

Factors influencing the use of trade credit in financing Polish listed companies¹

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Abstract: The aim of this article is to identify the most important factors influencing the use of trade credit and to assess their significance for Polish listed companies taking into consideration the role of trade credit as a source of financing. Theoretical and empirical literature does not provide clear guidance regarding factors influencing the use of trade credit. In this study the linear regression model with fixed effects for years is used to describe trade credit use in listed Polish companies in the period 2002–2018. The findings show that the following factors have the most pronounced influence on the use of trade credit: trade payables in the previous period, trade receivables, long-term debt, liquidity and short-term debt. Both long-term and short-term debt financing and trade payables are substitutes for Polish listed companies. Lower liquidity and higher trade receivables are related to a higher use of trade credit.

Keywords: trade payables, trade credit, sources of financing, Warsaw Stock Exchange.

JEL codes: G31, G32, L21.

Introduction

The aim of the article is to identify the most important factors influencing the use of trade credit and to assess their significance for Polish listed companies. Despite many theoretical and empirical studies on the mechanisms for offering and use of trade credit no consensus has yet been reached on the factors influencing the value of companies' trade receivables and payables. In particular the small number of studies on the significance of trade credit for the financial

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structure of Polish companies and the determinants of using this source of financing encourages further research in this area.

Various classifications of factors influencing the use of trade credit may be found in the literature. Generally the factors are divided into two groups: financial and business (Demirguc-Kunt & Maksimovic, 2001) as well as: financial and transactional motives (Zawadzka, 2009). Non-financial motives can be further classified into: strategic, transaction cost reduction and quality control/signalling (Ciżkowicz-Pękała, 2017).

Most of the previous research is focused on offering a possible explanation for the use of or offering trade credit by the companies. When the business motives are presented the studies are often accompanied with theoretical models (e.g. Ferris, 1981; Burkart & Ellingsen, 2004; Lee & Stowe, 1993). On the other hand the empirical investigation of trade credit financing is primarily the factors influencing the net trade credit used by the companies (i.e. the difference between the trade payables and trade receivables). Thorough examination of the theoretical research on this issue leads to a conclusion that the factors influencing the trade payables and trade receivables may differ significantly (see del Gaudio, Porzio & Verdoliva, 2018). As a consequence the focus is on the financial motives for the trade credit use in the companies.

Previous empirical research on the use of trade credit by Polish companies using econometric models has been scarce so far. Particularly noteworthy is the research conducted on the basis of individual panel data from Central Statistical Office reports for the years 1995–2011, for almost fifty thousand Polish companies (Białek-Jaworska & Nehrebecka, 2015). Therefore another attempt at empirical verification of factors influencing the amount of trade payables used by the companies in Poland is most justified.

The study is based on a sample of Polish companies listed on Warsaw Stock Exchange in 2002–2018. The long period of time covered by the analysis and a sample consisting of mainly large companies makes it possible to focus on the long-term relationships between the financial situation of the company and the use of trade credit.

The article is structured as follows. On the basis of the review of the literature on the motives for offering and using trade credit by companies, the role of trade credit as a source of financing for companies is described in Section 1. In the next section the most important factors influencing the use of trade credit are presented. In Section 3 the significance of the identified factors influencing the use of trade credit by the Polish listed companies is verified with the use of econometric modelling (linear regression model with fixed effects).

The findings of the study presented in Section 4 show that the following factors significantly influence the use of trade credit by the Polish listed companies: trade payables in the previous period, trade receivables, long-term debt, liquidity and short-term debt.

1. Trade credit as a source of financing for business operations

Trade credit is obtained by the company in the form of a deferral of payment for supplies of goods or services. Apart from bank loans trade credit is the most frequently used source of financing for companies worldwide (Beck, Demirguc-Kunt, & Maksimovic, 2008; del Gaudio et al., 2018). It was also confirmed by a survey of Polish listed companies (Duliniec, 2017). Out of 200 surveyed companies about 80% declared the use of bank loans while 78% confirmed the use of trade credit. At the same time issues of corporate bonds were the source of raising debt capital only in less than 20% of the surveyed listed companies.

Trade credit and bank credit are to some extent substitutable. This is particularly true when it is compared with a short-term open-account bank loan. Limited or insufficient access to bank financing, increases the company's interest in obtaining trade credit which is one of the most important financial motives for obtaining trade credit (Schwartz, 1974). In turn incurring significant liabilities to suppliers reduces not only the company's demand for bank loans but also for other sources of debt capital as well as equity capital.

However, the general principle of financing the company postulates maintaining positive net working capital: short-term liabilities (both interest-bearing and non-interest-bearing liabilities) should be lower than current assets held by the company (Petersen & Rajan, 1997). The net working capital is financed with long-term capital which increases the security of financing and the risk of losing financial liquidity is reduced. In such a situation ensuring the company's financial liquidity requires supplementing insufficient sources of short-term financing (including liabilities towards suppliers) with sources of long-term financing. This shows that the analysed sources of financing are not only substitutes (as shown above), but also complementary.

Trade payables are a part of the non-interest bearing liabilities but the absence of interest on trade credit does not mean that its use does not involve any cost. Its cost is related to the amount of a lost discount related to cash payment from the supplier and the length of the payment deferral period. The greater the cash discount available and the shorter the deferment period the higher the cost of trade credit used. Therefore the possibility of obtaining bank credit at a lower cost reduces the interest of the company in trade credit which is usually more expensive. Nevertheless some studies show that the trade credit can be obtained at low or no cost as in many cases cash payment does not include an early payment discount (Giannetti, Burkart, & Ellingsen, 2011).

Liabilities to suppliers are an important source of financing for the company's operations. If, at a given level of inventories and trade receivables trade payables increase the cash conversion cycle is shortened and, as a consequence, the company's need to maintain a cash surplus (Ferris, 1981) and to use other short-term sources of financing is reduced.

It should also be underlined that in most cases companies not only use trade credit but also offer it to its customers. Trade receivables are a source of financing for the company's trading partners. Depending on the relationship between trade payables and trade receivables the company may be either a recipient or a provider of net trade credit.

Trade credit should be looked at from two sides—the suppliers of goods and services and their customers. Accordingly decisions to offer and use trade credit are the result of negotiating the terms and conditions of a sale-purchase transaction. The granting of a trade credit by the supplier to the recipient is determined not only by financial motives but also, and above all, by business motives (Demirguc-Kunt & Maksimovic, 2001). Trade credit may be also an important instrument for increasing the sales of a company (Ferris, 1981) and reducing the level of stocks of finished products (Bougheas, Mateut, & Mizen, 2009). Deferral of payment for deliveries enables the recipient to purchase even if he/she does not have the wherewithal to pay in cash.

When it comes to financial motives of trade credit, mutual relations between trade payables and trade receivables have an impact not only on the formation of net working capital, i.e. the relationship between current assets and current liabilities but above all on the company's cash flow within its operating activity and current liquidity.

Receivables, inventories and non-interest-bearing (operating) liabilities are subject to continuous rotation—some of them are repaid or used and new ones are created instead. If the rotation period of inventories is added to the average collection period and then subtracted from the average payment period the speed of the company's cash flow (cash conversion cycle) is determined. The cash conversion cycle has a significant impact on the development of current liquidity and the company's need for additional cash in operating activities. In a situation where raising additional cash is difficult the company will be interested in increasing its trade payables. The longer the cash conversion cycle, the greater the willingness to extend payment terms for deliveries and to increase the financing of the company with trade credit.

2. Factors influencing the company's trade credit liabilities

The most important question when identifying the factors influencing trade credit as a source of financing is whether to analyse the trade payables or rather the net value of trade credit, i.e. the difference between trade credit obtained from suppliers and trade credit offered to customers. If it is assumed that the motives for the use of trade credit are primarily of a financial nature and that the amount of the trade credit offered is determined by business factors the trade payables and trade receivables should be considered separately. If, on the other hand, it is assumed that the factors influencing both trade receivables and

trade payables are very similar, although they concern two opposing parties to the transaction—suppliers and customers—the net trade credit should be analysed. In this study the aim of the analysis is to identify the factors influencing the use of trade credit from the point of view of the company that uses it. The amount of trade receivables from customers is therefore treated as one of the factors influencing the amount of trade payables.

On the basis of the theoretical research on the motives for offering and using trade credit a number of factors influencing use of trade credit can be identified. The factors analysed in empirical research by other authors are presented in Table 1.

Table 1. The influence of selected factors on trade payables

Factor	Positive influence on trade payables	Negative influence on trade payables
Debt financing	Zawadzka (2009)	Fisman (2001) Marzec and Pawłowska (2011) Palacín-Sánchez, Canto-Cuevas and di-Pietro (2019) Pepur, Kovač and Ćurak (2020) Santos and Silva (2014) Bhat (2004)
Size of the company	Petersen and Rajan (1997) de Bodt, Lobez and Statnik (2008) Bougheas et al. (2009) Cassia and Vismara (2009) Madaleno, Bărbuță-Mișu and Deari (2019) Pepur et al. (2020) Zawadzka (2009) Marzec and Pawłowska (2011)	Delannay and Weil (2004) Alphonse et al. (2006) Cunat (2006) Palacín-Sánchez et al. (2019)
Age of the company	Afrifa and Gyapong (2017) Petersen and Rajan (1997)	Alphonse, Ducret and Séverin (2006) Xu, Nguyen and Dao (2020)
Liquidity		Cunat (2006) Huyghebaert (2006) Madaleno et al. (2019) Palacín-Sánchez et al. (2019) Xu et al. (2020)
Profitability	Alphonse et al. (2006)	Delannay and Weill (2004) Madaleno et al. (2019) Palacín-Sánchez et al. (2019) Pepur et al. (2020) Xu et al. (2020)

Factor	Positive influence on trade payables	Negative influence on trade payables
Level of inventory	Cunat (2006) Fisman (2001) Palacín-Sánchez et al. (2019) Zawadzka (2009) Marzec and Pawłowska (2011)	Petersen and Rajan (1997)
Growth of revenue	Cunat (2006) Palacín-Sánchez et al. (2019)	Białek-Jaworska and Nehrebecka (2015)
Tangibility of assets	de Bodt et al. (2008)	Cunat (2006) Xu et al. (2020)
Asset turnover	Rodríguez-Rodríguez (2006)	Cassia and Vismara (2009)
Capital expenditure		Rodríguez-Rodríguez (2006)
Capacity use of the company	Fisman (2001)	
Probability of bankruptcy	de Bodt et al. (2008) Huyghebaert (2006)	
Unused credit facilities		Petersen and Rajan (1997)
Cost of goods sold	Cunat (2006)	

Source: Own work.

In the studies mentioned in Table 1 the use of trade credit was most often analysed in light of the companies' use of debt financing, the size and age of the company, level of inventory, and liquidity. Moreover, a significant number of factors was taken into account only in some studies including profitability, growth of revenue, tangibility of assets, asset turnover, capital expenditure, capacity use of the company, probability of bankruptcy, the amount of unused credit facilities and cost of goods sold.

For the purpose of this study the following factors were identified as the most important for the value of trade payables:

- company debt: that is the level of interest-bearing liabilities, divided into short-term and long-term,
- cash surplus, i.e. cash and cash equivalent resources,
- trade receivables,
- size of the company,
- net profitability of company sales,
- sales revenue.

The level of a company's indebtedness mainly due to bank loans and debt securities issued is a measure of a company's access to external sources of debt capital which depends to a large extent on its creditworthiness. The easier this

access the less a company seeks trade credit. In turn restrictions on access to bank financing increase the company's interest in trade credit (Meltzer, 1960). This relationship is further influenced by the issue of financing costs of both sources: the cost of bank credit and the cost of trade credit.

It seems, however, that the relationship between bank loans and trade payables is somewhat more complex. The question arises whether the current size of a company's debt (interest-bearing liabilities) is the result or the reason for the development of trade credit. On the one hand with a small company debt, an increase in trade payables may be an important complementary source of financing (complementarity of bank credit and trade credit). On the other hand however a higher level of debt may reduce interest in trade credit which would rather confirm the ability to substitute these sources of financing.

The cash resources resulting from the company's positive net cash flow, primarily from operating activities, constitute an internal source of financing for the company. The higher their level the higher the company's liquidity and at the same time the less pressure there is on the company to use external-sources of financing, mainly trade credit or bank credit.

The company is both a recipient of trade credit from suppliers and a donor of such credit for the recipients of the company's products. Increasing trade receivables and extending their collection period without a proportional increase of trade payables and extending their payment period could result in the necessity to obtain additional sources of interest-bearing financing (mainly short-term).

The impact of company size on the development of its trade payables is not clear. Usually larger companies are characterised by greater financial credibility and creditworthiness which make it easier for them to access to bank or capital market financing. Therefore they are more likely to choose interest-bearing rather than non-interest-bearing liabilities, especially when bank loans to companies with a lower credit risk are cheaper than trade credit. Smaller companies with lower creditworthiness and limited access to bank credit use trade credit to a larger extent. As a result as the size of an enterprise increases the share of trade payables in the financing of total assets usually decreases.

At the same time the size of a company is related to the bargaining power in negotiating payment terms with suppliers, especially when these are smaller enterprises with a weaker negotiating position. A stronger partner can negotiate deferred payment to suppliers on favourable terms which gives him/her an easy access to non-interest financing. As the company grows an increase in the proportion of trade payables in the company's liabilities can be observed.

Similarly to the size of the company it is difficult to clearly determine the impact of profitability on the level of trade payables. Higher profitability of an enterprise operations means undoubtedly its more favourable financial situation and its higher credibility on the financial market which strengthens access to bank and capital market financing while reducing interest in trade credit.

High profitability of a company's activity also translates into its wider access to internal sources of financing (net profit earned). Profitable companies usually report lower demand for external sources of financing. Therefore as profitability increases it can be expected that the share of trade payables in the financing of the company's assets rather decreases.

It is worth noting, however, that the better financial standing of the company resulting from higher profitability also increases the willingness of its suppliers to offer trade credit to that company. This is because the risk of such a recipient not meeting its obligations to suppliers is small. This in turn indicates that the increase in a company's profitability is often accompanied by an increase in trade payables. In practice a non-linear impact of an enterprise's profitability on the use of trade credit can be observed (Petersen & Rajan, 1997). The highest level of trade payables is observed for companies with the lowest and highest profitability.

The development of current assets, primarily trade receivables and inventories, as well as trade payables is most often proportional to the value of sales revenue generated by the company. Such an assumption is made during financial forecasting. The increase in sales results in an increase of trade receivables if it is assumed that the share of goods for which the company grants trade credit to its customers does not change significantly with the increase in its revenues.

When analysing the trade payables, i.e. the trade credit taken, other factors are sometimes also considered. Apart from the revenues and the costs of goods sold the growth of these items is also examined as a factor influencing the trade payables. Other factors include: the length of the cash conversion cycle, the level of inventory, as well as the financing structure of the company's total assets or fixed assets, with particular emphasis on the share of equity in this financing.

3. Description of the research

The aim of this study is to assess the importance of selected factors mentioned above for the use of trade credit by Polish listed companies. The study is based on the financial data of companies listed on the Warsaw Stock Exchange in 2002–2018 which are the members of the WIG Index. The source of the data is the EIKON Thomson Reuters information service. The sample excludes entities operating in banking and insurance according to the Thomson Reuters classification. As the research method used requires complete financial data for each observation the sample includes only the years and companies for which the value of each variable used in the analysis is available. In such a defined sample there are 4,909 observations for 431 listed companies.

The explained variable in the study are trade payables measured as the ratio of trade payables to the total assets.

In the previous empirical research of other authors trade payables were operationalised either as trade payables in relationship to the cost of goods sold (e.g. Petersen & Rajan, 1997; Love et al., 2007) or in relationship to the total assets (e.g. Delannay and Weill, 2004; Alphonse, Ducret, & Séverin, 2006; Cunat, 2006). As in this study the role of factors describing the financial situation of the company is taken into account, it was decided to analyse trade payables as one of the sources of financing of the company's assets. Therefore the latter measure of trade payables is used.

The study focuses on eight measures of financial situation of the company used as explanatory variables:

- long-term debt measured as the ratio of long-term interest-bearing liabilities to total assets,
- short-term debt measured as the ratio of short-term interest-bearing liabilities to total assets,
- liquidity measured as the ratio of cash and cash equivalents to total assets,
- financing structure of fixed assets measured as the ratio of equity to fixed assets,
- size of the company measured as the natural logarithm of total assets,
- profitability measured as the relation of net profit to company's revenues,
- trade receivables measured as the relation of trade receivables to total assets,
- growth of revenues measured as the ratio of revenues in the current period to revenues in the previous period minus 1.

The level of a company's trade payables is measured at the end of the period (i.e. at the end of year for the yearly data in the sample). The decisions influencing the company's trade payables are made taking into account the expected end-of-period values of the items listed above. As a consequence this study analyses the impact of the explanatory variables in the current period on the value of the explained variable in the current period. The set of explanatory variables is supplemented by the explained variable lagged by one period (i.e. trade payables in the previous period).

Pearson's linear correlation coefficients and the model of linear regression with fixed effects are the main research tools used in the study. First of all the correlation coefficients between the explained variable and the explanatory variables are examined. Next a linear regression model with fixed effects is used to describe the influence of explanatory variables on the explained variable.

As noted in the first part of the study trade payables may be analysed from the perspective of the company's source of financing (i.e. the financial motive) or from the perspective of the business motives for granting and using trade credit. As this study is focused on the financial motives the analysis of factors influencing the use of trade credit is carried out on the basis of a single-equation regression model.

The data analysed are of a panel nature describing a large number of entities compared to the number of periods covered by the analysis. As a result it is necessary to include two-dimensional errors in the study. In addition the explained variable is characterised by high persistency, i.e. the value of the explained variable is strongly correlated with its lagged values. In order to take account of this data structure a generalised method of moment (i.e. GMM-SYS or GMM-DIF estimators) may be used in studies on the factors influencing the use of trade credit while the second best choice is the fixed effects estimator (Baltagi, 2008). It should be noted that the fixed effects estimator allows for consistent estimators for parameters with independent variables (i.e. explanatory variables without lagged explained variable) but the estimated parameter with the lagged explained variable is higher than its true value (Antoniou, Guney, & Paudyal, 2008). The necessity to use a fixed effects model is confirmed by the Breusch-Pagan test confirming the heteroscedasticity ($\chi^2 = 38.53$, significance < 0.0001) and by the results of the Hausman proving the consistency of the fixed effect model in comparison with the random effects model with the same specification ($\chi^2 = 799.33$, significance < 0.0001)

The estimated model includes fixed effects for years which is an equivalent of adding a set of dummy variables for each of the years of the analysis. The estimated parameter values for each year allow for the average value of the dependent variable to change in every period reflecting the influence of changes in macroeconomic and market environment to the extent to which this influence is the same for every company in the sample.

Due to the large number of companies analysed in the study (431) and a small number of observations for some of the companies and taking into consideration the limitations of the estimation method used a model with the fixed effects for companies cannot serve as a baseline.

In view of the above the following regression model is estimated:

$$y_{it} = b_0 \times y_{i,t-1} + b_1 \times x_{1,i,t} + b_2 \times x_{2,i,t} + b_3 \times x_{3,i,t} + \\ + b_4 \times x_{4,i,t} + b_5 \times x_{5,i,t} + b_6 \times x_{6,i,t} + b_7 \times x_{7,i,t} + \\ + b_8 \times x_{8,i,t} + b_9 + \sum_{t=0}^T b_{10+t} \times D_{i,t} + \varepsilon_{i,t}$$

where:

- y : trade payables,
- x_1 : long-term debt,
- x_2 : short-term debt,
- x_3 : company's size,
- x_4 : liquidity,
- x_5 : fixed asset financing structure,

- x_6 : profitability,
- x_7 : trade receivables,
- x_8 : revenue growth,
- $b_0 - b_9$: parameters,
- D : zero-one variables denoting fixed effects for years,
- $b_{10} - b_{24}$: parameters for fixed effects for years,
- ε : random component.

4. Results of the study

The preliminary analysis of the dataset is conducted with the use of descriptive statistics. The research sample consists of listed companies of both low and high market capitalization. At the same time, due to the lack of weights reflecting the share of individual companies in the WIG index, the distributions of explanatory variables are characterized by very high variance, asymmetry and kurtosis significantly deviating from the normal distribution (for which the values of these indicators are 0 and 4 respectively). The sensitivity of the mean and the standard deviation to outliers causes the median for individual variables to differ significantly from the mean (excluding the size of the company which is operationalised as the natural logarithm of total assets). It should be stressed however that in the case of panel data the continuity of the sample is crucial for the estimation of parameters, hence the decision not to remove outliers which were observed for companies experiencing financial distress.

Table 2 presents descriptive statistics for the explained and explanatory variables.

For the average company in the analysed sample the total assets are financed at 14.3% by trade payables at 9.6% by long-term debt and at 8.4% by short-term debt. The average company has total assets of PLN 212.9m while 12.1% of them is in form of cash and cash equivalents and 18.33% is represented by trade receivables. The average company's equity is 33.47 times larger than its fixed assets (as a consequence of outlying observations: for 130 observations (55 companies) the book value of equity is negative, while for 30 observations (17 companies) the book value of equity was at least 100 times larger than the value of fixed assets). The average company in the sample has highly negative profitability with a net profit margin of -452.9% . The revenue growth of the average company amounted to 22,626.6%. It should be stressed that the somewhat surprising means of profitability and revenue growth are a direct consequence of the asymmetry and kurtosis of the distribution of this variable (resulting in outlying observations).

All analysed variables were characterized by a strong positive skewness which means there are more observations in the sample that are lower than

Table 2. Descriptive statistics for the explained and explanatory variables

Variable	Mean	Standard deviation	1. percentile	Lower quartile	Median	Upper quartile	99. percentile	Coefficient of skewness	Kurtosis
Trade payables	0.1428	0.1354	0.0001	0.0426	0.1067	0.1998	0.6116	1.64	6.27
Long-term debt	0.0958	0.1251	0.0000	0.0025	0.0455	0.1426	0.5546	1.88	6.91
Short-term debt	0.0836	0.0928	0.0000	0.0118	0.0557	0.1249	0.4009	1.91	8.82
Size	5.3609	1.9656	0.9325	4.1555	5.2054	6.4623	10.8832	0.70	5.61
Liquidity	0.1206	0.1545	0.0009	0.0268	0.0663	0.1473	0.7882	2.60	10.83
Fixed asset financing structure	33.4698	1691.8900	0.1382	0.8053	1.2030	1.9775	50.4071	68.46	4750.84
Profitability	-4.5293	202.1226	-14.3728	0.0074	0.0429	0.1080	1.9148	-44.78	2754.47
Trade receivables	0.1833	0.1591	0.0000	0.0582	0.1468	0.2701	0.4952	0.03	1.16
Revenue growth	226.2655	14699.5200	-0.8339	-0.0423	0.0907	0.2784	7.2959	65.74	4323.56

All statistics presented in absolute terms.

Source: Own work on the basis of Stata results.

the mean. The exception is net profitability which is characterized by strong left skewness. In the case of kurtosis it should be noted that the distribution of the trade receivables variable is flatter than the normal distribution while the distributions of the other variables are strongly leptokurtic.

When it comes to the median company (i.e. with the characteristics of the middle company in the sample) the total assets are financed at 10.7% by trade payables, at 4.6% by long-term debt and at 5.6% by short-term debt. The total assets of the median company amount to PLN 182.5m, out of which 6.6% is in form of cash and cash equivalents and 14.7% in form of trade receivables. The equity of median company is 1.2 times larger than the fixed assets. 50% of the companies in the sample had a net profit margin lower or equal to 4.3% while their revenue growth was not higher than 9.1%.

To verify the strength of the relationship between the explained variable and the explanatory variables, the Pearson's correlation coefficients are presented in Table 3.

The dependent variable is strongly related to its lagged values (i.e. trade payables in the previous period) while the magnitude of its relationship with the independent variables is visibly smaller. Trade receivables have moderate relationship with trade payables while the relationship of dependent variable and long-term debt is weak. For other independent variables the Pearson's correlation coefficients are below 0.2 which may suggest limited influence on the trade payables.

As far as the relationships between the independent variables are concerned none of the values reported in Table 3 exceeds 0.5. The moderate strength of the relationship is observed only between lagged dependent variable and trade receivables.

The main part of the study is the analysis of the trade payables with the use of the linear regression model with fixed effects the results of which are presented in Table 4.

The regression model was estimated on the basis of 4, 118 observations for 421 companies. There were three determination coefficients for the model reported: R^2 within, R^2 between and R^2 overall. In the fixed effect model the R^2 within is obtained by performing an ordinary least squares estimation on the model so it is an ordinary R^2 .

The other two R^2 coefficients are not equal to the ratio of the variances of observed and predicted values of dependent variable and as a consequence they are not required to be less than 1. R^2 between points that when the average values of the explanatory variables are taken into account the model allows to explain 83.61% of the differences between the observed and predicted relationship of trade liabilities to the total assets of the company. If the model is used to fit the overall data, then it explains the difference of 70.96% between the relationship of trade liabilities to the total assets of the company.

Taking into consideration the use of panel data and the explanatory goal of the study the obtained value of R^2 within (42.28%) can be seen as acceptable.

Table 3. Pearson's correlation coefficient for explained and explanatory variables

	Trade payables	Trade payables in the previous period	Long-term debt	Short-term debt	Size	Liquidity	Fixed asset financing structure	Profitability	Trade receivables	Revenue growth
Trade payables	1.0000									
Trade payables in the previous period	0.8581	1.0000								
Long-term debt	0.2199	0.1946	1.0000							
Short-term debt	0.0465	0.0537	0.0471	1.0000						
Size	0.0887	0.0987	0.2836	0.0731	1.0000					
Liquidity	0.1263	0.0957	0.1969	0.2706	0.2165	1.0000				
Fixed asset financing structure	0.0197	0.0191	0.0142	0.0169	0.0089	0.0079	1.0000			
Profitability	0.0227	0.0029	0.0189	0.0222	0.0291	0.0248	0.0005	1.0000		
Trade receivables	0.5365	0.4932	0.2448	0.0373	0.1734	0.1058	0.0191	0.0233	1.0000	
Revenue growth	0.0045	0.0095	0.0378	0.0017	0.0052	0.0100	0.0003	0.0005	0.0080	1.0000

Source: Own work on the basis of Stata results.

Table 4. Fixed effects model estimates

Fixed effects model			Number of observations	4118
Grouping variable: company			Number of groups	421
R^2 within	0.4228			
R^2 between	0.8361			
R^2 total	0.7096			
	Coefficient	Standard error	t-statistic	Significance
Constant	0.1043	0.0187	5.570	0.000
Trade payables in the previous period	0.4574	0.0274	16.680	0.000
Long-term debt	-0.0525	0.0144	-3.640	0.000
Short-term debt	-0.0486	0.0175	-2.780	0.006
Size	-0.0047	0.0032	-1.490	0.137
Liquidity	-0.0416	0.0131	-3.160	0.002
Fixed asset financing structure	> -0.0001	0.0000	-6.790	0.000
Profitability	< 0.0001	< 0.0001	9.020	0.000
Trade receivables	0.2148	0.0309	6.940	0.000
Revenues' growth rate	< 0.0001	0.0000	3.460	0.001
Fixed effects for years				
2004	-0.0320	0.0129	-2.480	0.014
2005	-0.0293	0.0119	-2.460	0.014
2006	-0.0204	0.0116	-1.770	0.078
2007	-0.0418	0.0119	-3.510	0.001
2008	-0.0340	0.0111	-3.070	0.002
2009	-0.0333	0.0112	-2.960	0.003
2010	-0.0303	0.0109	-2.770	0.006
2011	-0.0283	0.0110	-2.570	0.011
2012	-0.0311	0.0114	-2.720	0.007
2013	-0.0325	0.0114	-2.850	0.005
2014	-0.0329	0.0111	-2.960	0.003
2015	-0.0305	0.0111	-2.740	0.006
2016	-0.0289	0.0112	-2.580	0.010
2017	-0.0235	0.0114	-2.050	0.041
2018	-0.0244	0.0118	-2.060	0.040

Source: Own work on the basis of Stata results.

The models estimated on the basis of time series have significantly higher values of the determination coefficients, often above 90%, while for the cross-series studies the R^2 of 0.4 can be seen as satisfactory. Moreover the aim of this study is to analyse the use of trade credit as the source of financing while the factors influencing the trade payables solely from the perspective of the net working capital management are not included in the model. It should also be noted that other studies of trade credit use in Polish companies did not report the R^2 which makes it impossible to directly compare the accuracy of fit of the model in this study with the results of previous empirical research.

Trade payables in the previous period have a significant positive influence on the explained variable. An increase of one percentage point in the share of trade payables in the total assets at the end of the previous period is related to an increase of 0.46 percentage point in the share of trade payables in the total assets at the end of the current period. It should be underlined that despite the inconsistency of this parameter estimate due to the chosen fixed effects estimator the strength and significance of its impact are high enough to claim that the impact is also significant in the case of the use of a consistent estimator.

Long-term debt has a significant negative influence on trade payables. An increase in the relationship of long-term debt to the total assets by one percentage point is related to a decrease in the share of trade payables in the total assets by 0.053 percentage point. The negative influence of long-term debt on trade payables is in line with the results of empirical research of other authors (Fisman, 2001; Marzec & Pawłowska, 2011; Santos & Silva, 2014; Bhat, 2004).

Short-term debt has a significantly negative effect on trade payables. An increase in the share of short-term debt in the total assets by one percentage point is related to a decrease in the relationship of trade payables to the total assets by 0.049 percentage point. This result is consistent with the findings of other authors in relationship to the negative influence of debt financing on trade payables (e.g. Marzec & Pawłowska, 2011; Santos & Silva, 2014).

The size of a company measured as the natural logarithm of the total assets does not have a significant influence on trade payables at the significance level of 0.1. This may be due to the non-linear impact of this variable on the use of trade credit as suggested by empirical studies of other authors (e.g. Cunat, 2006).

The liquidity of the company has a significant negative influence on trade payables. An increase in the share of cash and cash equivalents in the total assets by one percentage point is related to a decrease in the relationship of trade payables to the total assets by 0.042 percentage point. The negative influence of liquidity on trade credit use was also observed in empirical studies of other authors (e.g. Cunat, 2006; Huyghebaert, 2006).

The financing structure of fixed assets has a significant negative influence on the share of trade payables in the total assets. An increase in the equity to fixed assets ratio by one percentage point is related to a decrease in the relationship of trade payables to the total assets by less than 0.0001 percentage point. As the

distribution of this independent variable in the sample was highly asymmetric and leptokurtic a very small influence on trade payables suggests that other measures may be more adequate to operationalize this variable.

Profitability has a significant positive influence on trade payables. An increase in the company's net profit margin by one percentage point is related to an increase in the relationship of trade payables to the total assets by less than 0.0001 percentage points. The positive influence is in line with the findings of Delannay and Weill (2004) for companies operating in Central and Eastern Europe while contrary results were presented by Alphonse and others (2006) for U.S. small companies.

Trade receivables have a significant positive influence on trade payables. An increase in the share of trade receivables in the total assets by one percentage point is related to an increase in the share of trade payables in the balance sheet total by 0.215 percentage points. The significant positive influence identified in the regression model confirms the results from the analysis of the Pearson's linear correlation coefficients (presented in Table 2), where the relationship between trade receivables and trade payables was the strongest observed among the independent variables. As empirical research of other authors focused on the net trade credit trade receivables were not included in the set of explanatory variables.

The impact of revenue growth in the current period compared to the previous period has a significant positive influence on trade payables. The one percentage point increase in revenue growth leads to an increase in the relationship of trade payables to the total assets by less than 0.0001 percentage points. As it was noted for a small influence of financing structure of fixed assets it proves that the operationalization of this variable should be revisited in future research. At the same time the positive influence of revenue growth is in line with the results of Białek-Jaworska and Nehrebecka (2015) for small and medium Polish companies.

The regression model also takes into account constant effects for years, i.e. dummy variables with a value of 1 in a given year and 0 in other cases. The analysis period included the years 2002 to 2018 but the use of the lagged explained variable in the regression model led to the lack of coverage of 2002 data in the sample while 2003 was taken as the base year. All estimated constant effects for the years are negative leading to a conclusion that in each of the years 2004–2018 the relationship of trade payables to total assets for an average Polish listed company was lower than in 2003. It should be noted that the fixed effects for years are calculated for the whole sample, i.e. the evolution of the average share of total payables in total assets in time may differ significantly between the industries and between the companies.

Based on the above analysis of the parameters of the regression model it is possible to assess the strength and direction of the relationship between the explained variable and the proposed explanatory variables. Since the average

value of random components in the regression model is zero the mean of the explained variable may be calculated as the sum of the products of the estimated parameters and the means of the explanatory variables. In order to determine the economic significance of the impact of selected variables on a company's trade payables the "impact of the sample mean of the explanatory variable on trade payables" is calculated by multiplying the mean value of the explanatory variable by the coefficient of the fixed effect for this variable. The ratio of these products to the mean of the explained variable is then determined reflecting the average influence of each factor in the mean of the explained variable. The results of this analysis are presented in Table 5.

Table 5. Economic significance of the explanatory variables

Explanatory variable	Coefficient	Sample mean	Impact of the sample average explanatory variable on trade payables	Impact of the sample average explanatory variable on trade payables (%)
Constant	0.1043	1.0000	0.1043	61.60
Trade payables in the previous period	0.4574	0.1428	0.0653	38.56
Long-term debt	-0.0525	0.0958	-0.0050	-2.97
Short-term debt	-0.0486	0.0836	-0.0041	-2.40
Size	-0.0047	5.3609	-0.0254	-14.97
Liquidity	-0.0416	0.1206	-0.0050	-2.96
Fixed asset financing structure	> -0.0001	33.4698	> -0.0001	-0.01
Profitability	< 0.0001	-4.5293	-0.0002	-0.09
Trade receivables	0.2148	0.1833	0.0394	23.24
Revenues' growth rate	< 0.0001	226.2655	< 0.0001	< 0.01

Source: Own work on the basis of Stata results.

On the basis of the calculations describing the economic impact of the individual explanatory variables it must be concluded that the highest influence on the predicted relationship of the trade payables to total assets is observed for the constant. It means that the relationship of trade payables to total assets for Polish listed companies is related also to other factors which are not included in the analysis above.

Taking into consideration the explanatory variables chosen for this study the most important factors for the shaping of trade payables in relationship to total assets are as follows: trade payables in the previous period, trade receiva-

bles and the size of the enterprise. The average value of trade payables in the previous period is 0.1428 which is related to an increase of 38.56% in trade payables in the current period compared to a company not using trade credit in the previous period. The mean of trade receivables is 0.1833, which represents a 23.24% increase in trade payables compared to a company not offering trade credit to its customers. The average natural logarithm of total assets in the sample is 5.36, which is related to 14.97% of the average value of trade payables in the current period. The list of variables whose product of the estimated parameter and the average value in the sample is more than 2% of the average value of trade payables include also long-term debt, liquidity and short-term debt. An assessment of the economic significance of the analysed variables indicates that despite the statistical significance of the impact of profitability the financing structure of fixed assets and the rate of revenue growth on trade payables these factors have a very small influence on the use of trade credit by the companies listed on the Warsaw Stock Exchange.

Conclusions

This study identifies the factors influencing the use of trade payables in the light of other authors' research and verifies the empirical significance of the influence of these factors on the use of trade credit in Polish listed companies. A sample with large time and cross-section dimensions mostly including large companies operating in Poland is used in an attempt to identify factors influencing trade credit use. The literature review suggests that trade credit use is influenced mostly by a company's debt, cash surplus, company size, net profitability of company sales and sales revenues. On the basis of the linear regression model with fixed effects reported in this study the following factors have a statistically and economically significant influence on the use of trade credit in Polish listed companies: trade payables in the previous period, trade receivables, long-term debt, liquidity, and short-term debt.

The increase in trade payables in the previous period is related to their increase in the current period. The increase in trade receivables is also related to an increase in trade payables in the current period which is in line with the predictions of theoretical research. Both of these factors are not included in the empirical research of other authors which included mostly net trade credit as the dependent variable.

The increase in long-term debt or short-term debt is related to a decrease in trade payables in the current period. This finding is in line with the negative influence of debt financing observed in empirical research of other authors supporting the substitutability of the company's financing sources described in the literature on trade credit use (e.g. Meltzer, 1960; Burkart & Ellingsen, 2004).

The increase in liquidity is related to a decrease in trade payables in the current period. This direction of the influence is in line with the results of previous research of other authors as well as with the theoretical models of Ferris (1991) or Schwartz (1974).

The findings of this study clearly acknowledge a substitutive relationship between debt financing and trade credit financing as well as an interdependence of trade receivables and trade payables. It is worth noting that these results may be useful for both formulating a financing strategy and cash management due to a better understanding of the importance of trade credit as a source of financing companies' operations.

This study can be viewed as an introduction to further research into the mechanisms of shaping trade payables and receivables of Polish listed companies. Apart from the factors included the analysis cross-industry comparisons of trade credit use and the influence of selected determinants would be of interest. Moreover, decisions affecting the granting and use of trade credit, the level of cash held and the use of interest-bearing liabilities are made by the company on the basis of an assessment of its financial situation and growth opportunities. Each of the indicated factors has an impact on the formation of other variables and the set of their determinants is partly common. From this perspective the analysis of trade payables could be continued with the use of a multi-equation model which would include, in addition to an equation explaining the trade payables, also equations describing the development of the other elements related to the cash cycle in the company such as trade receivables, short-term liabilities, as well as cash and cash equivalents.

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