}$<br>(0.017) | 0.124$^{***}$<br>(0.018) | 0.13$^{***}$<br>(0.033) | 0.125$^{***}$<br>(0.036) | 0.149$^{***}$<br>(0.034) | 0.128$^{***}$<br>(0.033) | 0.129$^{***}$<br>(0.020) | 0.106$^{***}$<br>(0.021) | 0.093$^{***}$<br>(0.021) |
| SIZE | -0.037$^{***}$<br>(0.009) | -0.029$^{**}$<br>(0.014) | -0.0129<br>(0.024) | | -0.001<br>(0.005) | | -0.036$^{***}$<br>(0.012) | -0.026<br>(0.017) | |
| Bus_RISK | 0.167$^{***}$<br>(0.033) | 0.183$^{***}$<br>(0.038) | 0.100<br>(0.081) | | 0.035<br>(0.067) | | 0.164$^{***}$<br>(0.038) | 0.188$^{***}$<br>(0.045) | 0.205$^{***}$<br>(0.046) |
| Lag_GDP_Grow | 0.702$^{**}$<br>(0.316) | 0.496$^{***}$<br>(0.122) | 0.800<br>(0.556) | | 0.321<br>(0.317) | | 0.680$^{*}$<br>(0.372) | 0.411$^{***}$<br>(0.126) | 0.361$^{***}$<br>(0.123) |
| **No. of observ.** | 14933 | 14742 | 1552 | 1613 | 1488 | 1628 | 12901 | 12779 | 12949 |
| Joint significance test | 52.01<br>p < 0.001 | 60.6<br>p < 0.001 | 4.63<br>p < 0.001 | 9.58<br>p < 0.001 | 4.08<br>p < 0.001 | 8.43<br>p < 0.001 | 46.93<br>p < 0.001 | 90.32<br>p < 0.001 | 105.24<br>p < 0.001 |
| F Test | 1.78<br>p < 0.001 | 1.94<br>p < 0.001 | 1.22<br>p = 0.003 | 1.24<br>p = 0.0015 | 1.01<br>p = 0.443 | 1.05<br>p = 0.262 | 1.77<br>p < 0.001 | 2.55<br>p < 0.001 | 2.56<br>p < 0.001 |
| Breusch-Pagan Test | 51.9<br>p < 0.001 | 42.1<br>p < 0.001 | 21.7<br>p < 0.001 | 22.1<br>p < 0.001 | 2.42<br>p = 0.119 | 2.67<br>p = 0.102 | 34.4<br>p < 0.001 | 74.88<br>p < 0.001 | 76.86<br>p < 0.001 |
| Hausman Test | 308.5<br>p < 0.001 | 1147.3<br>p < 0.001 | 32.8<br>p < 0.001 | 78.9<br>p < 0.001 | 29.3<br>p < 0.001 | 28.96<br>p < 0.001 | 255.7<br>p < 0.001 | 1561.7<br>p < 0.001 | 451.85<br>p < 0.001 |
| Wald Test | – | – | 1.68E+33<br>p < 0.001 | 8.86E+34<br>p < 0.001 | 26.4E+06<br>p < 0.001 | 4.88E+08<br>p < 0.001 | – | – | – |
| Wooldridge Test | 4.6<br>p = 0.032 | 64.7<br>p < 0.001 | 0.27<br>p = 0.604 | 0.30<br>p = 0.583 | 2.378<br>p = 0.018 | 2.61<br>p = 0.0095 | 3.08<br>p = 0.080 | 61.31<br>p < 0.001 | 61.26<br>p < 0.001 |

Source: own elaboration.

The results of the Breusch-Pagan and Hausman tests indicate that for models 1–4 and 7–9 the individual fixed effects models are appropriate for the data analyzed, while for models 5–6 the OLS model is appropriate. If the fixed effects model is applied to models 5 and 6, the difference with the present result would be that the variable DR has a statistically significant effect on investment, and this is a negative relationship. Thus, confirmation of the relationship obtained in model 4 would be obtained.

The models presented in Table 5 are based on two variants of the INV variable, in order to check whether a different definition of the variable would affect the results (robustness check). Three samples of companies were examined: 1) all companies (models 1 and 2), 2) companies with financial distress (Ebitda_to_Interest < 0.8, models 3–6) and 3) companies without financial distress (Ebitda_to_Interest > 0.8). Within each group, a model containing all the intended variables was tested and, in addition, if such a model contained statistically insignificant variables, a final model containing only statistically significant variables. The estimation results show that regardless of the variant of the dependent variable INV used, the results are similar. For the sample containing all companies, the results are the same. In the case of financially constrained companies for the variable INV_Saq (models 5–6), no confirmation of the negative relationship between DR and INV found in model 4 was obtained. The estimation of models 5 and 6 was performed using the OLS method, if the FE method had been used the result would have been the same as in model 4. Hence, it can be concluded that confirmation of this relationship, although weaker, was obtained. The second difference is the lack of confirmation in models 8 and 9 of the negative relationship between the SIZE variable and INV for the sample of companies without financial distress. Such a relationship was found in model 7. However, it should be noted that in models 8 and 9 no statistical significance was obtained for this variable, while the opposite relationship was not found. Therefore, based on model 7, it can be indicated that such a relationship does exist, although its support is not as strong as in the case of other relationships occurring simultaneously in the models for both variants of the dependent variable.

## Discussion and conclusions

Table 6 presents a summary of the results obtained. The findings show a positive relationship between cash flow and investment volume. A similar situation is observed for the remaining variables. Almost all the variables included in the models (CF, DR, TANG, GROW, RISK, GDP_Grow) have a positive impact on investment apart from the SIZE variable, which has a negative impact on investment.

**Table 6.** Summary of the results for companies in financial distress

| | Expected result | Result obtained (whole sample) | Result obtained (Ebitda < 0.8) | Result obtained (Ebitda > 0.8) |
|---|---|---|---|---|
| CF | + | + | – | + |
| DR | + | + | (–) | + |
| TANG | + | + | + | + |
| GROW | + | + | + | + |
| SIZE | + | – | | (–) |
| Bus_RISK | – | + | | + |
| Lag_GDP_Grow | + | + | | + |

Source: own elaboration.

These relationships are almost consistent with the expectations from the analysis of the previous studies, which are presented in the literature review chapter. The results obtained support (failed to reject) hypotheses H1, H2, H3, H4 and H7, while hypotheses H5 and H6 should be rejected. In terms of the differences obtained, these results indicate that relatively more (investments are normalized by assets) is invested by smaller companies (rejection of hypothesis H5) which are trying to catch up with larger companies (although it should be remembered that they are all listed companies, so in relation to all entities in a country they are relatively larger). With regard to risk, the relationship is positive (rejection of hypothesis H6). This means, therefore, not that companies postpone investment for fear of risk, but rather it has been found that more is invested by companies that have a greater appetite for risk. It appears that these two relationships, both for size and risk, may be related, and the difference between our results and those indicated in Table 1 may be due to a difference in the structure of the research sample. In the case of the European Union, a significant number of countries (and thus companies) are those that have relatively recently (no more than 30 years ago) switched to a market economy and are thus trying to catch up with older companies. This does not necessarily imply a universal dependency affecting all companies throughout the EU, but it can have a significant impact on the individual dependencies for the relationships studied. In this case, it could have revealed the relationship between investments and the size of a company and its approach to risk.

After dividing the companies into two samples: financially constrained companies and companies without financial problems, the same results were obtained for the companies without financial problems as for the whole sample. However, for financially constrained companies, only some of the relationships are confirmed. As for the other companies, the variables TANG and GROW have a positive impact on investment. A significant difference is the results for the variable CF. For this variable, the relationship between CF and firm investment reverses and is negative for financially constrained firms. This is consistent with the results of

Czerwonka (2014). A negative relationship can also be observed for the DR variable, although in this case the support for this relationship is weaker.

The results obtained for the whole sample indicate that cash flow (internal funds) is a key determinant of investment decisions. Companies use equity capital to finance their investment activities, but are also supported by external funds (debt).

However, in the case of financially distressed companies, those that invest are characterized by a lower cash flow and a lower debt. This means they need money. This need stems from both the past and the future. Financially troubled companies have little cash because of insufficient profits. But in terms of debt, they may have a twofold problem. Firstly, their financial troubles may cause financial institutions to require repayment of loans, making their access to cash all the worse. Secondly, looking ahead, such companies have much less, or no, chance of obtaining a loan. This means that they must have another source of funding. In the case of financial distress, such a source of investment financing could be selling off owned assets – which would be consistent with the results of Hovakimian and Titman (2006).

The study contributes to the literature with strong evidence of a change in the relationship between cash flow and investment volume depending on the financial situation of companies in European countries. To summarize briefly, it can be noted that for enterprises with financial problems, the relationship between a cash flow, debt and investment is negative, while for financially healthy enterprises this relationship is positive. This topic has been extensively researched in the world, but the research on the European Union companies is not as widespread. Our analysis indicates that these relationships in the European Union also exist. In addition – the previous studies have been conducted on a countrywide basis. Our study covers a large block of countries of particular importance to the global economy.

Research limitations include the adopted research sample which only considers the European Union countries, and the inability to conduct the analysis in certain additional cross-sections due to the lack of relevant data in the database that was used.

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