

## The Effects of Single Monetary Policy on Financial Position of Firms in the Slovak Republic<sup>1</sup>

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### Abstract

*The European Central Bank started to stimulate European economies in 2009 since the countries of the European Union have been facing a low growth and low inflation after both the global financial and sovereign debt crisis. The aim of the paper is to evaluate the effects of very low and negative interest rates on the financial position of manufacturing firms in the Slovak Republic using the balance sheet channel. The results confirm that firm-specific determinants affect the capital structure of firms. When assessing the impact of monetary policy on the financial structure in the environment of low interest rates, our findings support the existence of the balance sheet channel in the Slovak Republic, which is apparent in short-term structure.*

**Keywords:** *financial position, low interest rates, monetary policy, negative interest rates*

**JEL Classification:** E52, G32

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### Introduction

After both the global financial and sovereign debt crisis, the countries of the European Union (EU) have been facing a low level of economic growth and low inflation. The Slovak economy was no exception; it manifested a deep recession in 2009 predominantly because of its tight trade links with other EU countries, mainly Germany (OECD, 2010). Since both crises affected the EU's countries, the European Central Bank (ECB) started to stimulate their economies to stabilize

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<sup>1</sup> This work was supported by Masaryk University under internal grant [MUNI/A/1092/2017] and by institutional support of Mendel University. The authors also thank Oleg Deev for his helpful comments and the anonymous referees for their valuable feedback on an earlier version of the paper.

the situation and began to lower the key interest rates, e. g. the interest rate on deposit facility decreased gradually from 2009 until it reached 0.00% in June 2012 and negative values in June 2014. Lower rates should result in extended cash flow and net worth, increase in loans and aggregate demand. There are several channels through which the changes in interest rates can be transmitted into the economy. This paper deals with the balance sheet channel, which allows us to explain the effects of monetary policy on firms' financing using the balance sheet data.

The aim of this paper is to find out if the balance sheet channel exists in the Slovak Republic in the environment of low and negative interest rates. We would like to answer the following research questions. What are main firm-specific determinants of capital structure of firms? Does the monetary policy of very low and negative interest rates affect the financial structure of Slovak firms? What is the response of firm-specific characteristics to monetary loosening? Does the impact differ among small, medium-sized and large firms? Has the structure of debt changed in favour of short-term debt or long-term debt? Answering the questions can help us to evaluate both the factors that influence the financial position of manufacturing firms in the Slovak Republic and the impact of monetary policy in the environment of very low and negative interest rates with respect to balance sheet channel. Our empirical research is focused on the last period of monetary loosening that has taken place since 2009 in the Euro Area (EA). The period from 2009 to 2015 is also investigated as in 2009 the Slovak Republic adopted the euro currency and lost its autonomous monetary policy.

Our study contributes to the empirical evidence in several ways. First, main firm-specific determinants are chosen to confirm their importance within the capital structure of firms. Second, using the firm-level balance sheet data for Slovak manufacturing firms, we investigate the effects of monetary loosening on financing of small, medium-sized and large firms in a comprehensive way.

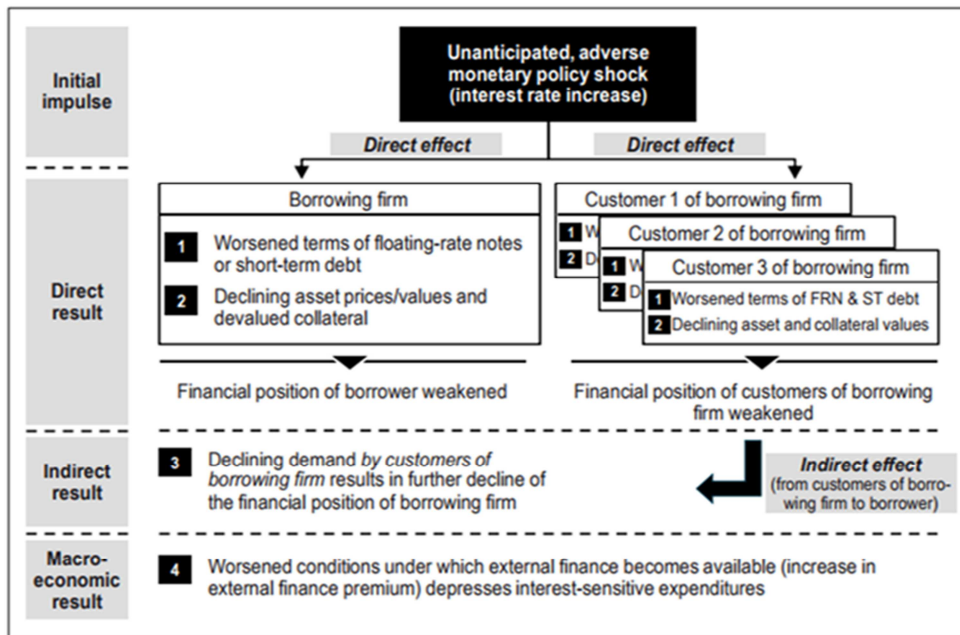
The structure of the paper is organized as follows. The next section explains the fundamental functioning of the balance sheet channel and the studies that deal with the balance-sheet channel are introduced. Then the dataset and its characteristics are presented in the following section. The econometric methodology of the paper follows in section three. Section four brings the results and discussion and section five provides robustness check. The final section concludes the paper.

## **1. Balance Sheet Channel and a Brief Literature Review**

Transmission mechanism represents the process through which the economy is affected by monetary policy decisions, the price level is the crucial variable which is influenced though different channels.

In this paper, the attention is focused on the balance sheet channel which is a part of *money, credit channel*. It can also be called the *broad credit channel* or *broad credit view* according to Gertler and Gilchrist (1993), Bernanke and Gertler (1995), de Haan and Sterken (2006) or Aliyev, Hájková and Kubicová (2015) among others. As emphasized by Bernanke and Gertler (1995), the broad credit view includes the *bank lending channel* which is focused on the effects of monetary policy on the supply of loans and the *balance sheet channel* that emphasizes the possible impact of monetary policy on borrower's balance sheets and income statements. The mechanism of balance sheet channel is demonstrated in Figure 1.

Figure 1  
Mechanism of the Balance Sheet Channel



Source: Brinkmeyer (2015), p. 12.

When focusing on expansionary monetary policy, balance sheet transmission can be described in the following three ways (Mishkin, 1996, p. 11):

$$\uparrow M \rightarrow \uparrow P_e \rightarrow \downarrow \text{asymmetry} \rightarrow \uparrow \text{lending} \rightarrow \uparrow I \rightarrow \uparrow Y \quad (1)$$

$$\uparrow M \rightarrow \downarrow i \rightarrow \uparrow CF \rightarrow \downarrow \text{asymmetry} \rightarrow \uparrow \text{lending} \rightarrow \uparrow I \rightarrow \uparrow Y \quad (2)$$

$$\uparrow M \rightarrow \uparrow \text{unanticipated } P \rightarrow \downarrow \text{asymmetry} \rightarrow \uparrow \text{lending} \rightarrow \uparrow I \rightarrow \uparrow Y \quad (3)$$

where

- $M$  – represents monetary policy,
- $P_e$  – equity prices,
- $I$  – investment spending,
- $Y$  – aggregate demand,
- $i$  – nominal interest rate,
- $CF$  – cash flow,
- $P$  – price level.

When studying the literature on transmission mechanism, one can find a large number of studies that focus on different transmission channels. Since we focus on the balance sheet channel, the consequent text is devoted to the contributions on this topic. To our knowledge, the empirical evidence on this channel is not as extent as it is e.g. for bank lending channel. It can be caused by more complicated access to databases which include firm-specific information. The following review is listed chronologically.

Gertler and Gilchrist (1994) examined the cyclical behaviour of small and large manufacturing firms in response to monetary policy in the U.S. economy between 1958 and 1990 with the use of vector auto-regression (VAR) model. They found out that small firms were more sensitive to the shifts in monetary policy.

Ogawa (2000) brought the evidence on monetary policy effects based on the balance sheets of Japanese manufacturing and nonmanufacturing firms during the period from 1975 to 1998 also with the use of VAR. He concluded that firms' investments were affected by monetary policy and had the impact on the external finance premium predominantly for small firms.

Mizen and Yalcin (2002) studied the impact of tightening monetary conditions on manufacturing firms' credit in the United Kingdom in the period from 1990 to 1999 with the application of panel regression fixed effect model. They found that smaller, younger, highly indebted or riskier firms are more influenced by tightening conditions.

Nagahata and Sekine (2005) investigated the effects of monetary policy on manufacturing and nonmanufacturing firm investments after the asset price bubble collapse in Japan with the use of micro data. They employed the error correction model (ECM) and observed the period from 1993 to 2000. They suggested that the channel was blocked due to deterioration in balance-sheet conditions.

Bougheas, Mizen and Yalcin (2006) analysed the access of manufacturing firms in the United Kingdom to external finance in response to monetary policy. The period from 1992 to 1999 was studied and panel regression model with fixed effects was employed. They came to the conclusion that risky, young, small firms are more affected by tight monetary circumstances.

De Haan and Sterken (2006) provided the evidence on the impact of monetary policy on the financing behaviour of firms from the sectors of manufacturing, construction, trade and transport in the United Kingdom and the Euro Area between 1990 and 1997 with the use of panel two stage least square (2SLS) model. Besides other findings, they found that after monetary tightening, small firms use less debt or firms in market-based systems are more sensitive to interest rate changes. The impact on different sectors was not provided.

Horváth (2006) and Fidrmuc et al. (2010) examined if the interest rates which firms should pay are affected by balance sheet position. Monetary conditions are also considered. The study is focused on 448 Czech firms, the period between 1996 and 2002 and panel model with fixed effects is used. The results indicate that firm-specifics determine corporate interest rates. It was also found that small firms were affected more by monetary policy than medium or large firms and that monetary policy impact is not dependent on the business cycle.

Angelopoulou and Gibson (2009) dealt with the cash flow sensitivity of investments of manufacturing firms in the United Kingdom in the period from 1970 to 1991. Their results indicate that investments are positively dependent on cash flow and confirmed the existence of balance sheet channel because of the effect on net worth of firms and their consequent decisions.

Aliyev, Hájková and Kubicová (2015) studied the existence of balance sheet channel in the Czech Republic during the period from 2003 to 2011 with the application of panel model with fixed effects. Their results showed that monetary contraction caused a reduction of long-term debt and total debt and increase in trade credit and short-term debt. They also confirmed that monetary contraction affected less profitable and smaller firms.

Masuda (2015) examined the impact of monetary policy shocks on fixed investments of manufacturing firms using panel model with fixed effects. The period from 1972 to 2006 was investigated. The results of the study suggest that liquidity of firms' constraints increase when monetary policy tightens, especially for smaller firms.

Zulkhibri (2015) analysed corporate finance behaviour of Malaysian non-financial firms during different monetary conditions. The study includes the period from 1990 to 2010 and uses the generalized method of moments (GMM) to estimate the effects of monetary policy. The results revealed that monetary policy significantly affected access of firms to external finance during times monetary tightening, especially bank-dependent firms.

Linnertová and Kajurová (2017) investigated the changes in the financial structure of Czech blue chips traded in the Prague Stock Exchange during the period from 2009 to 2015 also with the use of panel regressions with fixed effects. They found that the selected firms replace short-term debt by long-term debt.

Karpavičius and Yu (2017) studied the changes in corporate financing policies of non-financial U.S. firms in response to borrowing costs during the period from 1975 for 2014 with panel regressions use. Their results indicated that firms do not alter their capital structure based on interest rates and that the capital structure is adjusted only when real GDP is expected to be negative.

When focusing on the Slovak Republic, it should be mentioned that broad evidence on monetary transmission in the Slovak Republic can be found when we do not distinguish among different channels of transmission, e. g. Matousek and Sarantis (2009) or Lojschová (2017) studied the bank lending channel; the interest rate transmission mechanism was analysed, e.g. in Chuda and Sevcovic (2001) or Mirdala (2009); a study written by Pavlíčková and Urbanovičová (2013) focused on the exchange rate channel among others. A few related information can be found e. g. in Husek and Pankova (2008) who analysed the implications of the financial structure of private sector in the context of monetary transmission mechanism in the Czech and Slovak Republics. However, the complex evidence on the balance sheet channel has been rather limited.

## 2. Data

The dataset is gathered from Amadeus database (firm-specific characteristics), Eurostat and Bloomberg database. Data are of annual frequency and the period from 2009 to 2015 is observed. We chose as the starting year 2009 since the Slovak Republic entered the Eurozone and lost its autonomous monetary policy, and also the ECB began to decrease the official interest rates gradually. The sector of manufacturing is included in the research since it has a business cycle similar to the overall economy.

Even though the tertiary sector has the major share in the structure of developed economies, the sector of manufacturing should not be underestimated since it provides a crucial institutional background for learning and developing process skills, the discussion in Shih (2012).

Originally, the dataset included 18,733 manufacturing firms in total. However, due to missing values in the sample and the elimination of non-active firms, the final dataset includes from 5,037 to 7,140 firms depending on the ratio used as dependent variable. The specific number of firms and observations is provided in the tables within the results section.

When choosing the dependent variable and independent variables, we follow Bougheas, Mizzen and Yalcin (2006), de Haan and Sterken (2006) or Aliyev, Hájková and Kubicová (2015). The following four ratios are adopted as dependent variables:

- RATIO\_1 = total debt/total assets;
- RATIO\_2 = short-term debt/total assets;
- RATIO\_3 = long-term debt/total assets;
- RATIO\_4 = short-term debt/total debt.

The set of explanatory variables with expected signs of coefficients and definition is provided in Table 1.

Table 1  
Explanatory Variables

Variable	Abbreviation	Definition	Expected Sign
EURIBOR3M	MP	Monetary policy indicator in the year $t - 1$ represented by money market interest rate EURIBOR3M	+/-
SENTIMENT	SENT	Control variable for business cycle	+/-
INTERESTS	INT	Interest expenses	-
COLLATERAL	COLL	Tangible assets	+
SIZE	SIZE	The size of the company measured by the balance sheet total	+
DEPRECIATION	DEPR	The conversion of the cost of tangible assets into an operational expense	-
DEBT	DEBT(-1)	Debt outstanding at the end of the previous period	-
PROFIT	ROA	Return on total assets (ROA)	-

Source: Authors' elaboration based on Bougheas, Mizzen and Yalcin (2006), de Haan and Sterken (2006) and Aliyev, Hájková and Kubicová (2015).

We decided to use three-month EURIBOR as a monetary policy indicator since the short-term interest rate is associated with the monetary policy rate. A lagged three-month EURIBOR is used as we expect a delay in a transmission mechanism. Havránek and Rusnák (2013) propose the delay from ten to twenty months in transition economies. The lagged values of interest rate are also used in de Haan and Sterken (2006) or Aliyev, Hájková and Kubicová (2015) among others. When considering the short-term debt, it is expected that the decrease in the monetary policy indicator should lead to a lower price for debt and that the firms get more indebted in order to finance their activities. If we focus on the long-term debt, the impact on the ratios can be ambiguous. In the case the change in official interest rate is reflected in long-term interest rates, the long-term debt becomes attractive for firms, but if it not reflected in long-term rates, the effect of monetary policy cannot be noticed in debt ratios. Additionally, it depends on the overall economic situation – the banks can be very cautious to which firm they provide finance, and therefore the impact can be ambiguous.

The measure of economic sentiment is also included in our research instead of economic growth which many authors use as a measure of the business cycle. We checked for a correlation between economic growth and change in economic

sentiment, and it is almost 75%. We decided to use a variable SENTIMENT since it also includes market agents' expectations. It represents the economic sentiment indicator based on the data of Directorate General for Economic and Financial Affairs of European Commission (Eurostat, 2017). The indicator is derived from surveys gathering the assessments of economic operators of the current economic situation and their expectations about future developments. The impact on the debt ratios can be ambiguous since an increase in the indicator rate can mean that firms are encouraged to shift toward non-debt liabilities because of increased earnings or for some firms the use of shareholder's equity can be much more expensive than debt financing and therefore they can prefer debt financing.

The firm-specific variables INTERESTS, COLLATERAL, DEPRECIATION, DEBT, PROFIT are calculated as a ratio to total assets like in papers by de Haan and Sterken (2006) or Aliyev, Hájková and Kubicová (2015).

Variable INTERESTS that represents interest expenses is based on the trade-off theory introduced by Modigliani and Miller (1963) which shows that firms balance the tax benefit of further unit of debt against the possible financial distress (Ampenberger, Bennedsen and Zhou, 2012). Interest expenses can be deducted from the firms' tax base and indicate the presence of a debt tax shield. They can also be viewed as an indicator of financial distress. The negative sign of the coefficient is expected since low-distressed firms can use external financing more intensively. When considering a debt tax shield, firms can increase external financing to increase interest expenses.

The ratio of tangible fixed assets to total assets is used for variable COLLATERAL like in Bougheas, Mizen and Yalcin (2006), de Haan and Sterken (2006) and Aliyev, Hájková and Kubicová (2015). A positive sign of the coefficient is expected since it is supposed that firms with a higher level of collateral are likely to have more debt both long-term and short-term.

The logarithm of total assets represents the measure of SIZE like in de Haan and Sterken (2006) or Aliyev, Hájková and Kubicová (2015). Large firms have better access to financing than smaller ones. Also it should be taken into consideration that debt financing can be beneficial till a certain level of indebtedness since the weighted average cost of capital (WACC) decreases until it reaches such a level of debt from which the WACC starts to increase (Damodaran, 2003). Gertler and Gilchrist (1994) found that size is a major determinant of access to bank and marketable debt. Oliner and Rudebusch (1996) suggested that small firms are heavily dependent on short-term bank financing.

Variable DEPRECIATION is related to non-debt tax shield. A negative sign is expected since the use of depreciation deductions make the use of debt tax



shield relatively redundant. Prasad, Green and Murinde (2006) stated that firms that can use other non-debt tax shields do not have such a need to exploit the debt tax shield.

We also adopted variable DEBT that represents the total level of indebtedness like in Bougheas, Mizzen and Yalcin (2006). It expresses the total debt outstanding lagged by a one-year period. A higher level of this indicator might discourage creditors from offering further credits, as the firm is more vulnerable in terms of business risk.

Return on assets (ROA) is used as an indicator of PROFIT. It is expected that more profitable firms use less external financing because they can use earnings to finance their activities. On the contrary, less profitable firms are prone to use more debt financing. Therefore, we expect negative coefficients.

Also three dummy variables are applied: *d\_small* which is 1 for firms with balance sheet total less than 10 million EUR and 0 for the others; *d\_large* for firms with balance sheet total more than 43 million EUR and 0 for the others; and *d\_medium* which is 1 for firms with balance sheet total higher than or equal to 10 million EUR and lower than or equal to 43 million EUR, otherwise 0 (see OECD, 2013).

The descriptive statistics of used variables are provided in Table 2. The probabilities of Jarque-Bera test statistics are equal to zero in cases not reported here; hence, the normality is rejected in all cases.

Table 2

#### Descriptive Statistics

Variable	Mean	Median	Max	Min	Std. Dev.	J.-B. Stat
MP	0.0048	0.0029	0.0136	-0.0013	0.0050	3 201.7380
SENT	0.0291	0.0639	0.1690	-0.0941	0.0966	3 478.6340
INT	0.0135	0.0084	1.0786	-0.0480	0.0204	3.58E + 08
COLL	0.4024	0.3882	3.3730	-2.2633	0.2573	414.2364
SIZE	6.3576	6.1814	14.628	-1.9519	1.9407	753.7324
DEPR	0.0882	0.0657	9.8950	-0.6646	0.1069	6.56E + 09
DEBT(-1)	0.1321	0.0493	41.7997	-7.9722	0.3371	7.58E + 10
ROA	1.7373	1.8755	98.8880	-99.944	19.8686	41 063.8600

Source: Authors' calculations.

### 3. Econometric Methodology

The main interest of our research is to investigate the impact of monetary policy on the financing behaviour of firms. The construction of dependent variables allows us to reveal four questions.

- I. How do firms adjust leverage after the monetary loosening? (RATIO\_1);
- II. How do firms adjust their short-term external financing? (RATIO\_2);

III. How do firms adjust their long-term external financing? (RATIO\_3);

IV. How do firms change their financial choice, the structure of debt, respectively? (RATIO\_4).

We also employ the heterogeneity between firms with respect to their size. We expect that small firms are more dependent on bank external financing, especially short-term external financing, than large firms. We estimate the relationship between ratios and specific characteristics using standard panel model enabling us to control specific effects and to account for firm heterogeneity. The model form is following:

$$Y_{it} = \alpha_1 + \alpha_2 MP_{t-1} + \alpha_3 \Delta SENT_t + \alpha_4 INT_{it} + \alpha_5 COLL_{it} + \alpha_6 SIZE_{it} + \alpha_7 DEPR_{it} + \alpha_8 ROA_{it} + \alpha_9 DEBT_{it-1} + \alpha_{10} DUMMY_{it} + e_{it} \quad (4)$$

Where  $Y_{it}$  is one of the defined debt ratios of firm  $i$  in year  $t$ ,  $MP_{t-1}$  is monetary policy indicator in a year  $t-1$ , we use three-month interbank money market interest rate EURIBOR, which is also used in Angeloni, Kashyap and Mojon (2003), de Haan and Sterken (2006) and Aliyev, Hájková and Kubicová (2015),  $\Delta SENT_t$  controls for cyclical effects and expectations, as a positive expectation encourages firms to shifts toward long-term and non-debt liabilities,  $INT_{it}$ ,  $COLL_{it}$ ,  $SIZE_{it}$ ,  $DEPR_{it}$ ,  $ROA_{it}$ , and  $DEBT_{it-1}$  denote non-stochastic firm-specific explanatory variables explaining financial debt structure of firm  $i$  in year  $t$  (variables are specified in Table 1),  $DUMMY_{it}$  is dummy variable for the size of firm based on balance sheet total at time  $t$ ,  $e_{it}$  the is the error term,  $\alpha_2 \dots \alpha_{10}$  are coefficients to be estimated and  $\alpha_1$  is an intercept.

The investigation that compares estimates from a random effects model against a fixed effects alternative model based on Hausman test (Hausman, 1978) rejects the hypothesis of no systematic difference between coefficients obtained from both models. Therefore, we use the fixed effects model.

Being aware of possible endogeneity problem indicated in the literature, we took into consideration the use of panel GMM (Generalized Method of Moments) as is proposed in Arellano and Bond (1991), as the lags of the level dependent variables might be found correlated with the error terms in commonly applied fixed effect and random effect models and might become inconsistent and inefficient, mainly because of the presence of endogenous variables in the list of independent variables. Nevertheless, the requirements for instruments under GMM stand for the problem of our research, the Sargan test found all suggested instruments to be invalid. We also considered employing ARDL (Autoregressive Distributed Lag) technique. Unfortunately, this approach cannot be used, since our data are not predominantly stationary.

Moreover, taking into consideration the drawbacks of ARDL model (see Chudik et al., 2016 for discussion), our modelling approach seems to be the most relevant option. Thus, the estimates based on panel regression with fixed effects are reported.

After employing regressions for all ratios, the interaction terms between monetary policy indicator and firm-specific indicators are considered to catch the heterogeneity of responses to monetary policy changes as in Aliyev, Hájková and Kubicová (2015) or Kapaściński (2016). The model can be represented as:

$$\begin{aligned}
 Y_{it} = & \alpha_1 + \alpha_2 MP_{t-1} + \alpha_3 \Delta SENT_t + \alpha_4 INT_{it} + \alpha_5 COLL_{it} + \alpha_6 SIZE_{it} + \\
 & + \alpha_7 DEPR_{it} + \alpha_8 ROA_{it} + \alpha_9 DEBT_{it-1} + \alpha_{10} INT_{it} * MP_{t-1} + \\
 & + \alpha_{11} COLL_{it} * MP_{t-1} + \alpha_{12} SIZE_{it} * MP_{t-1} + \alpha_{13} DEPR_{it} * MP_{t-1} + \\
 & + \alpha_{14} ROA_{it} * MP_{t-1} + \alpha_{15} DEBT_{it-1} * MP_{t-1} + e_{it}
 \end{aligned} \tag{5}$$

where  $X_{it}MP_{t-1}$  is the interaction term between monetary policy indicator and company-specific variable. Wooldridge (2002) and Aliyev, Hájková and Kubicová (2015) are followed when estimating the partial effects of monetary policy on the selected ratio and when interpreting the results. Careful attention should be devoted to the interpretation of the coefficients in the case of interacted terms to overcome the incorrect conclusions that can be made.

#### 4. Empirical Results and Discussion

Before demonstrating the results, it is worth to explore correlation coefficients between variables (Table 3). We do not find any strong correlation between independent variables. Only the lagged monetary policy is negatively correlated with the sentiment indicator but the correlation coefficient  $-0.464$  has not proved to be a problem. Only low correlations are observed between other variables.

Table 3  
Correlation Matrix

	MP <sub>t</sub>	SENT <sub>t</sub>	INT <sub>t</sub>	COLL <sub>t</sub>	SIZE <sub>t</sub>	DEPR <sub>t</sub>	DEBT <sub>t</sub>	ROA <sub>t</sub>
MP <sub>t</sub>	1.000							
SENT <sub>t</sub>	-0.464	1.000						
INT <sub>t</sub>	0.024	0.001	1.000					
COLL <sub>t</sub>	0.012	0.002	0.077	1.000				
SIZE <sub>t</sub>	0.014	0.002	-0.195	0.166	1.000			
DEPR <sub>t</sub>	0.037	0.012	0.332	0.173	-0.255	1.000		
DEBT <sub>t-1</sub>	0.003	-0.003	0.081	0.040	-0.009	0.044	1.000	
ROA <sub>t</sub>	-0.028	-0.011	-0.163	-0.115	0.098	-0.156	-0.027	1.0000

Source: Authors' calculations.

Table 4 provides the results of panel estimation. Before analysing the impact of monetary policy, the results for company-specific variables are discussed.

Table 4

**Panel Estimation Results**

	RATIO_1	RATIO_2	RATIO_3	RATIO_4
<b>C</b>	-0.0242 -1.3473	0.1309 <sup>***</sup> 7.929	-0.1549 <sup>***</sup> -15.4001	1.4711 <sup>***</sup> 25.5119
<b>MP<sub>t-1</sub></b>	-0.9228 <sup>***</sup> -4.4577	-1.4618 <sup>***</sup> -7.6908	0.5372 <sup>***</sup> 4.6362	-6.1308 <sup>***</sup> -10.6242
<b>Δ SENT<sub>t</sub></b>	-0.0247 <sup>b**</sup> -2.324	-0.0429 <sup>***</sup> -4.392	0.018 <sup>***</sup> 3.0272	-0.1907 <sup>***</sup> -6.4094
<b>INT<sub>t</sub></b>	2.0961 <sup>***</sup> 29.3605	1.0101 <sup>***</sup> 15.4075	1.0861 <sup>***</sup> 27.1736	-0.5675 <sup>***</sup> -2.946
<b>COLL<sub>t</sub></b>	0.0431 <sup>***</sup> 5.5813	-0.0127 <sup>*</sup> -1.7967	0.0559 <sup>***</sup> 12.9151	-0.2108 <sup>***</sup> -9.1431
<b>SIZE<sub>t</sub></b>	0.0185 <sup>***</sup> 6.799	-0.0055 <sup>**</sup> -2.2255	0.024 <sup>***</sup> 15.7854	-0.0922 <sup>***</sup> -10.866
<b>DEPR<sub>t</sub></b>	-0.1108 <sup>***</sup> -6.9669	-0.1065 <sup>***</sup> -7.2925	-0.0043 -0.4793	-0.0391 -0.7769
<b>ROA<sub>t</sub></b>	-0.001 <sup>***</sup> -16.0773	-0.0009 <sup>***</sup> -15.5561	-0.0001 <sup>***</sup> -3.2002	0.0001 0.2782
<b>DEBT<sub>t-1</sub></b>	0.0843 <sup>***</sup> 22.4119	0.0634 <sup>***</sup> 18.3723	0.0208 <sup>***</sup> 9.8997	-0.0217 <sup>**</sup> -2.5127
<i>Effect of company size</i>				
<b>D_SMALL</b>	-0.0242 <sup>***</sup> -2.6082	-0.0132 -1.5459	-0.011 <sup>**</sup> -2.1238	0.0422 <sup>*</sup> 1.7348
<b>D_MEDIUM</b>	0.0184 <sup>**</sup> 2.2358	0.0099 1.3076	0.0085 <sup>*</sup> 1.8495	-0.0268 -1.2357
<b>D_LARGE</b>	0.0029 0.1641	0.0022 0.1347	0.0007 0.0722	-0.032 -0.6763
<b>Adj. R<sup>2</sup></b>	0.8735	0.8828	0.5787	0.5493
<b>F-statistic</b>	27.6606	30.0966	6.3051	5.2429
<b>D-W stat</b>	1.5222	1.4795	1.7996	2.0725
<b>No of obs.</b>	27,589	27,596	27,591	17,566
<b>No of firms</b>	7,137	7,140	7,137	5,037

Note: \*\*\*, \*\*, \* mean 1%, 5% and 10% level of significance.

Source: Authors' calculations.

The main focus of our research is on the impact of monetary policy on financial position. The estimated coefficients of MP are significant for all ratios. For ratios RATIO\_1, RATIO\_2 and RATIO\_4 the impact of monetary policy has negative signs. We find that monetary loosening encourages firms to use debt, especially short-term debt, for financing. The positive sign in the equation for ratio long-term debt to total debt (RATIO\_3) corresponds with the finding of de Haan and Sterken (2006), who suggested that the monetary policy does not have to be necessarily projected in the long-term interest rates. Therefore, we conclude that increase in the official interest rate is manifested in the price of short-term loans to a higher degree than in the prices of long-term loans. Further, the balance sheet channel can be confirmed.

We also add market agents' expectations into our analysis in order to determine if monetary effects change because of different expectations and the state of the economy. We find significant and negative effects of SENTIMENT on all the debt ratios except for long-term debt where the effect is opposite. Our findings suggest that sentiment encourages firms to focus on long-term debt financing or financing by the equity.

When assessing firm-specific characteristics, we find the majority of these firm capital structure determinants as highly statistically significant with the sign expected. We find a positive impact of interest expenses on the firm capital structure with the exception of RATIO\_4. Although we expected a negative sign, these findings correspond with the aspect that a higher debt reflects a higher interest rate payment. The negative coefficient of INTERESTS means lower demand for debt because of potential financial concerns. This is confirmed only for RATIO\_4, which represents the debt structure of a firm. However, a positive sign might be explained by increasing interest rate payments and domination of this effect for RATIO\_1, RATIO\_2, and RATIO\_3. The same implication of interest expenses on the demand side for debt is suggested by de Haan and Sterken (2006).

COLLATERAL is statistically significant for all debt ratios. Our findings correspond with Bougheas, Mizen and Yalcin (2006), de Haan and Sterken (2006) and Aliyev, Hájková and Kubicová (2015), as explained above, we expected a positive sign, which was confirmed for financial leverage (RATIO\_1) and ratio that measure the share of firm's assets financed by long-term debt (RATIO\_3). Tangible assets used for the calculation expected long-term financing and escalated access to long-term debt. Thus, there is a reduction in the share of short-term debt to total debt (RATIO\_4) and short-term debt to total assets (RATIO\_2) and increase in the long-term debt ratio as total debt to total asset ratio (RATIO\_1) and long-term debt to total asset (RATIO\_3). Berger and Udell (1990) suggested collateral as a very relevant factor that reduces the riskiness of a loan.

SIZE measured by balance sheet total amount has a positive impact on financial leverage (RATIO\_1) and the share of long-term debt financing of a firm (RATIO\_3). We find out that firms with more total assets might use long-term debt (RATIO\_1 and RATIO\_3) and reduce short-term debt (RATIO\_2 and RATIO\_4).

Gertler and Gilchrist (1994) found that size of the firm is a major determinant of access to long-term debt and this was also confirmed by our findings. Oliner and Rudebusch (1996) pointed out that small firms are strongly dependent on short-term debt finances and this was also confirmed.

A negative sign of DEPRECIATION and ROA is expected and also confirmed by our analysis. This means that firms with higher DEPRECIATION or ROA might use internal resources for financing and these firms focus less on external forms of financing, for similar findings see Bougheas, Mizen and Yalcin (2006), de Haan and Sterken (2006) and Aliyev, Hájková and Kubicová (2015).

Amount of debt outstanding DEBT(-1) is a significant determinant for all ratios. The positive coefficient reveals persisting debt financing of the firms. Debt financing is used by firms with higher financial leverage and positively influences the share of short-term and long-term debt in firms. A negative sign for the ratio short-term debt to total debt (RATIO\_4) indicates the focus of firms on long-term financing. The dummy variable for company size confirmed our expectation that small and medium sized firms are more dependent on short-term financing. Small firms in terms of balance sheets total have lower financial leverage, a lower share of long-term debt to total assets and a higher share of short-term debt to total debt.

In the next step of our analysis of firms' reactions to monetary policy changes, we focus on the interaction terms between interbank interest rate and firm-specific characteristics. In order to calculate eventual effects of monetary policy, we use median of the firm specific characteristic in computation. This approach is recommended, e.g. by Wooldridge (2012) and can also be found in Aliyev, Hájková and Kubicová (2015). The estimated coefficients are summarized in Table 5, and the results for full panel estimation with interaction terms can be found in Appendix 1.

Taking interactions between monetary policy and other firm-specific determinants into consideration, the results support our previous findings. We find that majority of firm-specific characteristics are influenced by monetary policy. The impact of individual effects varies within ratios and determinants. For RATIO\_1, the strongest interaction is found for the impact of monetary policy on interest expenses, the weakest for the interaction between monetary policy and collateral. It means that monetary policy of low interest rates influences interest expenses and the firms are open to financial leverage. The important relation between monetary policy and interest expenses is also found for RATIO\_2 that demonstrates a share of short-term debt to total assets. RATIO\_3 is used to measure long-term debt to total assets as the impact of monetary policy has an inverse sign. The results indicate that long-term firms' financing is mostly based on internal financing or equity. The monetary loosening also supports the rearrangement of debt on behalf of short-term debt as negative signs of all interactions for RATIO\_4 indicate.

Table 5  
**Estimated Coefficients of Interactions Terms**

Interaction term	RATIO_1	RATIO_2	RATIO_3	RATIO_4
$MP_{t-1} * INT_t$	-2.3433	-3.1036	0.7643	-8.4261
$MP_{t-1} * COLL_t$	-0.5810	-2.7281	2.1504	-10.9050
$MP_{t-1} * SIZE_t$	-0.9276	-1.2093	0.2824	-5.0248
$MP_{t-1} * DEPR_t$	-1.0567	-2.2547	1.2005	-8.7106
$MP_{t-1} * ROA_t$	-1.0303	-2.5127	1.4862	-9.2573
$MP_{t-1} * DEBT_{t-1}$	-0.6510	-2.5897	1.9424	-9.5350

Source: Authors' calculations.

These findings support the existence of the balance sheet channel, but this channel works mostly for firms' short-term external financing. The monetary policy loosening encourages manufacturing companies in the Slovak Republic to use financial leverage (RATIO\_1) and also increases the share of short-term debt to total assets (RATIO\_2) and to total debt (RATIO\_4). The impact of interaction on RATIO\_3 is positive in all interaction terms. This indicates that monetary loosening does not work in this situation and that the zero lower bound is not fully reflected in long-term interest rates. Thus, firms prefer internal financing or equity for long-term financing.

## 5. Robustness Check

Several tests are applied to measure the robustness of our results. Firstly, we examine the heterogeneous effect of monetary policy concerning economic conditions. Industrial production index (the first difference) in the manufacturing industry to measure the sensitivity of our results. This variable is obtained from the Eurostat and represents an alternative proxy for a business cycle indicator. The outcome of our estimation is provided in Appendix 1. The obtained results correspond with those gained from initial regression equation and findings confirmed the previous results about the effect of monetary policy on debt structure of a firm and the importance of firm-specific determinants. Secondly, we employed alternative measure for monetary policy as we constructed dummy variable that is equal to 1 if the interest rate decreases compare with previous period otherwise 0. The effect of monetary policy measures as the interaction between the dummy variable and the interest rate. The results of panel regression are brought in Appendix 2. The responses of majority variables are in line with the baseline model, except the SENTIMENT which is insignificant in this model and ROA and DEBT. The sign of ROA and DEBT is negative for the RATIO\_4, but this corresponds with our previous expectation of the impact of these variables in firm debt structure (similar findings, e.g., in Bougheas, Mizen and

Yalcin, 2006). Concluding the results for firm-specific characteristics confirm previous findings. Thirdly, the regression with the trend variable is conducted to test whether the link between monetary policy and the structure of financing is not the result of trends in all data series. Results are summarized in Appendix 3 and confirm the robustness of the results. The trend variable is statistically insignificant while the effect of monetary policy persists.

## Conclusions

In this paper, we focused on the reaction of Slovak firms' financial behaviour to monetary policy loosening. The mechanism of this transmission is known as the balance sheet channel of monetary policy. The aim of this paper was to find if the balance sheet channel exists in the Slovak Republic in the environment of low and negative interest rates. The analysis was carried out for manufacturing firms from 2009 to 2015 using Amadeus database.

When focusing on the impact of monetary policy rates on the financial structure of Slovak firms, our results indicate that the ECB monetary policy has a significant impact on the financial structure of Slovak manufacturing firms since it significantly affected all observed ratios in favour of short-term debt. We also found that the majority of firm-specific determinants, such as interest expenses, collateral, size, depreciation, amount of debt outstanding or profit as important elements for access of firms to short-term and long-term debt financing. The consequent analysis of interaction terms between monetary policy rate and firm-specific determinants also supports the significance of monetary policy. The interaction was significant for short-term ratios which demonstrates the overall effect of monetary policy on debt structure of a firm.

Assessing the impact on firms with respect to their size, using dummy variables, we can confirm that size is an important determinant of short-term debt availability, and small and medium-sized firms are sensitive to external financing.

If we focus on the structure of debt, the results showed that monetary loosening leads to support of short-term debt financing of firms. The absence of an effect for long-term ratio indicates that monetary loosening is reflected in short-term debt and the firms use more internal funds for long-term financing.

The private sector debt-to-GDP rose up to 145% of GDP in the EA in 2016. When focusing on the Slovak Republic, it reached 132% of GDP from which the indebtedness of households counts for 40%. Growing household indebtedness seems to be a potential threat to the Slovak economy according to NBS (2017). Also, the level of corporate debt is increasing, and we can view it also as a potential threat since firms prefer short-term debt.



The paper provides empirical evidence on the existence of the balance sheet channel of monetary policy in the Slovak Republic. We found that many firm-specific characteristics, prevailing monetary and economy conditions are important determinants of access to short-term and long-term loans. One should ask if the changes in monetary policy are associated with long-term and sustainable economic growth. Investments should be a primary source of such a growth. Our results revealed that short-term debt became a main source of financing; however, can short-term debt be a source of sustainable and long-term growth? To answer the questions, further research needs to focus on the changes associated with firms' investments. The findings might be employed by both developed countries and former transition economies in the EA.

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## Appendices

### Appendix 1

#### Panel Estimation Results with Interaction Terms

	RATIO_1	RATIO_2	RATIO_3	RATIO_4
C	-0.0310* -1.6767	0.1265*** 7.4168	-0.1574*** -15.2914	1.4947*** 25.2027
MP <sub>t-1</sub>	-1.098 -1.4224	-2.5962*** -3.6453	1.502*** 3.4953	-9.1807*** -3.9212
Δ SENT <sub>t</sub>	-0.0324*** -3.0577	-0.0459*** -4.6929	0.0133** 2.2584	-0.1865*** -6.2650
INT <sub>t</sub>	2.9300*** 29.7519	1.3692*** 15.0669	1.5608*** 28.4584	-1.0611*** -3.9252
MP <sub>t-1</sub> * INT <sub>t</sub>	-148.1392*** -12.8335	-60.3605*** -5.6670	-87.762*** -13.6524	89.7745*** 2.8005
COLL <sub>t</sub>	0.0405*** 4.6440	-0.0098 -1.2132	0.0503*** 10.3871	-0.1911*** -7.4924
MP <sub>t-1</sub> * COLL <sub>t</sub>	1.332* 1.7388	-0.3399 -0.4808	1.6700*** 3.9160	-4.4421** -2.0539
SIZE <sub>t</sub>	0.0189*** 6.7867	-0.0052** -2.0233	0.024*** 15.5317	-0.0963*** -11.0898
MP <sub>t-1</sub> * SIZE <sub>t</sub>	0.0276 0.2730	0.2244** 2.4089	-0.1973*** -3.5124	0.6723** 2.2848
DEPR <sub>t</sub>	-0.1144*** -5.2026	-0.1353*** -6.6690	0.0211* 1.7200	-0.0664 -0.1000
MP <sub>t-1</sub> * DEPR <sub>t</sub>	0.6279 0.2483	5.1958** 2.2268	-4.5874*** -3.2575	7.1512 0.8943
ROA <sub>t</sub>	-0.0012*** -14.0892	-0.0011*** -14.2463	-0.0001 -1.5835	0.0003 1.2308
MP <sub>t-1</sub> * ROA <sub>t</sub>	0.0361*** 0.0104	0.0445*** 4.6413	-0.0084 -1.4582	-0.0408 -1.2521
DEBT(-1) <sub>t</sub>	0.0533*** 11.3760	0.0616*** 14.2463	-0.0083*** -3.1747	0.0011 0.0985
MP <sub>t-1</sub> * DEBT(-1) <sub>t</sub>	9.074*** 10.2172	0.1315 0.1604	8.9402*** 18.0768	-7.1917*** -3.1443
Adj. R <sup>2</sup>	0.8751	0.8832	0.5886	0.5500
F-statistic	28.0429	30.1853	6.5201	5.2493
D-W stat	1.539	1.4846	1.8159	2.0776
No of obs.	27,589	27,596	27,591	17,566
No of firms	7,137	7,140	7,137	5,037

Note: \*\*\*, \*\*, \* mean 1%, 5% and 10% level of significance.

Source: Authors' calculations.

## Appendix 2

**Robustness Check with Industrial Production Index**

	<b>RATIO_1</b>	<b>RATIO_2</b>	<b>RATIO_3</b>	<b>RATIO_4</b>
<b>C</b>	0.0030 0.1397	0.1433 <sup>***</sup> 7.3521	-0.1402 <sup>***</sup> -11.8025	0.4893 <sup>***</sup> 18.1460
<b>MP<sub>t-1</sub></b>	-0.5580 <sup>***</sup> -2.9591	-0.7878 <sup>***</sup> -4.5498	0.2297 <sup>**</sup> 2.1768	-0.6331 <sup>***</sup> -2.6435
<b>Δ IPI<sub>t</sub></b>	-0.0378 <sup>*</sup> -1.8246	-0.0830 <sup>***</sup> -4.3555	0.0450 <sup>***</sup> 3.8770	-0.0256 -0.9720
<b>INT<sub>t</sub></b>	2.0934 <sup>***</sup> -1.8245	1.0010 <sup>***</sup> 15.4002	1.0836 <sup>***</sup> 27.1142	-0.3647 <sup>***</sup> -4.0213
<b>COLL<sub>t</sub></b>	0.0436 <sup>***</sup> 5.6348	-0.0121 <sup>*</sup> -1.7054	0.0557 <sup>***</sup> 12.8620	-0.1741 <sup>***</sup> -17.7270
<b>SIZE<sub>t</sub></b>	0.0177 <sup>***</sup> 6.4523	-0.0054 <sup>**</sup> -2.1558	0.0231 <sup>***</sup> 15.0553	-0.0238 <sup>***</sup> -6.8271
<b>DEPR<sub>t</sub></b>	-0.1110 <sup>***</sup> -6.9694	-0.1049 <sup>***</sup> -7.1760	-0.0060 -0.6740	-0.1595 <sup>***</sup> -7.8874
<b>ROA<sub>t</sub></b>	-0.0001 <sup>***</sup> -15.9411	-0.0009 <sup>***</sup> -15.3213	-0.0001 <sup>***</sup> -3.3405	-0.0020 <sup>***</sup> -25.5670
<b>DEBT<sub>t-1</sub></b>	0.08427 <sup>***</sup> 22.4117	0.0636 <sup>***</sup> 18.4050	0.0207 <sup>***</sup> 9.8450	0.0086 <sup>*</sup> 1.7971
<b>D_SMALL</b>	-0.0244 <sup>***</sup> -2.6310	-0.0134 -1.5780	-0.0110 <sup>**</sup> -2.1127	0.0040 0.3330
<b>D_MEDIUM</b>	0.0185 <sup>**</sup> 2.2475	0.0100 1.3264	0.0085 <sup>*</sup> 1.8402	-0.0017 -0.1668
<b>D_LARGE</b>	0.0032 0.1825	0.0025 0.1556	0.0007 0.0712	-0.0061 -0.2736
<b>Adj. R2</b>	0.8735	0.8830	0.5789	0.7367
<b>F-statistic</b>	27.6628	30.0950	6.3084	11.8014
<b>D-W stat</b>	1.5228	1.4791	1.8000	1.5333
<b>No of obs.</b>	27,589	27,596	27,591	27,602
<b>No of firms</b>	7,137	7,140	7,137	7,142

Note: <sup>\*\*\*</sup>, <sup>\*\*</sup>, <sup>\*</sup> mean 1%, 5% and 10% level of significance.

Source: Authors' calculations.

## Appendix 3

## Robustness Check with Dummy for EURIBOR

	RATIO_1	RATIO_2	RATIO_3	RATIO_4
<b>C</b>	-0.0019 -0.0693	0.1313*** 5.1217	-0.1330*** -11.2560	0.4878*** 13.7670
<b>MP<sub>t-1</sub>*D_MP</b>	-0.4054** -2.2350	-0.3983** -2.4220	0.0074*** 2.0740	-0.2920*** -3.2853
<b>Δ SENT<sub>t</sub></b>	-0.0010 -0.9870	-0.0140 -1.5083	0.0040 0.6928	0.0106 0.8264
<b>INT<sub>t</sub></b>	2.0807*** 29.1951	0.9875*** 15.0571	1.0931*** 27.3606	-0.3586*** -3.9568
<b>COLL<sub>t</sub></b>	0.0411*** 5.3283	-0.0165** -2.3345	0.0576*** 13.3450	-0.1735*** -17.7147
<b>SIZE<sub>t</sub></b>	0.0186*** 6.7907	-0.0040 -1.5318	0.0224*** 14.6329	-0.0243*** -6.9988
<b>DEPR<sub>t</sub></b>	-0.1133*** -7.1150	-0.1087*** -7.4260	-0.0046 0.6087	-0.1596*** -7.8940
<b>ROA<sub>t</sub></b>	-0.0010** -16.1130	-0.0009** -15.6202	-0.0001*** -3.1308	-0.0020*** -25.5721
<b>DEBT<sub>t-1</sub></b>	0.0845*** 22.4672	0.0640*** 18.4805	0.0261*** -2.0002	0.0083* 1.7332
<b>D_SMALL</b>	-0.0286 -1.4486	-0.0184 -1.0104	-0.0104** 0.0455	0.0099 0.3940
<b>D_MEDIUM</b>	-0.0035 -0.2011	-0.004 -0.2260	0.0082* 1.7713	0.0058 0.2587
<b>D_LARGE</b>	0.0039 0.2247	0.0040 0.2410	-0.0001 -0.0115	-0.0058 -0.2617
<b>Adj. R2</b>	0.8734	0.8825	0.5783	0.7366
<b>F-statistic</b>	27.6336	30.0055	6.2948	11.7955
<b>D-W stat</b>	1.5218	1.4748	1.7960	1.5336
<b>No of obs.</b>	27,589	27,596	27,591	27,602
<b>No of firms</b>	7,137	7,140	7,137	7,142

Note: \*\*\*, \*\*, \* mean 1%, 5% and 10% level of significance.

Source: Authors' calculations.

## Appendix 4

## Robustness Check with Trend Variable

	RATIO_1	RATIO_2	RATIO_3	RATIO_4
<b>C</b>	-0.0008 -0.0263	0.1168*** 4.3398	-0.1175*** -7.1613	0.4804*** 12.8947
<b>MP<sub>t-1</sub></b>	-0.5873*** -7.5669	-0.2930*** -6.8520	0.2940*** 5.4002	-0.7310*** -6.5357
<b>TREND<sub>t</sub></b>	0.0010 1.0275	0.0035 1.0478	-0.0025 -1.7931	0.0002 0.1755
<b>Δ SENT<sub>t</sub></b>	-0.0136 -0.0978	-0.0044 -0.3256	-0.009 -1.1157	-0.0223 1.1888
<b>INT<sub>t</sub></b>	2.0656*** 29.3414	1.0160*** 15.4970	1.0795*** 27.0130	-0.3705*** -4.0833
<b>COLL<sub>t</sub></b>	0.0440 5.6885	-0.0109 -1.5292	0.0549*** 12.6740	-0.1758*** -17.8746
<b>SIZE<sub>t</sub></b>	0.0171*** 6.1744	-0.0067*** -2.6529	0.0238*** 15.3762	-0.0230*** -6.5636
<b>DEPR<sub>t</sub></b>	-0.1113*** -6.9221	-0.1048*** -7.1706	-0.0064 -0.7232	-0.1608*** -7.9495
<b>ROA<sub>t</sub></b>	-0.0010*** -16.0367	-0.0009*** -18.3491	-0.0001*** -3.3130	-0.0020*** -25.6262
<b>DEBT<sub>t-1</sub></b>	0.0842*** 22.4066	0.0633*** 18.3491	0.0209*** 9.9110	0.0085* 1.7882
<b>D_SMALL</b>	-0.0264 -1.3345	-0.0140 -0.7711	-0.0124 -1.1199	0.0081 0.3217
<b>D_MEDIUM</b>	-0.0023 -0.1313	-0.0013 -0.0787	-0.0010 -0.1055	0.0048 0.2156
<b>D_LARGE</b>	0.0027 0.1527	0.0045 0.0910	0.0011 0.1235	-0.0049 -0.2179
<b>Adj. R2</b>	0.8735	0.8829	0.5792	0.7367
<b>F-statistic</b>	27.6519	30.1098	6.3138	11.7988
<b>D-W stat</b>	1.5223	1.4777	1.7990	1.5333
<b>No of obs.</b>	27,589	27,596	27,591	27,602
<b>No of firms</b>	7,137	7,140	7,137	7,142

Note: \*\*\*, \* mean 1% and 10% level of significance.

Source: Authors' calculations.