

**Publication selection bias in the sources of financing the enterprises research?  
A Meta-Regression Analysis<sup>1</sup>**

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**Abstract**

The impact of firms characteristics on bank debt financing has always been a field of conflicts among economists (e.g. *static trade-off theory* vs. *pecking order theory*). This study provides a systematic analysis of the empirical literature on the usage of bank debt by conducting a meta-analysis, based on t-statistics reported in empirical studies. The benefits of meta-analysis include a quantitative review of a large and sometimes apparently conflicting part of literature. In particular the problem of publication selection bias is discussed. Estimates may be subject to publication selection bias, which distorts conclusions. Publication bias occurs when researchers choose which estimate to report based on statistical significance and expected sign. Non-expected coefficient are unlikely to be reported due to believe that a it must be a signal of some estimation or misspecification error. The funnel graph and econometric models are used for the identification of the publication selection bias. We explore the sources of heterogeneity among studies including moderator variables in random- and fixed effects regressions. Our results indicate that there is evidence of publication selection in the assets structure, profitability and company size coefficients. Then, with the aim of deepening the economic analysis we conduct study of bank loans at country level and for Polish non-finance firms.

Keywords: financing sources, meta-regression analysis, publication selection bias, bank loan

JEL codes: G32, C12, C13.

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## **Introduction**

This study pursues two objectives that have not been analyzed to date. On one hand, we conduct a meta-analysis, we make comparison of results differentiating between publications and verify publication selection bias, on the other, we explore the determinants of bank loan financing based on the country level data and Polish firms level data and compare with results published so far. Our analysis of Polish non-finance firms concentrate on the causes of low inclination to use bank loan as a source of business financing, taking into consideration the monetary policy aspect.

Access to finance is key to business development. Investment, innovation and survival are not possible without adequate financing. In recent years, the uncertainty and instability caused by the economic crisis has affected businesses. The decreased international demand and increased competitiveness caused that both small and medium sized companies, and large firms faced greater difficulties in sustaining their profit levels and surviving in a unfavourable environment.

Modigliani and Miller (1958) formed the basis of modern thinking on capital structure. They claimed that under the assumption of perfect markets where for example taxes and transaction costs do not exist the value of a company would be independent of the capital structure. Nevertheless, subsequent studies have examined the determinants of capital structure and provided new theories with different views on the determinants of capital structure: the pecking order theory, the trade-off theory, the agency theory, the market timing theory.

Bank loans constitute one of the sources of external funding for enterprises. The determinants of a company's capital structure, including bank debt financing have been the focus of much research since the 20th century. The empirical literature indicates the influence of the low competitiveness in the banking sector, the high concentration as measured with the Lerner index and the macroeconomic situation, including the financial development of the country, the access to information and the state treasury share in the ownership structure of banks. The impact of these determinants varies – in particular, Love and Peria (2012) observe that the impact of bank competition and concentration depends on the economic environment. In some countries, the negative effect of low bank competition may be mitigated by such positive factors as the accessibility of loan information or the general country-level of financial development, while in some other this impact may be moderated by the high share of government ownership in the banking sector.

This paper presents a survey of the micro-econometric literature on the effects of profitability, size and assets structure on firms' bank loans activities. We focus on one specific aspect that has not received sufficient attention in previous research: the verification of publication selection bias. Our meta-regression analysis sets up a new database collecting a large number of firm-level studies on the determinants of bank loan financing and investigates the factors that may explain differences in the estimated effects that are

reported in the literature. Our paper aims to estimate the size, sign, and significance of publication selection bias and to analyse the determinants behind the heterogeneous results of the primary empirical studies.

Much attention has been given in recent years to meta-analysis in economic research. The meta-analysis enables the collective analysis of the results of independent studies and a more precise assessment of the effect of the given independent variables on the analysed phenomenon. The conclusions of the meta-analysis help explain the discrepancies in the dependencies described by different researchers. Due to the fact that the empirical literature is very diverse as for the applied, often incorrect, estimation methods, the purpose of this article is the verification of the existence of the publication selection bias in the available literature on business financing sources. The objective of this paper is to summarize and synthesize estimates of the coefficients of explanatory variables in issues relating to bank loans, while accounting for dispersion and potential biases due to heterogeneity; dependence of estimates due to methodology and sampling; and publication selection bias. Graphical tools such as the Funnel and Galbraith plot will be used in order to detect evidence indicating the presence of publication bias. The true effects estimation will be estimated by an equation for the FAT (*Funnel Asymmetry Test*) and PET (*Precision-effect Test*) tests. Heterogeneity and selection bias are examined jointly in meta-regressions containing moderator variables for econometric methodology, primary data, and precision of estimates. The works which show a weaker correlation or a lack of significance are less attractive and are seldom published – they are viewed as not providing enough contribution to science and not explaining the studied phenomena.

In order to econometrically analyse the sources of heterogeneity in published effects of profitability, size and assets structure on firms' bank loans financing, we reviewed existing empirical studies. 30 studies on the determinants of bank loan financing, for which the dependent variables were constructed in a similar way were selected from the review of literature on sources of business financing (over 130 articles). 119 regressions from 22 publications were used in the final phase of the meta-analysis. 35 of them devoted to financing with bank loans were selected to construct a database containing information about the 303 estimated models.

This is the first study where meta-analysis of the literature regarding business operation financing with bank loans was performed. The study of the use of bank loans took into account the variables of profitability (e.g. Jiménez et al. 2009; Huyghebaert et al. 2007), assets structure (e.g. Berrospide et al. 2012; Dewaelheyns and Van Hulle, 2007), company size (e.g. Demiroglu et al. 2012; Ghosh, 2010).

Meta-analysis conducted in this research allows to draw conclusions about the publication selection bias in the bank debt financing literature. Our study fills an important gap as such investigation was not presented before. Publication selection bias may lead enterprises to limit the use of external funding, decreasing scale of operations can be observed, range of investment may be limited to the amount of internally generated sources of funding.

## 1. Literature review.

### *Profitability*

According to the **trade-off theory** (Kraus and Litzenberger, 1973) profitability is positively correlated with the amount of bank debt in the capital structure. The **pecking order theory** (Myers, Majluf, 1984; Myers, 1984), on the other hand, stressing the problem of information asymmetry, indicates that companies choose sources of capital with the lowest level of information gap to minimize information costs. Therefore firms first look to retained earnings and then to debt.

The findings of Smith (1987) and Carey et al. (1998) imply that low profitability may lead to credit rationing by banks, and therefore to a positive relationship between profitability and bank debt use. On the other hand, companies may attract bank debt to fill cash shortages caused by low profitability, if banks have possibilities for monitoring services (Diamond, 1984, 1991; Fama, 1985; Ramakrishnan and Thakor, 1984; among others). **Alonso et al. (2005)** identify a negative correlation between return on assets and loan-based financing, thereby supporting the pecking order theory. Using a probit model, **Cole (2008)** proves that companies declaring no need to borrow are smaller, more profitable, higher liquidity, are longer present on the market, have no problems with late payment of their trade credit. **Cole (2010)** finds that smaller, more profitable companies with a higher liquidity and owing less fixed assets do not use bank loans. On the other hand, firms financing their business with bank loan are larger, younger, less profitable and have a lower liquidity. **Dewaelheyns et al. (2007)** states that firms with weak profitability (ROA) use more of bank debt and that as profitability increase, bank debt is replaced by internal debt. This is consistent with the hypothesis that shortages in cash generation are filled with extra bank debt. The author stress that analysis is based on data for mature firms that, given their age, have been able to build a reputation, and hence should be able to increase bank borrowing even in bad times.

Ghosh and Sensarma (2004) include monetary conditions in their analysis. They indicate that old, high-debt and low profit firms increase bank lending, in response to a monetary contraction.

### *Company size*

The availability of credit is one of the most fundamental issues facing a small business. Small firms often have fewer tangible assets to provide as collateral and are less profitable than are larger firms. Cole and Dietrich (2012) find that among firms that need credit, a “discouraged” firm is younger, smaller and growing slower than a firm that applied for credit.. Firms applying for credit, are older, larger, and growing faster. 40% of companies that need credit do not apply for credit because they expect to be turned down (33% of companies from developed countries and 44% from developing countries). Furthermore, these firms are discouraged by unfavourable interest rates and lending terms. Alonso et al. (2005) reveal a positive correlation between the company size and the bank credit use. Large firms have more bargaining power

they may use in building relations with banks. As a result, large firms finance their business with bank credit. It seems that this is typical for the non-Anglo-Saxon financial system, where the banking sector plays the main role in the financial sector. Jimenéz et al. (2013) indicate that the company size and age are positively correlated with the number of bank loans granted. Firms with a better financial standing use more external funding. Larger and older firms, as well as firms from the industrial sector are more likely to access bank funding (Love and Peria, 2012). Being more diversified, better known to external players and experiencing less information asymmetry, large firms are assigned lower risk ratings - Ghosh and Sensarma (2004). Brown et al. (2012) prove, that small East-European firms are less likely to apply for credit than Western firms, even though they are more likely to need it. Businesses, although in need of a loan, do not submit their loan applications, discouraged by collateral conditions, high – from their point of view – interest rates and cumbersome lending procedures. Among Eastern-European firms, the probability of being denied credit is higher for small, private, young businesses. Detragiache et al. (2008) indicate that foreign banks lend to large firms with credible financial reporting rather than to numerous micro- and small, informationally opaque enterprises. The higher rate of firms discouraged to apply for credit in Eastern Europe is driven more by the presence of foreign banks than by the macroeconomic environment or the lack of creditor protection. Based on analysis outcomes, Sufi (2009) finds that the company size and cash flow is positively correlated with the probability of having a credit line. He indicates that the probability of having a credit line is lower for companies with a high market value. Beck *et al.* (2008) find that, in countries with poor institutions, firms use less finance, especially from banks; and that small firms, in general, use less bank finance. Beck *et al.* (2006) and Aterido *et al.* (2007) find that micro and small firms face more obstacles in accessing finance than do large firms.

### ***Assets structure***

The pecking order theory predicts that firms holding more tangible assets are less prone to asymmetric information problems and reduce the agency cost. Generally the supply of bank loans is expected to be higher for firms with higher collateral. Firms operating in industries characterized by a higher level of asset tangibility are expected to face lower credit constraints. When firms use tangible assets as collateral, they reduce the cost of bank loans by limiting exposure and asset-substitution problems (Myers and Majluf, 1984; Detragiache, 1994; Boot et al., 1991; Leeth and Scott, 1989; among others). As a result higher levels of tangibility would imply more bank debt. Petersen and Rajan (1994) report that large firms with a high level of tangible assets use more bank credit. Cole (2008) shows that firms in certain industries, such as construction, manufacturing and transportation, are thought to be more creditworthy because they typically have more tangible assets that can be used as collateral than do firms in other industries, such as business services. Bougheas et al. (2004) confirm that the short-term debt share in total liabilities is higher for companies with a lower level of collateral. A higher collateral level provides greater access to

long-term funding, thereby reducing the long-term debt share in total debt. Dewaelheyns and Van Hulle (2007) indicate that large companies with a high share of fixed assets in total assets use bank credit to a greater extent, while firms belonging to capital groups prefer internal financing, due to its lower cost. Cole (2010) finds that firms having less tangible assets do not use bank credit. According to findings presented by Liberti and Sturgess (2012), collateral – and non-specific collateral in particular – is a channel through which borrowers can mitigate bank-specific lending channel effects without turning to alternate lenders in the credit market. Firms with a low collateral level and a high probability of bankruptcy experience worst consequences of the shock. Companies pledging specific collateral (such as inventories, machinery and equipment, accounts receivable, guarantees and promissory notes) experience a smaller decline in lending when exposed to credit supply shock. Borrowers with a low creditworthiness, less collateral and generating lowest returns experience greatest declines in lending in response to the credit supply shock. Borrowers pledging non-specific collateral (real estate, cash and liquid securities) experience lower cuts in lending under a bank-wide credit supply shock. Jiménez et al. (2013) prove that firms with more tangible assets or cash tend to contract less new loans, relying on internal financing rather.

## **2. Funnel graph and verification of the publication selection bias**

Stanley and Jarrell (1989) considered why do researchers come to such different findings when they are investigating the same phenomenon. Is it because of statistical methods, model misspecifications, different data sets? The authors offered a quantitative methodology for reviewing the empirical economic literature. Proposed meta-regression analysis is the regression analysis of regression analyses. Meta-regression analysis not only recognizes the specification problem but also attempts to estimate its effects by modelling variations in selected econometric specifications. Meta-analysis is the analysis of empirical analyses that attempts to integrate and explain the literature about some specific important parameter.

The purpose of meta-analysis is to provide objective and comprehensive summaries of researches conducted by different authors. Meta-analysis is aimed at finding explanation of variation in the regression results published by independent researchers and presenting a statistical conclusion (Sauerbrei and Blettner, 2003). This approach was first described by Rosenthal in 1979, in the article “*Combining results of independent studies*” regarding the possibility of combining results from independently conducted studies. This approach was then developed by Rosenthal and Rubin (1982), Hunter and Schmidt (1990). Stanley et al. (2013) have offered guidelines for conducting and reporting meta-analyses in applied econometric research.

There is a probability that the results obtained by the researchers may be affected by the problem of statistical significance selection (so-called: publication selection bias). The selection of publications occurs when the researchers and reviewers prefer the statistically significant results. The works which show a weak

correlation or a lack of significance are less attractive and are seldom published – they are viewed as not providing enough contribution to science and not explaining the studied phenomena. The problem of publication selection is related to the overstating of the empirical effect of the discussed matter and causes an unimportant effect of a given variable to appear significant.<sup>2</sup> The arguments presented above support the need to perform the meta-analysis in order to summarise and compare the results of the adaptation rate parameter estimates by other authors as well as the investigation of the existence of the publication selection bias which may significantly influence the results obtained by researchers.

In meta-analysis the simplest way to see if there is publication bias is the funnel graph, which is nothing more than a scatter diagram of all empirical estimates and these estimates' inverse of the standard error. In figures 1 and 2 we present the funnel graphs of the estimated minimum wage elasticities and coefficients, respectively.

The funnel graph is a classic method used for the identification of the publication selection bias. It is a distribution diagram for the precision (measured as the inverse of the standard error) from the estimated coefficient. The precision can also be measured by sample size or its square root. In the case of the absence of the publication selection bias, the diagram should resemble an upside down funnel – wide at the base, tapering as the values on the vertical axis increase. The funnel diagram should also be symmetrical, regardless of the value of the true effect, at which the estimations should converge. The expected upside down funnel shape is determined by heteroscedasticity. The studies on small samples characterised by larger standard errors and the resulting lower precision are located on the bottom of the diagram which results in the more dispersed base of the chart. Asymmetry is the sign of the occurrence of publication selection bias. It is usually manifested by the imbalance of the chart to one side – proving the preference of the specific direction or value of the coefficient estimated by researchers.

In order to identify if there is publication bias in our meta-samples we follow Stanley et al. (2008) and we estimate equation (1).

$$t_i = \beta_{SE} + \beta_e \left( \frac{1}{SE_i} \right) + v_i \quad (1)$$

where:  $t_i$  –  $t$  – distribution,  $SE_i$  – standard deviation,  $\beta_{SE}$ ,  $\beta_e$  – unknown parameters,  $v_i$  – random error.

Testing whether the constant is equal to zero ( $H_0: \beta_{SE} = 0$ ) is equivalent to the testing of distribution asymmetry and can be used as the measurement of the occurrence of the effect of the publication selection bias on the results referred to precision-effect test (PET) (Egger et al., 1997; Stanley, 2008; Stanley,

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<sup>2</sup> T.D. Stanley, *Beyond Publication Selection*, Journal of Economic Surveys, 19, 2005, p. 309-345.

Doucouliaqos, 2012). Whereas, testing whether the  $\beta_e$  parameter is equal to zero ( $H_0: \beta_e = 0$ ) shows the direction of the bias with the studied effect (Egger et al., 1997; Stanley, 2008).

However, like any regression model, the estimates can be biased when important explanatory variables are omitted. Therefore, we need to include moderator variables to control for the possible heterogeneity across studies. Finally we perform a meta-regression analysis, incorporating into the model 21 possible moderators that take into account the study heterogeneity.

Like in any regression model, the estimates of MRA's coefficients can become biased when important explanatory variables are omitted. MRA model (1) can be expanded to include variables,  $Z_k$ , that explain variation in estimates and other factors, and  $K_j$ , that are correlated with the publication selection process itself.

$$t_i = \beta_{SE} + \sum \gamma_j K_{ij} + \beta_e(1/SE_i) + \sum \alpha_k Z_{ik}/SE_i + v_i \quad (2)$$

where:  $K$  variables may affect the likelihood of being selected for publication.  $Z$  variables may affect the magnitude of the estimator. In the meta-analysis the equation for the FAT and PET tests is estimated by both random and fixed effects models.

The difference between the fixed effects and random effects estimates (for a weighted average estimates) can be the probable indicator of the effect of the selection of publications. This difference occurs because the less precise estimates are more biased in random effects models compared to fixed effects models. Random effects models reflect unobserved heterogeneity, which may be real or appears as the result of the methodology. Biase of the standard errors of estimates may also occur. It means that the more precise estimates may indicate on biease or inefficiency. Using random effects models can eliminate inefficiency or incorrect outliers. As a consequence of the foregoing we are using random effects and fixed effects models in this study.

### **3. Bank loan - verification of the publication selection bias**

30 studies on the determinants of financing with bank loans, for which the dependent variables were constructed in a similar fashion were selected from the review of literature on business financing sources (over 130 articles). Finally, 119 regressions from 22 publications were selected for further analysis.

According to the theory of financing sources hierarchy, the businesses prefer internal over external financing because high profit enables the financing of investments with revenue. More profitable businesses can be treated as having higher credit standing because they show the capacity to cover and service future liabilities. Low profitability may results in the limited availability of bank loans. It is, therefore, reasonable to expect a positive impact of profitability on bank loans. However, the businesses may increase their



indebtedness with banks in order to cover cash shortages resulting from low profitability. In this case, a negative correlation between the profitability and bank loan should be expected. The results of empirical studies do not clearly define the character of the correlation between profitability and bank loan financing – the examples of positive and negative correlation can be found with similar frequency. In empirical studies, the profitability was usually measured by the return on assets (ROA), return on equity (ROE) and EBITDA for assets total. The ROA indicator had a negative impact on bank loans, for example in the following studies: Alonso et al. (2005), Dewaelheyns and Van Hulle (2007), Jiménez et al. (2009). Positive correlation was found in over a dozen models, with similar results for no significant correlation. For ROE, Bougheas et al. (2006) obtained negative impact on bank loan financing and for the EBITDA indicator, Huyghebaert et al. (2007) found positive impact. The theory of financing sources hierarchy predicts that profitable businesses, without limitation in access to external financing sources, as well as businesses from the industries with low fixed assets expenditure are relatively less indebted.

The collateral was usually measured as the ratio of fixed assets to assets total. Higher collateral improves access to long-term loans and limits the ratio of short-term loans in the total indebtedness. If the businesses use tangible fixed assets as collateral, they limit the cost of bank loans by the limitation of the problem of assets disclosure and substitution (e.g. Myers and Majluf, 1984; Detragiache, 1994; Boot et al. 1991; Leeth and Scott, 1989). The positive correlation between the collateral and bank loan were found by Huyghebaert et al. (2007), Dewaelheyns and Van Hulle (2007), Bougheas et al. (2006) and Berrospide et al. (2012). By the estimation of probit models for the specification of determinants of the use of bank loan and the Heckman model for the ratio of bank loan in the assets, Cole (2011) found that companies with less fixed assets do not use loans. The low application of bank loans despite the high ratio of fixed assets in the property of the company was shown by Jimenez et al. (2009 and 2013). Jimenez et al. (2013) showed that the businesses with more fixed assets or cash get less new loans and rely more on internal financing.

The decisions on granting loans to businesses with certain specifications differ depending on the interest rate. Collateral is less important during the credit market constriction. The balance channel of monetary policy impulses transmission is based on the fact that the changes of interest rates lead to the changes in the values of collateral offered as security by potential debtors. The loss of value may force the businesses to limit the investment expenditure because their credit standing becomes weaker (Bernanke and Gertler, 1995). The increase of interest rates results in the drop of share prices and reduction of the cash flow value. It also decreases the value of the asset to be used as collateral and thus may lead to lower credit supply. The amount of the loan taken by businesses may be limited by the value of owned assets used as payment security.

The correlation between the size of the company and bank loan financing is unclear. Large, diversified companies, well known external businesses with lower information asymmetry problems are

associated with lower risk factors. Large businesses have more negotiation strength – used to build and maintain the relationship with the bank. Due to that, large companies which could replace bank financing with financing by debt issue, take bank loans for financing. It can be assumed that the size of the company as positive correlation with indebtedness, however the results of studies not always verify this hypothesis. The positive correlation between company size and financing by bank loan was found by Alonso et al. (2005), Dewaelheyns and Van Hulle (2007), Cole (2011), Jiménez et al. (2013), Demiroglu et al. (2012) and Berrospide et al. (2012) and low use of bank loans by large companies was reported by Ghosh (2010) and Jiménez et al. (2010 and 2012). Ghosh and Sensarma (2004). Based on the estimations of the probit model for the probability of declaration of need for bank loans, Brown et al. (2012) showed that among the countries from Eastern Europe, smaller businesses are less likely to require bank loans for operations financing. The impact of company size is less visible in Western Europe.

The diversity of the applied independent variables and the diverse size of data sets result in the fact that during results generalisation it is inevitable to limit the meta-analysis to the variables measured in the same way in empirical studies from the literature. This is the reason why the meta-analysis takes into account model estimation results only from the studies which included profitability measured by ROA, collateral reflected in the assets structure (set as the ratio of fixed assets in the property) and size of the company measured with a natural logarithm of total assets (Table 2) in the list of determinants of business financing with bank loans. The most common method for the verification of the meta-analysis in relation the selection of publications with empirical research results is the analysis of the chart presenting the relation between parameter estimations (*estimation effect*) and the inverse of the standard deviation (*precision*) ( Figures 1, 3, 5).

In all cases, the publications to date obtained positive, negative and insignificant estimations. The lack of publication selection is evident when the estimated parameters change randomly and symmetrically around the “true” population effect. The asymmetry of the graph can be used as an evidence of the presence of type I publication bias in the literature. As the dataset does not contain many observation the Galbraith plots, which examine type II publication bias, will be omitted. Based on the graphical analysis, Figure 1 shows no publication selection, whereas Figures 3 and 5 contain publication selection. The obtained results indicate the existence of the publication selection bias in the analysed empirical literature. It is worth noting that man econometric decisions, such as omission of variables, selection of the estimation method or functional form can also change the shape of the chart. However, the discussed sources of variance may be described as bias related to wrong model specification. Furthermore, the heterogeneity of the “true effect” between the studies, caused by the application of different sets of data for different times and countries may be the reason for the asymmetry in the funnel chart, even in the case of the lack of publication selection bias.

In Figure 1, the top point approaches a value near 0. If the results obtained by the researchers are not biased, they should spread symmetrically around this point. The mean of all profitability estimations is -0.045, so it is close to the top chart value. In the case of Figure 3, the top point approaches the value near 0 and the mean of all assets structure estimations is 0,089 – far more than the top chart value. In Figure 5, the top chart value is -0.2 and the mean of all estimates for company size is lower – -0.6.

Figures 2, 4 and 6 illustrate how the parameter estimations changed in time. One can see that the impact of assets profitability on bank loan financing grows in time ( Figure 2). There is no clear correlation visible for the assets structure ( Figure 4), while negative correlation has been mostly found for company size in recent years ( Figure 6), which – together – indicate the growing interest in bank loan financing among smaller businesses, often without assets to be used as collateral.

In order to confirm the results on the chart, which are often a subjective assessment of the researcher, the regression described by formula (1) was estimated. The results from the FAT test indicate that type I publication bias is present only in the case of assets structure, company size investigation (Table 3 – publication selection bias). The FAT tests in other categories fail to prove its presence. The PET tests' reject statistical difference of these estimates from zero. Adding moderator variables to Eq. (1) yields a weighted least-squares meta-regression model (FE – FIXED EFFECTS) and method-of-moments (RE – RANDOM EFFECTS) of heterogeneity and publication bias. We present the results of Tau2 test for within variance of residuals (Table 3). For models estimated by Method of Moments we got Q statistics. The null hypothesis states that fixed effects model is correct. Q statistics for our models are large and their p-values are equal to zero. The real value of the actual effect probably varies between research, what means that the data are not consistent with the assumptions of fixed effects models.

Testing whether the constant is equal to zero is used as the measurement of the occurrence of the effect of the publication selection bias. We find that the intercepts in regressions for profitability, assets structure and company size are significant (Table 3 – publication selection bias). The inclusion of potential sources of heterogeneity removes publication bias just for the case of company size.

Potential explanatory variables included in meta-regression analysis are presented in Table 4. We include moderator variables to control for heterogeneity across studies. Table 3 presents the results of the reduced models, as during estimation, we observed that some moderator variables are not important in contributing to the potential source of heterogeneity, as they are not statistically significant.

We find now that precision coefficients in regressions for assets structure (0,85) and profitability (-0,85) are significant (Table 3 – publication selection bias + heterogeneity). . Estimates for the  $\beta_e$  parameter show the direction of the bias. In case of profitability we observe a positive bias, and for assets structure it is negative. More often cited studies report assets structure estimates that are larger (on average

5e-06 lower). Furthermore, analysis with higher number of firms included are likely to report lower assets structure estimates (on average 0,007 higher).

In summary, the results of the meta-analysis show the occurrence of the publication selection bias in the case of the profitability and structure of the assets. One reason for that can be wrong model specification, another reason may be connected with pressure for obtaining a statistically significant estimator.

#### **4. Bank loans – country level data**

The objective of this part of the paper is to explore the determinants of bank loan financing based on the country level data and compare with results published so far, but based on firm level data. The sample was obtained from the database of the European Committee of Central Balance Sheet Data Offices (BACH / ESD, 2013) and encompasses European countries for the period 2000-2014. BACH (Bank for the Accounts of Companies Harmonized) is a database of aggregated and harmonized accounting data of non-financial companies in European countries, based on their national accounting standards. The database currently includes data for 11 countries (Austria, Czech Republic, France, Germany, Italy, Poland, Portugal, Slovakia, Spain and Belgium, Netherlands). The data sources for this database include financial statements (balance sheets and income statements) of individual non-financial corporations .

Based on Figures 8-12 we may see that macroeconomic effects are crucial as company financing methods differ significantly between countries. Equity is most prevalent among enterprises in Poland, Netherlands and Czech Republic while total debt is most widespread among enterprises in Austria, Portugal, Germany and Italy, where bank loans play a greater role. What we see in Table 5 is that at the country level tangibility, profitability, size of a companies and Interests on financial debts/Total Assets are significant for bank loans in case of whole sample. We conclude that these are crucial variables that we analyze in previous, meta-analysis, section. Analyzing the estimation of parameters, we note that tangibility significantly determines the bank loan financing in the countries surveyed when we consider the company's small and medium-sized. For both groups of companies the impact is negative. The profitability of companies by groups of size does not differentiate between the use of bank credit to finance activities in the countries surveyed. Interests on financial debts in companies big and small significantly differentiate the use of bank credit in the country. A similar conclusion was obtained for Logarithm of Total Assets.

#### **5. Bank loans – Poland level data**

The empirical analysis is based on balance sheet and profit and loss account data reported by Polish firms in annual and quarterly reports of the years 1995 – 2011 (about 50 thousands companies per year). Parameters were estimated using the robust system GMM (Generalised Methods of Moments) estimator

(see: Arellano & Bover, 1995; Blundell & Bond, 1998). In addition, a resistant variance-covariance matrix was used. The structure of the sample shows that small enterprises prevail in number (about 66%), while the share of major companies is smallest (5-7%). Over the years, the share of small companies dropped to the advantage of medium-sized businesses.

A dynamic econometric model has been estimated, describing how the long-term and short-term credit contracted by non-financial companies in Poland is affected by three categories of factors: macroeconomic (WIBOR and the effective currency rate), microeconomic – associated with the internal financial situation and structural (e.g. legal status, direction of sales) (Table 6, Table 7). A method of estimation addresses the cost of capital in the long- and short-term credit equation, an element being extremely hard to observe at company level.

Factors determining the long-term bank credit contracted by companies have been analysed for the inclination to contract long-term credit (model I and III) and for the extent to which long-term credit is used (model II and IV) (Table 8). Determinants of the short-term bank credit contracted by companies have been analysed in a breakdown by company size (Table 9). Two models have been estimated for each of the three categories: small, medium and large firms, namely: the inclination to contract short-term credit and the extent to which short-term credit is used.

The findings show that the inclination to contract long-term credit is observed to grow in a period of prosperity, while in the years 2000 and 2001, the restrictive monetary policy weakened firms' inclination to contract long-term loans. In response to the economic slowdown of the year 2002, firms were less inclined to contract long-term loans and the share of long-term credit in external funding declined. Poland's accession to EU reduced the demand for long-term credit, opening access to Union's internal market and to EU funds. This resulted in a reduced share of long-term credit contracted from external financing sources over the years 2004-2006. The economic prosperity and good macroeconomic situation of the year 2007 boosted the inclination to contract long-term bank loans. As a result of a downturn, growing interest rates and unstable macroeconomic situation, the share of long-term loans in external funding declined in 2008, in spite of the credit boom. The financial crisis experienced by the EU states in 2009 reduced the inclination to contract long-term bank credit. According to National Bank of Poland's reports, the year 2010 brought tighter lending terms, especially margin and collateral requirements. This resulted in a reduced inclination to contract long-term credit and a lower share of long-term credit in external funding.

Large firms used more short-term credit in the years 2000 and 2001, before the economic crisis and slowdown, while the financial crisis in the EU states (2009-2010) triggered a short-term external financing decline in this category of companies. Medium-sized enterprises used more short-term loans immediately before the financial crisis, i.e. in 1998, 2000 and 2007, while in the category of small enterprises, this form of external financing was more common in the periods 1999-2002 and 2004-2006 than in 1996.

Construction firms and trading companies are more inclined to finance their business with long-term bank credit than industrial firms, while small and medium-sized enterprises add short-term credit too, since they are capable of pledging a higher value mortgage-backed security or collateralize their trade receivables, inventories or VAT receivable. Small firms, considered to be less creditworthy and subject to higher business risks, experience very strict limitations in respect of external financing, including bank credit availability. Hence, they may be more susceptible to the so-called financial accelerator effect and more dependent upon their current financial standing when planning any capital expenditures. Small construction companies, as well as small and medium-sized trading enterprises are more inclined to use short-term bank credit than industrial firms. Construction companies use more long-term bank credit – small construction companies also more short-term bank credit – than industrial companies, due to the high capital intensity of their infrastructural projects, long project payback periods (adequate to credit maturity) and the need to incur expenditures prior to receiving any advance payments or reimbursement grant. Large and medium-sized service firms are less inclined to finance their business with short-term bank credit than industrial companies, while small service firms use less short-term bank credit than industrial firms do, owing to insufficient assets that might be pledged as loan collateral. Firms' inclination to take on long-term bank credit decreases and the long-term credit share in external funding declines, as their profitability and capability of generating cash surplus grows. Monetary policy affects – via the interest rate channel – the inclination to contract long-term bank credit, increasing the cost of external funding. Additionally, higher business profitability, enabling firms to accumulate higher capital reserves and retained earnings, results in a lower inclination to use long-term bank credit, which conforms to the pecking order theory. Medium-sized firms are less inclined to take on short-term bank credit as their profitability and capability of generating cash surplus grows; hence, the share of short-term credit in their external funding decreases – as postulated by the pecking order theory. The situation looks similarly in the category of small enterprises, although at the 20% significance level. Large firms capable of generating cash surplus are more inclined to take on short-term bank credit, which is a result of the larger scale of operations, as well as of having stable sources of income. The higher the quick ratio, the more firms are inclined to take on long-term bank loans, since their capability to service debt in due time grows. On the other hand, firms with a higher cash liquidity (regardless their size) are less inclined to contract short-term bank credit, since they are more capable of financing their current accounts on their own. Higher previous period cash liquidity in large firms and higher current period quick liquidity in medium-sized firms results in a reduced share of short-term bank credit in external funding.

Higher absolute financial losses of a previous period accompany a higher share of long-term credit in external funding, which is a result of the constant inclination to finance business with long-term credit. Financing with new long-term loans plays a major role in small and medium-sized enterprises, since it

provides a significant capital supply with a relatively long maturity. The greater the difference between gross margin and the share of operating profit in net sales revenue, the more debt companies tend to take on, using bank loans. Medium-sized firms are more inclined to take on long-term bank credit than small firms. A higher share of tangible assets in total assets in the current period, with capital expenditures on tangible assets under construction and advances for tangible assets under construction of period  $t$  included, strengthens the inclination to take on long-term bank credit and results in a higher share of long-term bank credit in external funding. A higher share of fixed assets in total assets in the current period results in a reduced inclination to take on short-term bank credit in the category of medium-sized firms and reduces the large and medium sized firms' demand for short-term bank credit financing, since in a situation like this they have a better access to alternative sources of financing, including long-term bank loans. Therefore, medium-sized firms with more substantial assets pledged as collateral are less inclined to use short-term bank credit. This is a consequence of risk aversion, i.e. for fear of losing the ability to service debts in due time, firms choose sources of funding with a longer maturity. A higher share of fixed assets in total assets in previous period, which plays the role of collateral at the stage of the loan application analysis, increases small firms' inclination to contract short-term bank loans. Firms with a relatively low proportion of tangible assets to total assets may be thought of as non-transparent and experiencing more information asymmetry problems.

Firms with a low bankruptcy risk, tend to choose lower long-term loans. Large firms with a higher bankruptcy risk are more inclined to contract short-term bank loans, while small and medium-sized firms with a higher bankruptcy risk are less inclined to contract short-term bank loans. This is caused by the short maturity of these loans and by the fact that loan applications of small and medium-sized firms are analysed longer than those submitted by large firms. Facing a higher credit risk involved in financing small and medium-sized enterprises, banks are more thorough and rigorous when analysing SMEs' creditworthiness and reject loan applications of firms with a lower liquidity, incapable to pay short-term loans in a timely manner. The higher bankruptcy risk causes that small and medium-sized firms are less inclined to take on short-term bank credit. In the category of medium-sized firms, a higher bankruptcy risk of a previous period ( $t-1$ ) at the stage of the loan application analysis, results in a lower share of short-term credit in external financing. Firms with a bankruptcy risk (regardless their size) have a higher share of short-term credit in financing.

In the category of government owned enterprises, only small entities show a significantly higher inclination to use short-term bank credit than that observed in the group of partnerships and civil law companies. The findings show that firms with foreign ownership are less inclined to use long-term bank credit and SMEs with foreign ownership are also less inclined to use short-term bank credit than domestic firms, since they have a better access to alternative sources of financing, including loans from their parent

companies or its subsidiaries. Government owned firms are less inclined to use long-term bank credit than partnerships and civil law companies and this tendency is additionally strengthened by monetary policy, which affects the cost of external financing via the interest rate channel. Owing to the better access to alternative sources of financing, medium-sized firms with foreign ownership have a lower share of short-term bank credit in external funding than domestic firms. Non-specialized and specialized exporters are more inclined to take on long-term bank credit than non-exporters. Monetary policy, via the interest rate channel, increases specialized exporters' willingness to contract long-term bank credit, owing to the better access to credit, including foreign lending. Among small and medium-sized firms, exporters tend to be more willing to contract short-term bank loans and have a higher share of short-term bank credit in external funding than non-exporters, this being a result of an easier access to foreign markets, which involves a higher demand for inventory financing. Furthermore, specialized exporters have a better access to less expensive short-term foreign lending and their currency risk is lower. In the category of SMEs, non-specialized exporters show a lower share of short-term bank credit in external funding than non-exporters at a 15% significance level.

We find that firms financing their business with long-term credit in a previous period are more inclined to use long-term credit. The same applies to short-term credit, what indicates that firms are characterized by stable financial strategy. A higher inventories to sales ratio results in a greater inclination among medium-sized and large firms to finance their business with short-term bank loans, since with higher liquidity they are more capable of debt servicing (maturity matching theory). Small enterprises are much less capable of self-financing than large firms, which is confirmed by their cautious approach to using short-term credit (a negative correlation between the inventories to sales ratio in year  $t-1$  on the use of short-term credit at a 15% significance level). In case of medium-sized firms, the higher inventories to sales ratio in year  $t-1$  increases the short term credit share in external financing.

The effect of tax shield follows the financial leverage model. A higher interest tax shield results in a greater inclination to contract short-term bank loans, owing to economies resulting from deduction of interest payments from taxable income. A higher non-debt tax shield of the given year reduces the inclination to contract short-term bank credit, since other, alternative and less expensive sources of financing can be used. As a result, it is not necessary to borrow from a bank in order to save on taxes. Large firms reduce their tax liabilities significantly through high cost of depreciation. In the group of small enterprises, a higher interest tax shield reduces the inclination to contract short-term credit owing to risk aversion, i.e. fear of losing the ability to service debts in due time. Firms with a high development rate have greater financial needs and, therefore, are more inclined to contract long-term bank credit. Sales growth is inadequate to their financial needs, especially to capital expenditures, since developments are capital-intensive.



A higher share of liquid securities in assets translates into a reduced share of short-term credit in external funding. Medium-sized firms with a higher share of liquid securities in assets of a previous period are less inclined to finance their business with short-term bank credit. Only small enterprises with a higher share of liquid securities in assets of a previous period use more short-term bank credit, since collateral in the form of liquid securities mitigates their credit risk aversion. Payment gridlocks increase small firms' demand for short-term bank credit and its share in sources of financing. In the category of medium-sized firms, previous year's payment gridlocks causes a higher demand for short-term credit, since current financial needs are greater than the revenue from sales.

## **Conclusion**

This article discusses the verification of the effect of publication in the studies regarding the sources of financing business operations, such as bank loans. There is a probability that the results obtained by the researchers may be affected by the problem of statistical significance selection (so-called: publication selection bias). The described study is the continuation and summary of the previous meta-analyses of the authors (Bialek-Jaworska, Dzik-Walczak, Nehrebecka, 2015). Meta-analysis is a technique used in, to a growing extent, economics. The benefit of this work is that, by aggregating results across a large number of investigations and exploiting between-study design variation, we point variables that modify them more precisely than could be done through qualitative review. The meta-analysis enables a more precise assessment of the effect of the given independent variables on the analysed phenomenon. The conclusions of the meta-analysis help explain the discrepancies in the dependencies described by different researchers. Due to the fact that the empirical literature is very diverse as for the applied, often incorrect, estimation methods, the purpose of this article is the verification of the existence of the publication selection bias in the available literature on business financing sources. The works which show a weaker correlation or a lack of significance are less attractive and are seldom published – they are viewed as not providing enough contribution to science and not explaining the studied phenomena.

In the publications regarding bank loans, the publication selection bias was found in the case of the structure of the assets, and profitability. The heterogeneity analysis indicated that some types of data can affect the magnitude of the results. Such an analysis can help researchers in the choice of theoretical approaches for their estimations as it indicates whether the use of specific techniques has impact on the result.

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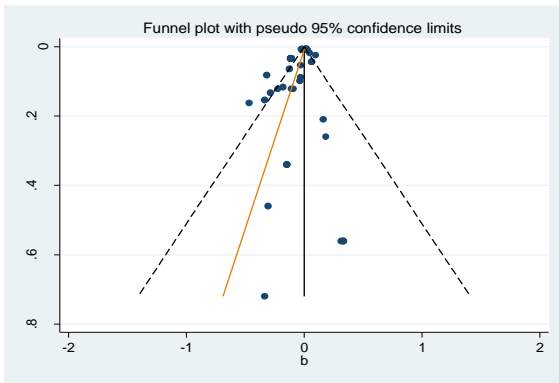
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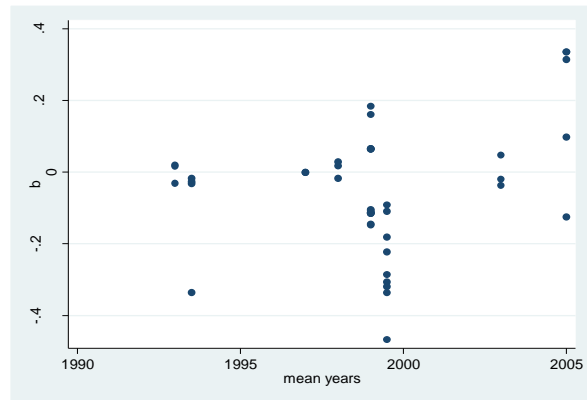
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**Figure 1. Profitability: relation between the parameter estimation and the inverse of the standard deviation.**



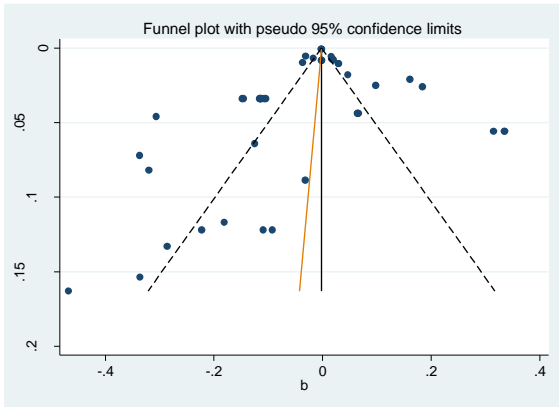
Source: own study based on the review of empirical literature.

**Figure 2. Profitability: change of estimated values in time.**



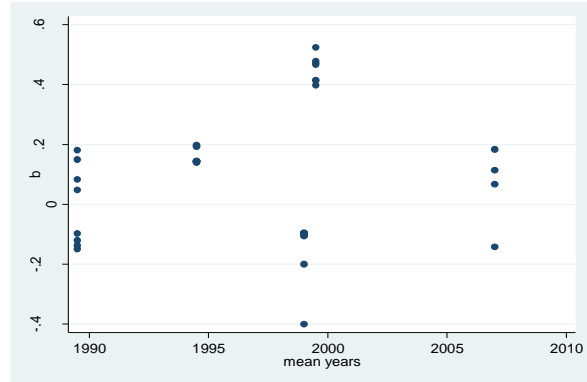
Source: own study based on the review of empirical literature.

**Figure 3. Assets structure: relation between the parameter estimation and the inverse of the standard deviation.**



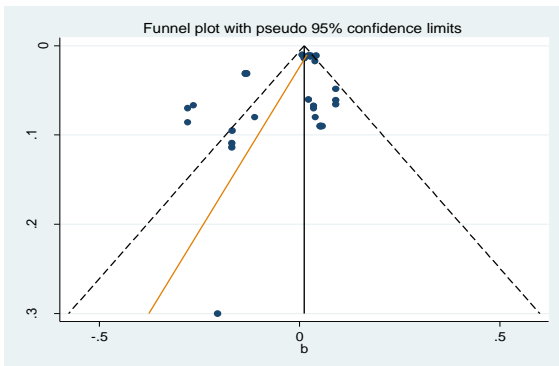
Source: own study based on the review of empirical literature.

**Figure 4. Assets structure: change of estimated values in time.**



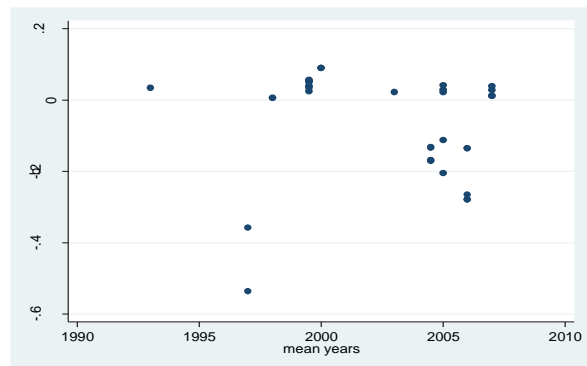
Source: own study based on the review of empirical literature.

**Figure 5. Company size: relation between the parameter estimation and the inverse of the standard deviation.**



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

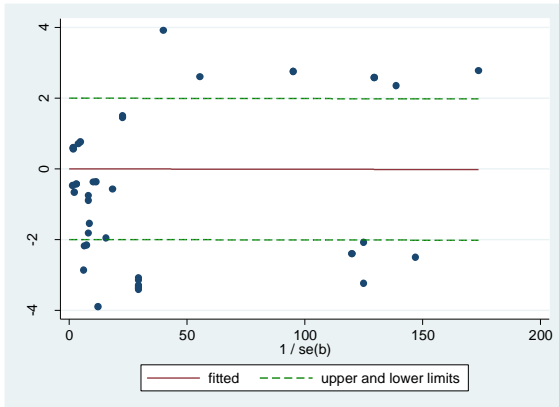
**Figure 6. Company size: change of estimated values in time.**



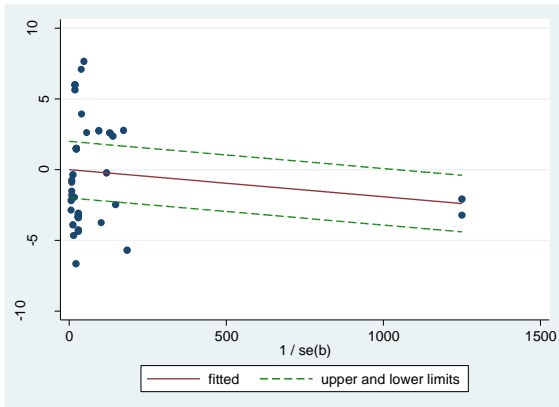
Source: own study based on the review of empirical literature.

**Figure 7. Galbraith plot for the effect of the selected determinants of bank credit financing**

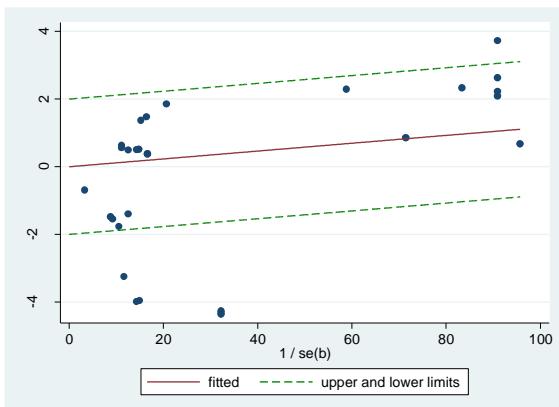
**(I) profitability**



**(II) tangibility**



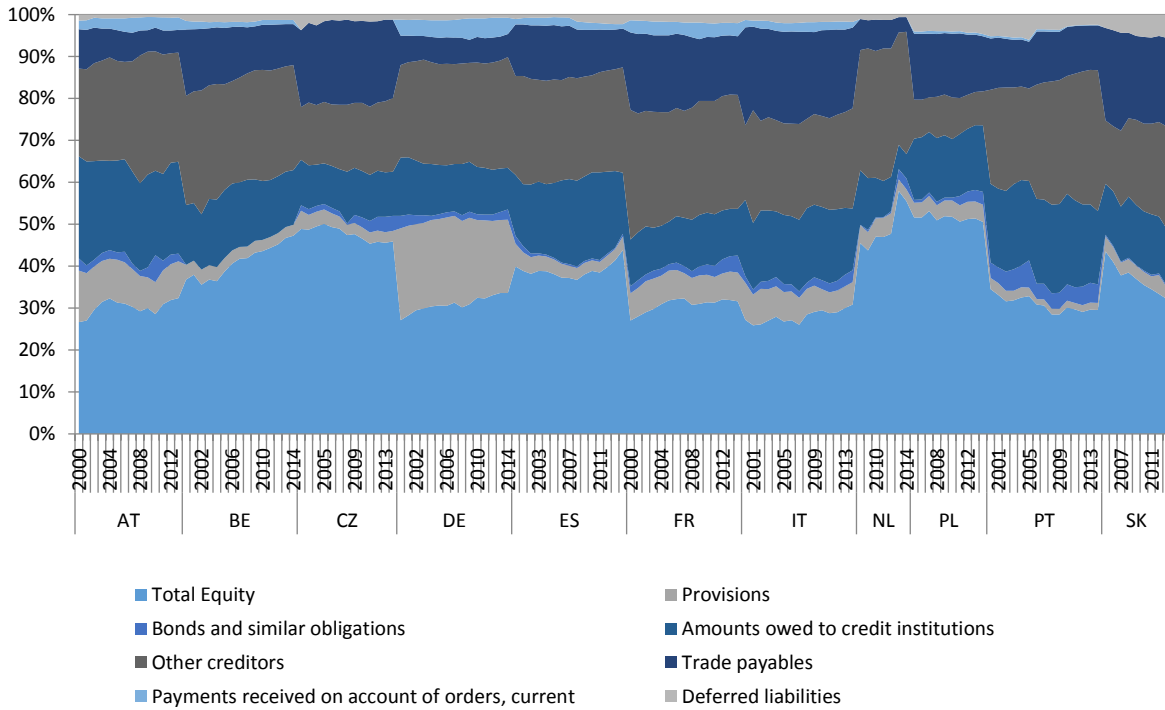
**(III) size**



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

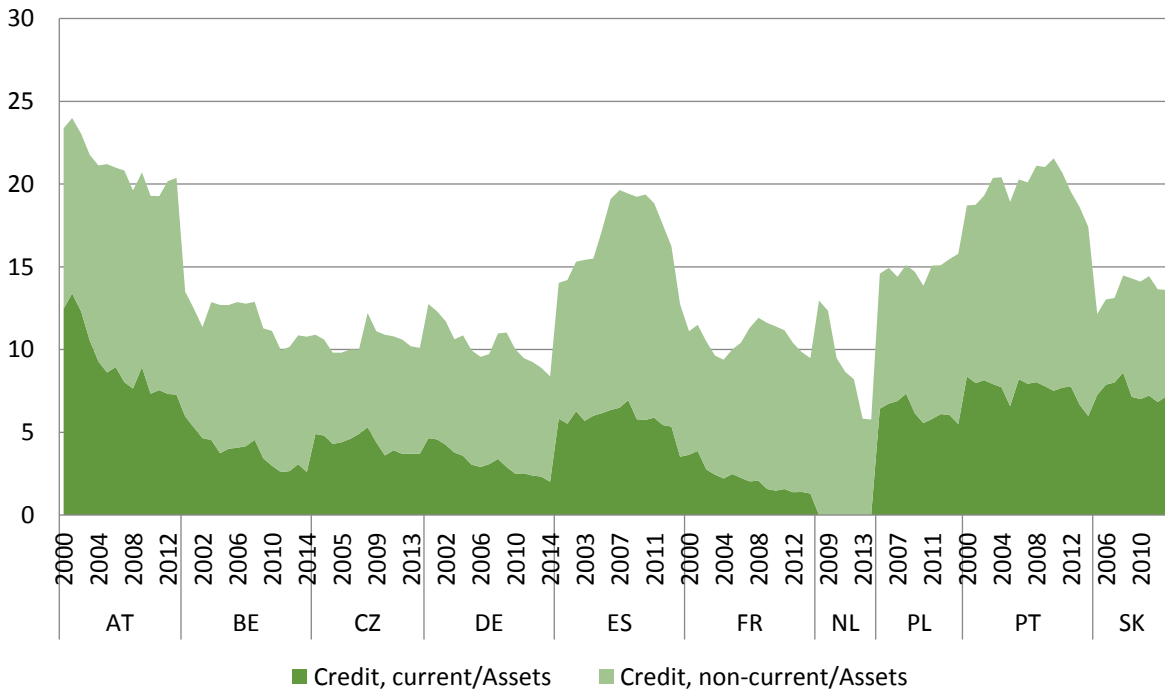


**Figure 8. Weight of each source of financing on total liabilities**



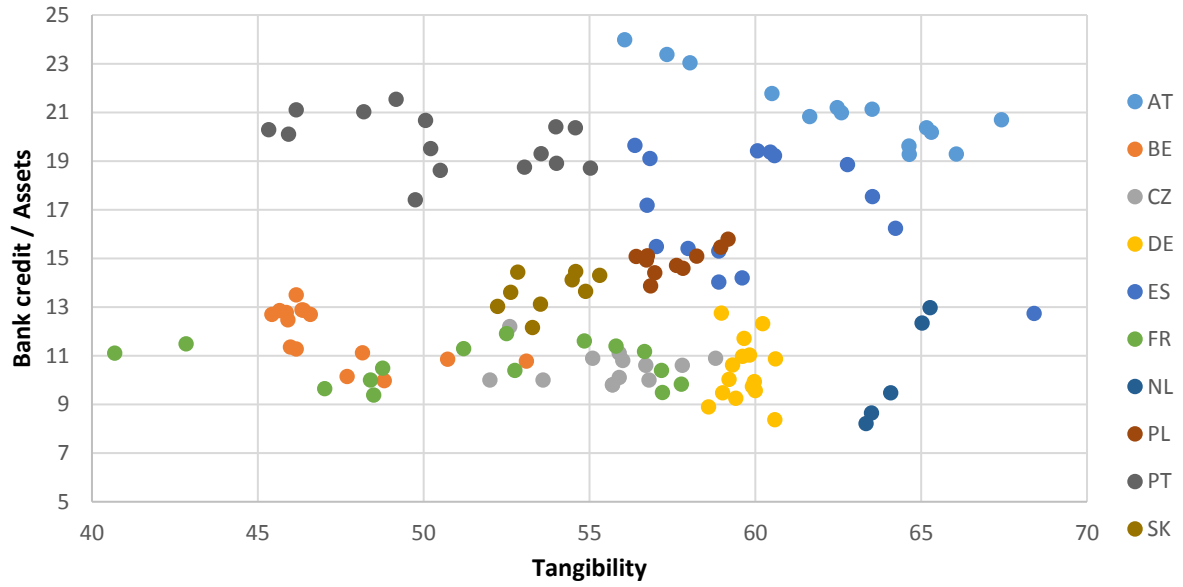
Source: own study based on BACH DATABASE.

**Figure 9. Bank credit on total assets**



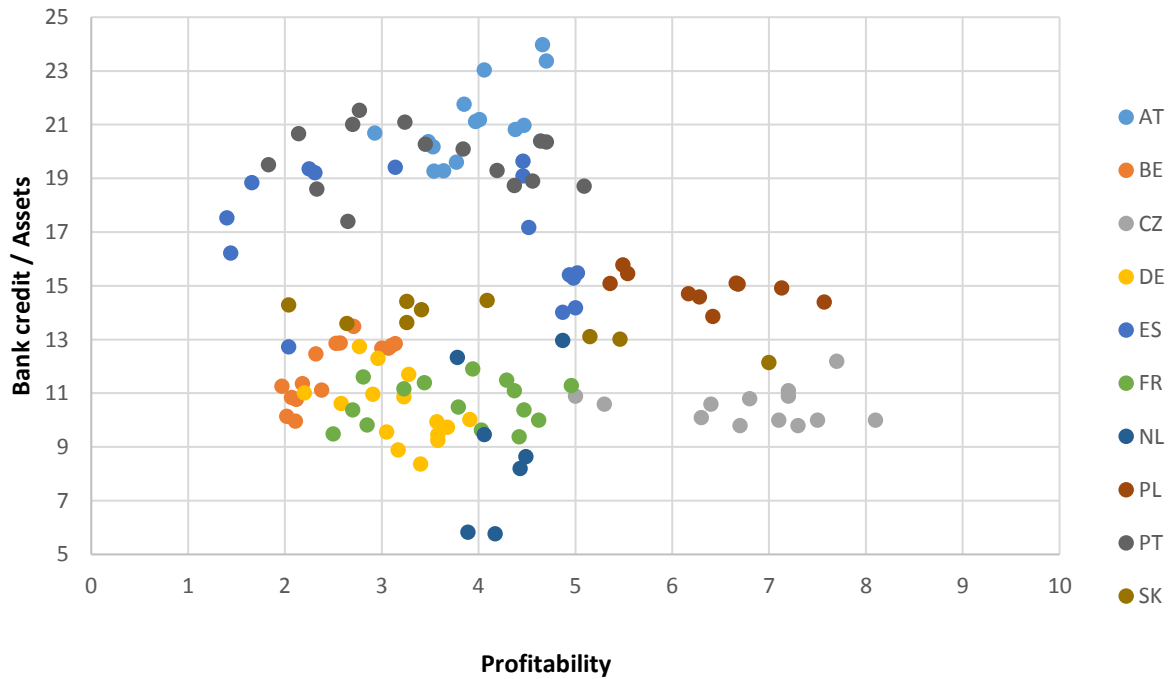
Source: own study based on BACH DATABASE.

**Figure 10. Bank credit and tangibility relation**



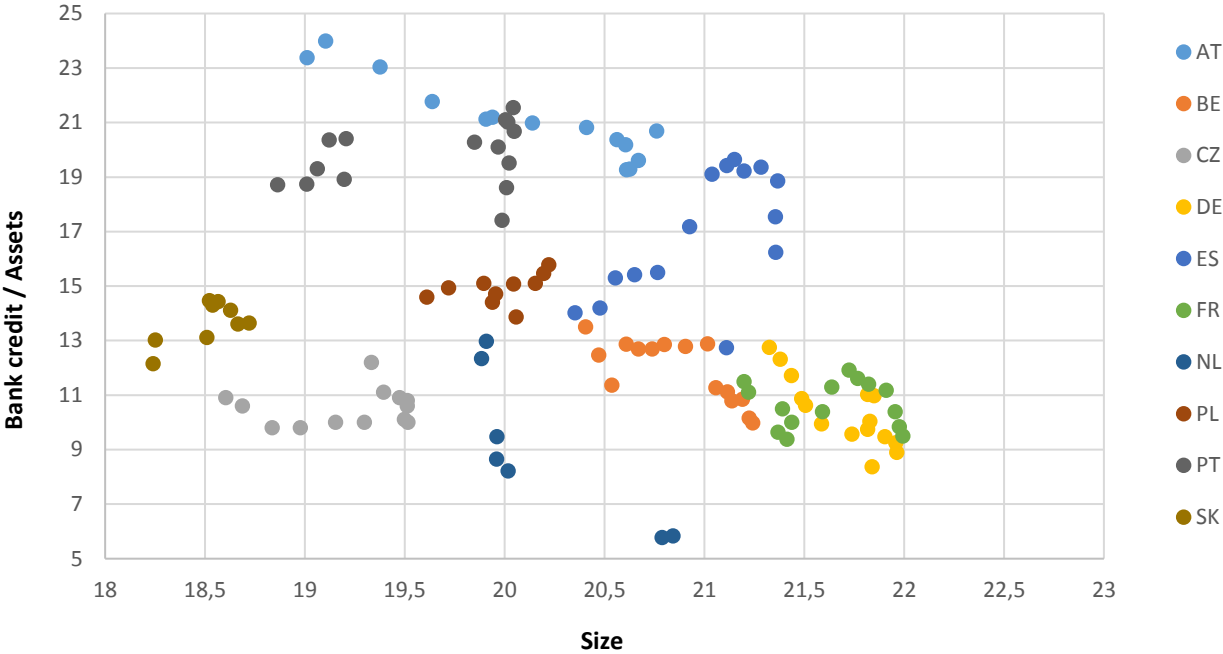
Source: own study based on BACH DATABASE.

**Figure 11. Bank credit and profitability relation**



Source: own study based on BACH DATABASE.

Figure 12. Bank credit and company size relation



Source: own study based on BACH DATABASE.

**Table 1. List of articles included in the last phase of the meta-analysis**

Authors and title	Years of research	Country	Publications	Impact Factor
Alonso et al. (2005) Determinants of Bank Debt in a Continental Financial System: Evidence from Spanish Companies	1991-1996	Spain	The Financial Review, Eastern Finance Association	
Białek, Dzik-Walczak, Nehrebecka (2014)	1995-2011	Poland	Materiały i Studia National Bank of Poland	
Boguszewski, Kocięcki (2000) Wpływ polityki pieniężnej na zachowania przedsiębiorstw w świetle danych GUS i badań ankietowych - wybrane zagadnienia	1994	Poland	Bank i Kredyt	
Bougheas et al. (2006) Access to external finance: theory and evidence on the impact of firm-specific characteristics	1990-1999	Great Britain	Journal of Banking and Finance	1,299
Brown et al. (2011)	2003-2007	Bulgaria	Economic Policy	2.485
Berrospide, Meisenzahl, Sullivan (2012), Credit Line Use and Availability in the Financial Crisis: The Importance of Hedging	2006-2008		FEDS Working Paper	
Cole, Sokolyk (2016) Who needs credit and who gets credit? Evidence from the surveys of small business finances.	1993, 1998, 2003	USA	Journal of Financial Stability	1,506
Cole., Bank Credit, Trade Credit or No Credit: Evidence from the Surveys of Small Business Finances (January 14, 2011). Available at SSRN: <a href="http://ssrn.com/abstract=1540221">http://ssrn.com/abstract=1540221</a> or <a href="http://dx.doi.org/10.2139/ssrn.1540221">http://dx.doi.org/10.2139/ssrn.1540221</a>	1993, 1998, 2003	USA	Office of Advocacy, U.S. Small Business Administration	
Cole, Dietrich (2012) SME Credit Availability Around the World, Evidence from World Bank's Enterprise Survey	2006-2011	80 countries	World Bank's Enterprise Survey	
Cook (1999) Trade Credit and Bank Finance: Financing Small Firms in Russia	1995	Russia	Journal of Business Venturing	3,678
Demiroglu et al. (2012) Bank lending standards and access to lines of credit	1996-2004		Journal of Monetary, Credit and Banking	1.036
Dewaelheyns, Van Hulle (2010) Internal capital markets and capital structure: Bank versus internal debt	1997-2001	Belgium	European Financial Management	1.158
Ghosh, Sensarma (2004) Does monetary policy matter for corporate governance? Firm-level evidence from India.	1992-2002	India	Advances in Financial Economics	
de Haan, Sterken (2000)	1990-1997	EU, Great Britain	De Nederlandsche Bank, Research Memorandum WO&E	
de Haan, Sterken (2006)			European Journal of Finance	0,750
Huyghebaert, Van de Gucht, Van Hulle (2007), The Choice between Bank Debt and Trade Credit in Business Start-ups	1988-1991	Belgium	Small Business Economics	1.795
Jiménez, Ongena, Peydró, Saurina (2010), Credit supply identifying balance-sheet channel with loan applications and grantem loans,	2002-2008	Spain	European Central Bank Working Paper	
Jiménez et al. (2010)	2002-2008	Spain	AMERICAN ECONOMIC REVIEW	2.69
Jiménez, Ongena, Peydró, Saurina, (2012) Credit Supply versus Demand: Bank and Firm Balance-Sheet Channels in Good and Crisis Times	2002-2010	Spain	European Banking Center Discussion Paper	
Jiménez, Ongena, Peydró., Saurina, (2009), Monetary Policy and Credit Crunch: Identifying Simultaneously the Bank Lending and Balance Sheet Channels	1992-2006	Spain	Bank of Spain mimeo	
Love, Peria (2014)	2002-2010	80 countries	World Bank Econ Rev	1.488
Aghion, Askenazy, Berman, Cette, Eymard (2012)	1993-2004	France	Journal of the European Economic Association	3.461

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

**Table 2. Summary statistics for the effect of the selected determinants of bank loan financing**

Group	Variable	The direction of impact	# regressions	Mean	Median	SE	Minimum	Maximum
Profitability	ROA = Net Income / Total Assets	+	13	-0,045	-0,017	0,168	-0,468	0,336
		-	22					
		Not significant	12					
Tangibility	Fixed Assets / Total Assets	+	27	0,089	0,139	0,202	-0,401	0,524
		-	15					
		Not significant	12					
Size	Logarithm of Total Assets	+	19	-0,058	0,023	0,146	-0,536	0,090
		-	12					
		Not significant	6					

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

**Table 3. Linear regression results for (I) profitability, (II) assets structure, (III) company size**

Variables	I profitability b (se)		II assets structure b (se)		III company size b (se)	
<b>Publication selection bias</b>						
1/se	0,0094 (0,0065)		-0,1139*** (0,0362)		0,0327*** (0,0109)	
constant	-0,9718*** (0,4273)		2,1118*** (0,5891)		-1,3635*** (0,5192)	
<b>Publication selection bias + heterogeneity</b>						
Model	FE	RE	FE	RE	FE	RE
<b>Publication bias (K-variables)</b>						
Constant	-0,8315*** (0,3477)	-0,84932* (0,4917)	0,7868*** (0,1682)	0,8496*** (0,2086)	-0,0379 (0,2626)	-0,0337 (0,3023)
No. of firms			-5,44e-06*** (9,90e-07)	-5,63e-06*** (1,07e-06)		
Study citations			0,00678** (0,0034)	0,0071*** (0,0033)		
<b>Genuine empirical effects (Z-variables)</b>						
1/se	0,0227*** (0,0049)	0,0228*** (0,0068)	-0,1085*** (0,0096)	-0,1106*** (0,0107)	0,0229*** (0,0049)	0,0229*** (0,0057)
Sector fixed-effects /se			0,1445*** (0,0335)	0,1392*** (0,0323)		
OLS/se					-0,1728*** (0,0152)	-0,1728*** (0,0174)
One-step estimations/se	-0,0202*** (0,0088)	-0,0202 (0,0123)				
Working paper/se	0,1375*** (0,0272)	0,1376*** (0,0380)				
Time span/se	-0,0046*** (0,0015)	-0,0045** (0,0020)				
N	45		46		35	
F (Ho: K variables are jointly not significant)	-	-	F( 2, 41) = 17.31 Prob > F = 0.0000	F( 2, 41) = 16.24 Prob > F = 0.0000	-	-
Test for residual between-study variance (of tau2=0)	-	Q_res (40 df) = 5.7e+05 Prob > Q_res = 0.0000		Q_res (41 df) = 1001.21 Prob > Q_res = 0.0000	-	Q_res (32 df) = 79153.48 Prob > Q_res = 0.0000

\* Significant at 10%, \*\* Significant at 5%, \*\*\* Significant at 1%. Mean error values are enclosed in round brackets.

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

**Table 4. Potential Explanatory Variables for Meta-Regression Analysis**

<b>Variables</b>	<b>Definition</b>
<b>Data Characteristics</b>	
Panel data	1 if panel data are used (cross-sectional data are the base)
Time span	The number of years of the data used
No. of firms	Sample size/time span
Average year	Average year of the data used
Year of publication	Year when an article was published
Large	1 if large enterprises are investigated
Capital groups	1 if capital groups are investigated
<b>Estimation Characteristics</b>	
Differences	1 if the regression is estimated in differences
Year fixed-effects	1 if year fixed-effects are included
Sector fixed-effects	1 if sector fixed-effects are included
OLS	1 if OLS used for estimations (random effects, GMM, WLS, and others as a base)
Macro	1 if macroeconomic conditions variables are included
One-step estimations	1 if coefficients are estimated in one-step
<b>Specification Characteristics</b>	
Firm size	1 if the specification controls for firm size (sector competition)
One country	1 if one country firms are included in the regression
Lagged spillover	1 if the coefficient represents lagged foreign presence
Europe	1 if European countries are investigated
<b>Publication Characteristics</b>	
Publication date	The publication year of the study
Published	1 if the study was published in a peer-reviewed journal
Study citations	Study citations in Google Scholar per age of the study, as of May 2016
Journal rank	1 if the study published in high journal rank, 2013 ISI impact factor
Working paper	1 if research is a working paper

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

**Table 5. Country data level analysis of bank loans**

Variable	Whole sample		Small firms		Medium firms		Large firms	
	RE	GLS	RE	GLS	RE	Random-effects linear models with an AR(1) disturbance	RE	Random-effects linear models with an AR(1) disturbance
Tangibility (Fixed Assets / Total Assets)	-0,187 (0,035) [-5,3]	-0,124 (0,038) [-3,3]	-0,041 (0,069) [-0,6]	-0,170 (0,057) [-3,0]	-0,269 (0,063) [-4,3]	-0,180 (0,054) [-3,4]	0,014 (0,053) [0,3]	-0,045 (0,042) [-1,1]
Profitability (ROA = Net Income / Total Assets)	-0,489 (0,130) [-3,8]	-0,225 (0,095) [-2,4]	0,122 (0,300) [0,4]	-0,085 (0,234) [-0,4]	-0,429 (0,242) [-1,8]	0,067 (0,192) [0,4]	-0,181 (0,163) [-1,1]	0,038 (0,131) [0,3]
Interests on financial debts/ Total Assets	0,743 (0,421) [1,8]	1,325 (0,370) [3,6]	1,844 (0,638) [2,9]	1,423 (0,441) [3,2]	-0,176 (0,654) [-0,3]	0,052 (0,496) [0,1]	0,696 (0,585) [1,2]	2,237 (0,486) [4,6]
Size (Logarithm of Total Assets)	-0,553 (0,336) [-1,7]	-0,961 (0,366) [-2,6]	-1,386 (0,589) [-2,4]	-3,121 (0,633) [-4,9]	1,522 (0,618) [2,5]	0,263 (0,683) [0,4]	-1,177 (0,486) [-2,4]	-0,651 (0,520) [-1,3]
Constant	37,341 (7,054) [5,3]	39,089 (7,893) [5,0]	45,209 (12,014) [3,8]	84,714 (12,890) [6,6]	6,552 (10,833) [0,6]	22,717 (12,577) [1,8]	33,412 (9,923) [3,4]	23,450 (10,193) [2,3]
N	143							
<b>Diagnostic</b>	<b>Statistical tests</b>	<b>p-value</b>	<b>Statistical tests</b>	<b>p-value</b>	<b>Statistical tests</b>	<b>p-value</b>	<b>Statistical tests</b>	<b>p-value</b>
Test for panel-level heteroskedasticity	151.33	0.0000	158.15	0.0000	2.13	0.9952	-84.94	1.0000
Test for panel-level autocorrelation	29.476	0.0003	13.669	0.0041	52.296	0.0000	-0.034	0.9731
Test of cross sectional independence	1.816	0.0694	0.802	0.4225	0.666	0.5057	8.147	0.0171

Mean error values are enclosed in round brackets, t Student – in square brackets.

Source: own study based on BACH DATABASE.

**Table 6.** Description of variables used in the long-term credit model

Variable	Definition
Long-term credit use	Positive change in long-term bank loan liabilities between year $t$ and $(t-1)$ , according to the balance sheet presentation rules (the part of long-term bank loan liabilities payable within a period up to one year is recorded as short-term liabilities (in year $t$ )) / $(total\ debt + (equity - revaluation\ reserve))$
Company size	Logarithm of assets
Financial loss	$[(Taxable\ financial\ income / Revenue\ from\ sales) - (Operating\ income / Revenue\ from\ sales)] / (Long-term\ liabilities + Short-term\ liabilities\ (issue\ of\ debt\ securities,\ credits,\ loans)\ and\ trade\ liabilities\ (trade\ credit)\ (without\ current\ expenses))$
Self-financing – dynamic approach	Cash flows from operating activities computed by indirect method (Net profit (loss) + Total adjustments) / $(total\ debt + (equity - revaluation\ reserve))$
Quick ratio measure	$(Current\ assets - Inventories) / Short-term\ liabilities$
Non-debt tax shield	$Depreciation / (total\ debt + (equity - revaluation\ reserve))$
Interest tax shield	Interest / Total assets
Growth opportunities	$(Revenue\ from\ sales\ (t) - Revenue\ from\ sales\ (t-1)) / Revenue\ from\ sales\ (t-1)$
Cumulated Return on Equity	$(Retained\ profit + Capital\ reserves) / Equity$
Inverse bankruptcy prediction	Nehrebecka, Dzik (2012)
Tangibility	Tangible assets / Total assets
WIBOR3M	3-month WIBOR interest rate
Effective rate of exchange	Effective rate of exchange

Source: author's analysis.

**Table 7.** Description of variables used in the short-term credit model

Variable	Definition
Short term credit use	Short-term bank credit liabilities without the part of long-term bank credit liabilities payable within a period of up to one year / $(total\ debt + (equity - revaluation\ reserve))$
Liquidate inventory ratio	Inventory / Sales
Liquid securities in assets	$(Short-term\ financial\ assets + cash\ and\ cash\ equivalents) / total\ debt + (equity - revaluation\ reserve)$
Tangibility	Fixed assets / Total assets
Cumulated Return on Equity	$(Retained\ profit + Capital\ reserves) / Equity$
Self-financing – dynamic approach	Cash flows from operating activities computed by indirect method (Net profit (loss) + Total adjustments) / $(total\ debt + (equity - revaluation\ reserve))$
Cash liquidity measure	Cash / Short-term liabilities
Non-debt tax shield	$Depreciation / (total\ debt + (equity - revaluation\ reserve))$
Interest tax shield	Interest / Total assets
Growth opportunities	$(Revenue\ from\ sales\ (t) - Revenue\ from\ sales\ (t-1)) / Revenue\ from\ sales\ (t-1)$
Payment gridlocks measure	Trade receivables / Revenue from sales
Quick liquidity measure	$(Current\ assets - Inventories) / Short-term\ liabilities$
Inverse bankruptcy prediction	Nehrebecka, Dzik (2012)
WIBOR3M	3-month WIBOR interest rate
Effective rate of exchange	Effective exchange rate

Source: author's analysis.



**Table 8** Models of inclination to contract and utilize new long-term credit

Explanatory variable	Models with effect of the year		Models with control variables for the monetary policy impact	
	MODEL I Inclination to contract long-term credit	MODEL II Long-term credit use	MODEL III Inclination to contract long-term credit	MODEL IV Long-term credit use
Long-term credit use one period lagged	0,4895*** (0,0696)	-0,0049 (0,1578)	0,1998*** (0,0368)	-0,2026 (0,3424)
Financial loss	208,7816 (689,4657)		-294,9681 (674,3764)	
Financial loss one period lagged	63,8670 (757,5585)	910,5556* (540,1879)	475,2289 (784,0990)	-1019,4921 (1073,7402)
Medium-sized firms	0,1499*** (0,0560)	0,0107 (0,0624)	1,7035* (0,9476)	1,3906 (1,2842)
Large firms	-0,0295 (0,1038)	-0,0813 (0,0819)	0,5871 (2,2952)	0,2097 (1,8295)
1997	-0,0114 (0,0259)			
1998	0,0009 (0,0222)	0,0095 (0,0099)		
1999	-0,0065 (0,0180)	-0,0102 (0,0110)	0,0430** (0,0169)	0,0343 (0,0347)
2000	0,0122 (0,0157)	-0,0152 (0,0122)	-0,0368** (0,0155)	0,0018 (0,0232)
2001	0,0196 (0,0160)	0,0094 (0,0146)	0,0212* (0,0109)	-0,0262 (0,0199)
2002	-0,0656*** (0,0114)	-0,0644** (0,0262)		
2003		-0,0326*** (0,0122)		
2004	-0,0139* (0,0083)	-0,0364*** (0,0118)	-0,0339*** (0,0084)	-0,0275# (0,0183)
2005	0,0112 (0,0119)	-0,0229* (0,0119)		
2006	0,0145# (0,0094)	-0,0245** (0,0115)	0,0085# (0,0055)	0,0045 (0,0083)
2007	0,0210** (0,0098)	-0,0143 (0,0126)		
2008	-0,0060 (0,0114)	-0,0314*** (0,0098)		
2009	-0,0325** (0,0146)	-0,0158 (0,0143)	-0,0117 (0,0147)	-0,0161 (0,0154)
2010	-0,0269*** (0,0090)	-0,0151### (0,0112)	-0,0129** (0,0060)	-0,0032 (0,0106)
Exporter unspecialised	0,1290* (0,0730)	-0,0352 (0,0629)	0,0911 (0,0831)	-0,0291 (0,0684)
Exporter specialized	0,1699** (0,0730)	0,0507 (0,0889)	0,1780** (0,0801)	-0,0673 (0,1243)
The share of foreign ownership	-0,2402*** (0,0767)	0,1056 (0,1114)	-0,2430*** (0,0859)	0,1118 (0,1502)
Construction	0,1855** (0,0427)	0,1710* (0,0909)	0,2195*** (0,0874)	-0,0488 (0,1304)
Trade	0,2264*** (0,0595)	0,0896 (0,0803)	0,2713*** (0,0598)	-0,1192 (0,1536)
Transport	-0,0863 (0,1174)	-0,0764 (0,1251)	-0,1504 (0,1242)	0,2002 (0,1381)
Other services	0,0274 (0,0657)	0,0076 (0,0536)	0,0771 (0,0705)	-0,0735 (0,0710)
Limited partnerships	-0,2501 (0,4278)	-0,0668 (0,3539)	-0,4583 (0,4189)	0,0087 (0,5293)

Limited liability companies	-0,0144 (0,0852)	0,0002 (0,0566)	-0,0397 (0,0887)	-0,1787** (0,0734)
Joint-stock companies	-0,0488 (0,1173)	0,1055 (0,0824)	-0,0871 (0,1263)	-0,2146** (0,0944)
Foreign companies	-1,2696# (0,8219)		-1,2766# (0,7933)	
State-owned enterprises	-0,3233* (0,1869)	-0,2203 (0,3382)	-0,3628* (0,1931)	-0,3596 (0,3890)
Cooperatives	-0,1626* (0,0936)		-0,1692* (0,1011)	
Others	-0,1293 (0,1186)	0,1691** (0,0768)	-0,1549 (0,1270)	-0,0549 (0,0896)
Self-financing – dynamic approach	-0,2936** (0,1279)	-0,7604*** (0,1284)	-0,2055* (0,1142)	-0,6867*** (0,1346)
Self-financing – dynamic approach one period lagged	0,4421*** (0,1112)	0,0930 (0,1635)	0,3198*** (0,1005)	-0,1232 (0,2063)
Quick ratio measure	0,0117* (0,0069)	-0,0129 (0,0112)	0,0056 (0,0077)	0,0189 (0,0135)
Non-debt tax shield	1329,1726# (822,8181)	-564,1082 (622,0263)	784,1315 (829,6037)	-2070,9775** (936,6371)
Non-debt tax shield one period lagged	-1526,7247* (793,1381)	1055,6131* (614,1637)	202,9648 (688,5436)	1588,4828* (811,1607)
Interest tax shield	1,5338** (0,5956)	2,1298** (0,8080)	1,0643* (0,5885)	1,8957* (0,9982)
Growth opportunities	0,1886* (0,1130)	0,1189# (0,0754)	0,2019** (0,0894)	-0,0950 (0,1362)
Growth opportunities one period lagged	0,0507 (0,0702)	-0,0523## (0,0374)	-0,0933# (0,0582)	0,0891 (0,1017)
Cumulated Return on Equity one period lagged	-0,0178 (0,0262)	0,0985*** (0,0290)	-0,0590** (0,0263)	0,0860# (0,0545)
Inverse bankruptcy prediction	10,0286 (16,2113)	18,3860## (16,1236)	5,2512 (16,4880)	-8,2385 (22,4953)
Tangibility	0,6593# (0,4082)	1,6712*** (0,2294)	0,8868** (0,3890)	1,4422*** (0,4492)
Tangibility one period lagged	-0,0671 (0,3942)	-1,2075*** (0,1074)	-0,5037## (0,3644)	-1,4155*** (0,3036)
WIBOR3M			-0,41 (0,0033)	-0,44 (0,0057)
Effective currency rate			0,39** (0,0016)	0,18 (0,0034)
WIBOR3M X medium-sized firms			3,16** (0,0136)	-2,11 (0,0136)
WIBOR3M X large firms			-3,45 (0,0293)	8,70*** (0,0239)
WIBOR3M one period lagged, small firms			0,14 (0,0024)	0,52 (0,0063)
WIBOR3M two periods lagged, small firms			0,22 (0,0035)	0,06 (0,0058)
WIBOR3M one period lagged X medium-sized firms			-0,46 (0,0124)	1,85 (0,0160)
WIBOR3M one period lagged X large firms			3,95## (0,0291)	-10,33*** (0,0312)
WIBOR3M two periods lagged X medium-sized firms			-2,10* (0,0108)	0,18 (0,0157)
WIBOR3M two periods lagged X large firms			-0,24 (0,0164)	-0,47 (0,0138)
Effective currency rate X medium-sized firms			-0,94# (0,0063)	-0,23 (0,0079)
Effective currency rate X large firms			-0,86 (0,0143)	0,44 (0,0113)
Effective currency rate one period lagged			-0,33* (0,0018)	-0,18 (0,0031)

Effective currency rate two periods lagged			0,45*** (0,0016)	0,57# (0,0038)
Effective currency rate one period lagged X medium-sized firms			1,14# (0,0070)	-0,34 (0,0079)
Effective currency rate one period lagged X large firms			-1,65 (0,0156)	0,63 (0,0120)
Effective currency rate two periods lagged X medium-sized firms			-1,76*** (0,0061)	-0,84 (0,0111)
Effective currency rate two periods lagged X large firms			2,02## (0,0154)	-0,89 (0,0153)
Constant	-0,2591** (0,1041)	-0,4177 (0,5573)	-0,6979*** (0,2559)	-0,0315 (1,0870)
Test	<b>Test statistic [p-value]</b>			
Arellano-Bond Test for the first-order autocorrelation	-21,735 [0,0000]	-13,101 [0,0000]	-21,489 [0,0000]	-6,204 [0,0000]
Arellano-Bond Test for the second-order autocorrelation	2,137 [0,0326]	1,447 [0,1479]	-1,104 [0,2695]	-1,224 [0,224]
Sargan Test	110,236 [0,0470]	216,205 [0,0163]	105,930 [0,0512]	90,247 [0,1435]

**Table 2. Short-term bank credit determinants with the monetary policy impact taken into account**

Explanatory variable	Large firms		Medium-sized firms		Small firms	
	MODEL I Inclination to contract short-term credit b (se)	MODEL II Short-term credit use b (se)	MODEL III Inclination to contract short-term credit b (se)	MODEL IV Short-term credit use b (se)	MODEL V Inclination to contract short-term credit b (se)	MODEL VI Short-term credit use b (se)
Short-term bank credit use one period lagged	1,2881*** (0,1009)	0,3559*** (0,0407)	1,7663*** (0,3030)	0,0314 (0,1556)	1,2802*** (0,2921)	0,4339*** (0,1575)
Short-term bank credit use two periods lagged					0,5983** (0,2775)	
Liquidate inventory ratio	1,8080** (0,8083)	-0,2657 (0,2141)	0,0711 (0,5891)			
Liquidate inventory ratio one period lagged	-2,0609** (0,8430)	0,5038** (0,2236)		-0,2772 (0,2864)	0,4887 (0,4924)	0,0117 (0,2039)
WIBOR3M	-0,43* (0,0024)	-0,08 (0,0011)	-1,24** (0,0053)	0,09 (0,0010)	-0,47*** (0,0015)	-0,09 (0,0010)
WIBOR3M one period lagged	1,15*** (0,0019)	0,18*** (0,0007)	1,55*** (0,0024)	0,66*** (0,0013)	-0,14 (0,0016)	0,07 (0,0012)
WIBOR3M two periods lagged	-1,15*** (0,0030)	-0,02 (0,0010)	-0,61** (0,0029)	-0,49*** (0,0014)	0,11 (0,0020)	-0,09 (0,0014)
Effective currency rate	-0,40*** (0,0008)	-0,01 (0,0003)	-0,37*** (0,0006)	0,02 (0,0004)	-0,17*** (0,0006)	-0,001 (0,0004)
Effective currency rate one period lagged	0,42*** (0,0012)	0,05* (0,0003)	0,44*** (0,0010)	0,09* (0,0005)	-0,09 (0,0009)	0,10** (0,0005)
Effective currency rate two periods lagged	0,19* (0,0010)	0,07** (0,0003)	0,07 (0,0011)	0,13*** (0,0004)	0,17** (0,0007)	0,14*** (0,0005)
1999	0,1548*** (0,0243)	0,0319*** (0,0093)	0,1864*** (0,0393)	0,0775*** (0,0159)	0,0427** (0,0215)	0,0234 (0,0164)
2000	0,0577** (0,0253)	0,0216** (0,0092)	0,1311*** (0,0451)	-0,0021 (0,0128)	0,1200*** (0,0242)	0,0145 (0,0117)
2001	0,1245*** (0,0217)	0,0173** (0,0067)	0,0387## (0,0299)	-0,0024 (0,0102)	0,1010*** (0,0195)	-0,0025 (0,0118)
2004					-0,0409*** (0,0151)	
2005	0,0166 (0,0219)		-0,0127 (0,0273)			
2006	0,0070 (0,0107)	-0,0010 (0,0036)	-0,0094 (0,0097)	-0,0014 (0,0052)	-0,0060 (0,0066)	-0,0011 (0,0052)
2008	-0,0288## (0,0216)	-0,0097## (0,0075)	-0,0338** (0,0172)	-0,0298*** (0,0095)		-0,0261*** (0,0085)

2009		-0,0242*** (0,0080)		-0,0280*** (0,0095)	-0,0260 (0,0207)	-0,0367** (0 0147)
2010	-0,0103 (0,0115)	-0,0043 (0,0056)	0,0038 (0,0107)	-0,0128# (0,0086)	-0,0045 (0,0121)	-0,0071 (0,0078)
Exporter unspecialised	0,0260 (0,0908)	0,0309 (0,0289)	0,0905 (0,1209)	0,0089 (0,0404)	0,1587 (0,1333)	-0,0623 (0,0507)
Exporter specialised	0,0242 (0,1074)	0,0153 (0,0354)	0,2552* (0,1476)	0,1255** (0,0576)	0,2674## (0,1993)	0,0013 (0,0928)
The share of foreign ownership	-0,0706 (0,0969)	-0,0073 (0,0260)	-0,5895*** (0,1695)	-0,1887*** (0,0702)	-0,4574*** (0,1582)	0,1279# (0,0813)
Construction	-0,0177 (0,1348)	0,0591# (0,0376)	-0,1880# (0,1257)	-0,0764 (0,0502)	0,0440 (0,0108)	-0,0316 (0,0610)
Trade	0,0055 (0,1511)	-0,0736* (0,0401)	0,2491* (0,1313)	-0,0030 (0,0443)	0,1181## (0,0922)	-0,0036 (0,0482)
Transport	-0,2576# (0,1589)	0,0426 (0,0486)	-0,0772 (0,2036)	-0,2197** (0,0965)	0,0126 (0,2406)	-0,1149 (0,1036)
Other services	-0,3393*** (0,1013)	-0,0188 (0,0369)	-0,2549** (0,1286)	0,0076 (0,0604)	-0,1181 (0,0997)	0,0059 (0,0530)
Limited partnerships	0,6465 (0,5776)	0,0093 (0,1374)	-1,0044** (0,4411)	-0,1287 (0,3063)	0,7055 (0,8684)	0,2385 (0,3698)
Limited liability companies	-0,1904## (0,1330)	0,0074 (0,0408)	0,0896 (0,1033)	0,1177*** (0,0431)	-0,1284 (0,1073)	-0,0239 (0,0351)
Joint-stock companies	0,0843 (0,1225)	-0,0173 (0,0379)	0,1160 (0,1465)	-0,0222 (0,0618)	-0,4152* (0,2173)	-0,0953 (0,0869)
Foreign companies	-3,3029 (3,4477)	0,7908 (0,6955)				
State-owned enterprises	-0,0137 (0,1952)	-0,0882 (0,0789)	-0,2528 (0,2956)	0,1697 (0,1534)	-0,1826 (0,3613)	-0,2580 (0,3130)
Cooperatives					-0,2967** (0,1297)	
Others	0,2712 (0,2909)	0,2057*** (0,0696)	-0,0794 (0,1914)	-0,0340 (0,0759)	-0,3659** (0,1669)	0,0320 (0,0545)
Liquid securities in assets	-0,2640 (0,3629)	0,0952 (0,2302)	-0,0579 (0,7000)	0,0703 (0,5273)	0,3405 (0,5839)	0,6932 (0,4115)
Liquid securities in assets one period lagged	0,0315 (0,1442)	0,0013 (0,1209)	-0,3826 (0,7237)	-0,2378 (0,4454)	-0,0569 (0,4958)	-0,3565 (0,4070)
Tangibility	-0,0424 (0,4051)	-0,1648# (0,1037)	0,8158 (0,5509)	-0,1881 (0,1829)	-0,2205 (0,4214)	-0,0308 (0,1865)
Tangibility one period lagged	0,3895 (0,3499)	0,0392 (0,1079)	-0,6533 (0,5526)	0,0602 (0,1852)	0,4644 (0,4341)	-0,1229 (0,1856)
Cumulated Return on Equity one period lagged	0,0405 (0,0363)	0,0662*** (0,0173)	0,4025 (0,3114)	-0,2887** (0,1185)	-0,4349** (0,1988)	-0,0281 (0,1134)
Cumulated Return on Equity			-0,4514 (0,3298)	0,2485** (0,1150)	0,4366** (0,2112)	0,0181 (0,1206)
Self-financing – dynamic approach	0,4295*** (0,1570)	-0,1603*** (0,0482)	-0,5818** (0,2054)	-0,0108 (0,0897)	-0,0299 (0,1682)	-0,2105** (0,0835)
Self-financing – dynamic approach one period lagged	-0,0120 (0,0248)	0,0945*** (0,0366)				
Cash liquidity measure	-0,2324*** (0,0676)	-0,0893** (0,0381)	-0,1539*** (0,0330)		-0,1382*** (0,0215)	-0,0238 (0,0570)
Cash liquidity measure one period lagged	0,0401 (0,0328)	0,0273 (0,0238)				
Non-debt tax shield	-133,2199 (772,5174)	507,8992# (344,0444)	-7327,3303*** (1830,8526)	-1117,8592# (714,9313)	-1774,1613## (1273,5663)	-1011,0791 (836,5361)
Non-debt tax shield one period lagged	388,3091 (326,1477)	206,1014 (283,3589)	9148,8272*** (1691,9192)	1398,8546** (546,7805)	1582,3459# (1054,8323)	1408,9310* (818,9098)
Interest tax shield	1,1517## (0,8777)	0,9866*** (0,3645)	2,9029# (1,7708)	3,6951*** (1,1028)	-2,6856## (1,9667)	0,9467 (1,2138)
Interest tax shield one period lagged					3,3940** (1,5913)	0,0859 (0,6397)
Growth opportunities	0,5852*** (0,0907)	-0,0536* (0,0322)	0,2568** (0,1251)		0,0844 (0,1126)	-0,1203* (0,0687)

Growth opportunities one period lagged	-0,0620*** (0,0194)	-0,0005 (0,0216)	0,1725 (0,1351)	-0,0925* (0,0551)	0,2739*** (0,0942)	0,0577 (0,0565)
Payment gridlocks measure	1,2629** (0,6303)	-0,4231** (0,1694)		0,6821** (0,3286)	0,2428 (0,6354)	-0,5037 (0,3616)
Payment gridlocks measure one period lagged	-0,9349*** (0,3058)	0,2720* (0,1536)	0,8932** (0,3698)	-0,0193 (0,2827)	-0,2781 (0,5124)	0,5759 (0,3742)
Inverse bankruptcy prediction	45,6676## (33,8621)	-12,4123 (13,0037)	-131,4245** (56,8771)	89,8833*** (28,8268)	-60,8136** (29,0144)	99,8246*** (15,3522)
Quick liquidity measure				-0,0660** (0,0262)		
Constant	0,0377 (0,2123)	-0,0727 (0,0768)	0,2967 (0,2679)	-0,3459*** (0,1264)	0,5975*** (0,1871)	-0,2740*** (0,1014)
Test	<b>Test statistic</b> <b>[p-value]</b>					
Arellano-Bond Test for the first-order autocorrelation	-22,317 [0,0000]	-9,388 [0,0000]	-11,238 [0,0000]	-4,745 [0,0000]	-11,194 [0,0000]	-5,290 [0,0000]
Arellano-Bond Test for the second-order autocorrelation	-1,693 [0,0904]	1,161 [0,2455]	2,235 [0,0254]	-0,354 [0,7232]	-2,193 [0,0583]	1,582 [0,1136]
Sargan Test	150,614 [0,0323]	141,193 [0,3193]	109,497 [0,0445]	92,586 [0,0512]	91,270 [0,0844]	68,726 [0,3851]