# Reconsidering the Profitability–Capital Structure Relation: Findings from Poland


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**Abstract** The aim of the study is to verify whether and how the relation between profitability and corporate financing policy depends on the firm size and its industrial classification. The relationship between return on equity and selected measures of capital structure for Polish private firms in the period 2005–2015 is explored in two cross-sections: across size groups of firms and across industrial sections. The issue is addressed by estimating panel data models with interactions between variables so as to identify the factors responsible for the variability of the considered relationship. The study contributes to the existing literature by capturing the indirect size effect and industry effect in the profitability–capital structure relation. It also takes into account the issue of debt maturity by considering the relationship in question for different debt measures. Findings provide evidence that this relation is more industry- than size-dependent for long-term debt, but that the size effect prevails when short-term debt is considered. The results also suggest greater relevance of the pecking order theory for long-term debt, whilst the trade-off predictions seem more adequate for explaining short-term financing decisions.

## 1 Introduction

The complexity of corporate financing choices and the factors influencing these decisions has been the subject of academic research for decades. Since the seminal irrelevance theorem by Modigliani and Miller (1958) a remarkable number of competing theories have been developed aiming at solving the capital structure puzzle. However, none of the currently available model seems capable of simultaneously accounting for the whole variety of factors potentially affecting corporate financing policies, which is why the relative importance of these factors remains open to debate (Frank and Goyal 2008). The apparent contradictions between both

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theories and stylised facts make it purposeful to further explore the problem by addressing the issue with yet another approach. This study contributes to the existing academic literature in several ways. Firstly, instead of directly verifying the significance and the direction of the profitability impact on leverage, it searches for the indirect factors potentially affecting this relation, namely the firm size and its industrial classification. Secondly, the issue of debt maturity is covered by considering the impact of profitability separately on short-term and long-term debt. Finally, the analysis includes private firms and not the most commonly explored public companies.

## 2 Literature Review

Profitability is considered as one of the key factors determining corporate financing choices by the two leading capital structure theories, namely the static trade-off theory (TOT) grown on the debate over the MM irrelevance proposition and the pecking-order theory (POT) by Myers and Majluf (1984). However, the theories remain contradictory in terms of the direction in which financial leverage is affected by profitability.

According to the classic statement of the TOT provided by Kraus and Litzenberger (1973), the optimal leverage reflects a balance between the tax benefits of debt and leverage-related costs, mainly including costs of financial distress. As a result, the TOT predicts a positive relation between profitability and debt level, as profitable companies borrow more to compensate taxes (Frank and Goyal 2003). A positive relationship between profitability and debt is also explained on the grounds of the idea that financial market is reluctant to offer funds to underperforming companies. Moreover, higher leverage indicates greater interest burden for companies with low rates of return for owners, which decreases the valuation of the firm's equity and reduces the possibility of its issuance (Kumar 2007). A positive profitability–leverage relationship was empirically found e.g. by Gill et al. (2011).

According to the POT, developed by Myers (1984), the assumed adverse selection implies that firms prefer internal to external financing and debt to equity if external financing is needed. This ranking stems from such sources as agency conflicts or information asymmetry. Therefore, the POT predicts a negative profitability–leverage relation, as firms generating high returns may have less debt, since retained earnings are used first. The negative relation between profitability and debt has been reported e.g. by Myers (1984), Myers and Majluf (1984), Harris and Raviv (1991), Rajan and Zingales (1995), Hall et al. (2004), Abor (2005) and latterly by González and González (2012).

Another firm-level determinant of leverage considered in this study is the firm size, whose positive relation with debt predicted by TOT is explained by the fact that large firms usually enjoy better reputation in the credit market, bear lower costs of obtaining information, and often have more diversified business. Studies by Frank

and Goyal (2003) or Kurshev and Strebulaev (2008) empirically confirm such a relation.

Along with the firm-specific determinants, corporate financial leverage might be affected by external conditions, including industrial classification whose significance in terms of debt is reported e.g. by Harris and Raviv (1991). The industrial characteristics responsible for leverage diversity in this cross-section include such variables as the assets flexibility (Shleifer and Vishny 1992), technological differences (Maksimovic and Zechner 1991) or industrial competition (Leibenstein 1966).

However, it appears that the impact of the firm size or its industry on capital structure may be twofold. Apart from the direct influence of the firm-related or macroeconomic variables on debt, they may also impact corporate financing choices indirectly—by influencing primary factors affecting debt level (Jong de et al. 2008; Koralun-Bereźnicka and Ciołek 2018). Therefore, following the main aim of the study, which is to identify the importance of the firm size and its industrial classification for the relation between profitability and capital structure in Polish private firms, three research hypotheses are formulated: (i) the profitability–capital structure relation is size-dependent, (ii) the profitability–capital structure relation is industry-dependent, (iii) the profitability–capital structure relation varies depending on the debt maturity. The verification of these hypotheses would add to the hitherto research findings by recognizing the indirect effect of firm size and its industrial specifics in the relation between financial leverage and the seemingly well-known determinant of debt.

## 3 Data and Methodology

The empirical data comes from the BACH-ESD[1] database published by the European Commission (Banque de France 2018). It contains comparable data from financial statements for non-financial incorporated European companies aggregated by industries, firm sizes and years. The study uses data for Polish firms of three size groups of firms: small (SM), medium (ME) and large (LA) in the 11-years' period 2005–2015. The 16 industries included in the analysis cover the following section-level NACE divisions: A, B, C, D, E, F, G, H, I, J, L, N, P, Q, R, S. The ratios used in this study were computed by separately aggregating the data of the numerator and of the denominator.

In order to examine how the profitability–capital structure relation depends on the industrial classification and on the firm size, regressions explaining capital structure measures were estimated. The dependent variable was either long-term debt ratio (LTD) or short-term debt ratio (STD), defined according to the formulas in Table 1. The main explanatory variable in the model was the ROE, defined as a relation of net profit or loss of the year to capital and reserves. In addition to this main covariate,

[1] Bank for the Accounts of Companies Harmonised – European Sectoral references Database.

**Table 1** Construction of variables

| Variables | Definition |
|---|---|
| *Dependent variables* | |
| Long-term debt to assets (LTD) | Non-current debt/Total assets |
| Short-term debt to assets (STD) | Current debt/Total assets |
| *Explanatory variables* | |
| Return on equity (ROE) | Net profit or loss for the period/Equity |
| Size | SM, ME, LA |
| Industry | A, B, C, D, E, F, G, H, I, J, L, N, P, Q, R, S |
| Profitability—size interactions | ROE*SM, ROE*ME, ROE*LA |
| Profitability—industry interactions | ROE*A, ROE*B, …, ROE*S |

dummy variables representing size groups and industries were included in the regressions in order to reflect the fixed individual effects specific for firm size and industry. Coefficients of these effects can be interpreted as the specific size impact or industry impact on debt. Obviously, because of omitting one of the dummy variables due to perfect collinearity, the effects were interpreted in relation to the omitted size or industry. Moreover, following the aim of the study, which was to evaluate the importance of firm size and industry for the profitability–capital structure relation, the interactions between profitability and size dummies and between profitability and industry dummies were included in the model so as to estimate the different coefficients of profitability impact. The general formula of the estimated models was as follows:

$$D_{its} = \beta_0 + \beta_1 ROE_{its} + \gamma_1 D_1 + \ldots + \gamma_{16} D_{16} + \alpha_1 D_S + \alpha_2 D_M + \alpha_3 D_L + \\ + \delta_1 ROE_{its} D_1 + \ldots + \delta_{16} ROE_{its} D_{16} + \rho_1 ROE_{its} D_s + \rho_2 ROE_{its} D_M + \rho_3 ROE_{its} D_L + \xi_{its}, \\ i = 1,\ldots,16; t = 1,\ldots,11; s = 1,2,3 \quad (1)$$

where: $D_{its}$ denotes one of the two debt measures (LTD or STD) for $i$ industry of firm size $s$ in year $t$, $D_1$-$D_{16}$ are dummies representing industries, $D_S$, $D_M$, $D_L$—dummies for small, medium and large firms, $\beta$, $\gamma$, $\alpha$, $\delta$, $\rho$ are coefficients, and $\xi_{i,t,s}$ is the error term. Mathematically, it means that e.g. the impact of profitability on debt in the industrial section S (16th) in medium firms would be equal to the sum of three parameters: $\beta_1$, $\delta_{16}$, and $\rho_2$. Each regression model type (1) was estimated by OLS with standard errors robust for heteroscedasticity and autocorrelation of error terms (Baltagi 2008). To answer the question whether the profitability impact on debt depends more on the firm size or industry, a joint significance test was applied for groups of interaction parameters. In order to compare the importance of these two types of interactions, additional regressions were estimated with only one group of interactions in each case. Then the Akaike's information criterion (AIC) was applied to decide which group of parameters better explains the variability of the analysed debt measures.

## 4 Results

The model was first estimated for LTD as the dependent variable. The results are shown in Table 2. Joint tests for interactions reveal the significance of the industry–profitability interactions, as opposed to the size–profitability interactions, which proved insignificant both in the model without industry interactions and with both types of interactions. This indicates that the impact of ROE on long-term debt does vary across industries, but not across size groups of firms. The AIC values also confirm that introducing the industry interactions brings more explanation of long-term debt than size interactions.

The influence of ROE on long-term debt is also illustrated in Fig. 1, which demonstrates that the sign of the relation between ROE and LTD in most cases remains unchanged across size groups for a given industry. The only exceptions from this rule are the sections of information and communication (J), education (P), and other service activities (S), for which the relation is positive for small and medium-sized firms, but negative for large ones.

As for the estimation results for short-term debt, shown in Table 3, it can be seen from joint significance tests that this time the size-profitability interactions cannot be ignored. They proved significant in both models where size interactions were included.

Industry interactions, however, were only significant in the model without size interactions. This suggests that while the industry effect might not be crucial in its impact on profitability–short-term debt relation, the size effect is considerable in this case. It is also clear from Fig. 2 that the relation between ROE and short-term debt is evidently size-dependent in a number of industries. The often repeated pattern here is that the relation is negative for small firms, while positive for medium and large ones. This indicates the greater validity of POT for small firms, which was also reported by González and González (2012) for Spain.

## 5 Conclusions

The cross-sectional analysis of Polish private firms reveal that the relation between profitability measured by ROE and long-term debt is significantly positive, according to the predictions of trade-off theory. However, the relation proved insignificant for short-term debt. Moreover, the relation between profitability and debt is found to be dependent on the indirect factors, namely industry and firm size. The sign of the profitability–capital structure relation depends significantly on the industrial classification of companies in the case of long-term debt. The size effect is of negligible importance here, although it proves significant when the relation is considered for short-term debt. These results provide partial support for hypotheses (i) and (ii). As stated in hypothesis (i), the profitability–capital structure relation is size-dependent, but only for short-term debt, while—following hypothesis (ii)—the

**Table 2** Estimation results of panel regressions for long-term debt

| Variable | Long-term debt (LTD) | | | | | |
|---|---|---|---|---|---|---|
| Interactions | Size | | Industry | | Size and industry | |
| Const. | 0.126*** | (0.044) | 0.024 | (0.041) | 0.008 | (0.045) |
| ROE | −0.365*** | (0.131) | 0.645** | (0.328) | 0.777** | (0.361) |
| ME | 0.004 | (0.025) | 0.031** | (0.014) | 0.032** | (0.016) |
| LA | −0.007 | (0.025) | 0.017 | (0.023) | 0.037 | (0.027) |
| B | −0.018 | (0.043) | 0.065 | (0.039) | 0.076* | (0.045) |
| C | 0.014 | (0.043) | 0.085** | (0.040) | 0.095** | (0.042) |
| D | −0.011 | (0.042) | 0.093** | (0.043) | 0.107** | (0.047) |
| E | −0.002 | (0.043) | 0.044 | (0.039) | 0.054 | (0.043) |
| F | 0.051 | (0.043) | 0.143*** | (0.038) | 0.149*** | (0.039) |
| G | −0.012 | (0.044) | 0.068* | (0.036) | 0.083** | (0.040) |
| H | 0.090* | (0.049) | 0.203*** | (0.049) | 0.206*** | (0.047) |
| I | 0.178*** | (0.066) | 0.299*** | (0.046) | 0.314*** | (0.051) |
| J | 0.060 | (0.056) | 0.124* | (0.065) | 0.134** | (0.064) |
| L | 0.023 | (0.044) | 0.123** | (0.056) | 0.142** | (0.059) |
| N | 0.160** | (0.066) | 0.100 | (0.110) | 0.107 | (0.110) |
| P | 0.029 | (0.051) | 0.054 | (0.052) | 0.069 | (0.056) |
| Q | 0.150** | (0.066) | 0.161*** | (0.059) | 0.162*** | (0.058) |
| R | 0.083 | (0.065) | 0.213*** | (0.046) | 0.239*** | (0.055) |
| S | 0.080* | (0.048) | 0.120** | (0.047) | 0.136*** | (0.051) |
| ROE*ME | 0.270 | (0.196) | | | −0.019 | (0.092) |
| ROE*LA | 0.191 | (0.219) | | | −0.191 | (0.157) |
| ROE*B | | | −0.836** | (0.338) | −0.870** | (0.359) |
| ROE*C | | | −0.750** | (0.358) | −0.805** | (0.366) |
| ROE*D | | | −1.262*** | (0.478) | −1.393*** | (0.505) |
| ROE*E | | | 0.188 | (0.382) | 0.151 | (0.402) |
| ROE*F | | | −0.918*** | (0.315) | −0.974*** | (0.331) |
| ROE*G | | | −0.823*** | (0.316) | −0.937*** | (0.343) |
| ROE*H | | | −1.219*** | (0.363) | −1.225*** | (0.352) |
| ROE*I | | | −1.455** | (0.677) | −1.584** | (0.694) |
| ROE*J | | | −0.684* | (0.375) | −0.740* | (0.381) |
| ROE*L | | | −1.419 | (0.900) | −1.753* | (0.943) |
| ROE*N | | | 0.498 | (0.711) | 0.480 | (0.708) |
| ROE*P | | | −0.536 | (0.332) | −0.654* | (0.362) |
| ROE*Q | | | −0.174 | (0.346) | −0.154 | (0.366) |
| ROE*R | | | −1.143*** | (0.340) | −1.228*** | (0.357) |
| ROE*S | | | −0.578* | (0.328) | −0.679* | (0.357) |
| No. obs. | | 499 | | 499 | | 499 |
| $R^2$ | | 0.455 | | 0.577 | | 0.581 |
| Adj. $R^2$ | | 0.433 | | 0.547 | | 0.549 |
| Heteroscedasticity | 417.44 [0.000] | | 223.13 [0.000] | | 245.4 [0.000] | |
| Normality | 134.61 [0.000] | | 70.90 [0.000] | | 78.16 [0.000] | |
| AIC | −1130.7 | | −1230.5 | | −1231.6 | |

(continued)

**Table 2** (continued)

| Variable | Long-term debt (LTD) | | |
|---|---|---|---|
| Interactions | Size | Industry | Size and industry |
| Joint significance for interactions | | | |
| Size | 1.251 [0.211] | | −0.210 [0.234] |
| Industry | | −2.093 [0.037] | −12.36 [0.027] |

Notes: (1) Robust standard errors in parentheses. (2) White test for heteroscedasticity. (3) Doornik-Hansen test for normality of residuals. (4) Interpretation of parameters in relation to section A and small firms

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

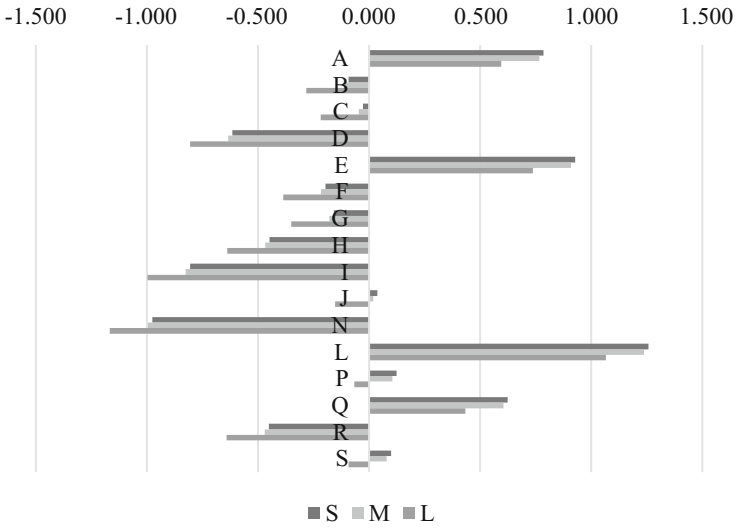


**Fig. 1** The impact of profitability on long-term debt across industries and size groups

profitability–capital structure relation is industry-dependent, but mainly for long-term debt. These differences also indicate the likely truthfulness of hypothesis (iii) referring to the differences in profitability–leverage relation resulting from debt maturity. The conclusion resembles the one reached by Degryse et al. (2012), who also found differences between the significance of variables related to debt maturity.

When comparing the considered relation for long-term debt across industries, it appears that companies in industries such as: agriculture (A), water supply (E), administration (L), education (P), healthcare (Q), and other service activities (S) are more in line with the trade-off predictions on positive profitability–debt relation, whereas firms from the remaining industries, i.e. the majority of the analysed sample, provide more support for the pecking order theory by demonstrating mainly negative relation. However, when the other cross-section and the short-term debt is taken into account, it appears that the trade-off is more suitable for medium and large-sized

**Table 3** Estimation results of panel regressions for short-term debt

| Variable | Short-term debt (STD) | | | | | |
|---|---|---|---|---|---|---|
| Interactions | Size | | Industry | | Size and industry | |
| const. | 0.175*** | (0.012) | 0.140*** | (0.016) | 0.167*** | (0.019) |
| ROE | −0.036 | (0.048) | 0.331*** | (0.092) | 0.078 | (0.124) |
| ME | −0.016 | (0.018) | 0.004 | (0.011) | −0.016 | (0.011) |
| LA | −0.040*** | (0.015) | −0.020 | (0.016) | −0.048** | (0.019) |
| B | 0.068*** | (0.014) | 0.117*** | (0.017) | 0.109*** | (0.018) |
| C | 0.164*** | (0.014) | 0.177*** | (0.024) | 0.166*** | (0.031) |
| D | −0.005 | (0.015) | 0.042** | (0.021) | 0.024 | (0.020) |
| E | −0.060*** | (0.013) | −0.034** | (0.017) | −0.047* | (0.024) |
| F | 0.194*** | (0.011) | 0.228*** | (0.013) | 0.223*** | (0.011) |
| G | 0.285*** | (0.019) | 0.333*** | (0.049) | 0.316*** | (0.048) |
| H | 0.088*** | (0.030) | 0.093 | (0.057) | 0.086* | (0.050) |
| I | −0.029* | (0.015) | 0.000 | (0.021) | −0.013 | (0.019) |
| J | 0.073*** | (0.026) | 0.119*** | (0.032) | 0.115*** | (0.030) |
| L | −0.084*** | (0.011) | −0.052*** | (0.019) | −0.071*** | (0.022) |
| N | 0.167*** | (0.023) | 0.132*** | (0.035) | 0.126*** | (0.038) |
| P | 0.090*** | (0.030) | 0.158*** | (0.048) | 0.152*** | (0.053) |
| Q | 0.071** | (0.030) | 0.097** | (0.039) | 0.098*** | (0.036) |
| R | 0.079*** | (0.018) | 0.120*** | (0.015) | 0.078*** | (0.020) |
| S | 0.087 | (0.053) | 0.072 | (0.067) | 0.066 | (0.069) |
| ROE*ME | 0.269*** | (0.097) | | | 0.240*** | (0.068) |
| ROE*LA | 0.226** | (0.102) | | | 0.305*** | (0.099) |
| ROE*B | | | −0.523*** | (0.152) | −0.513*** | (0.151) |
| ROE*C | | | −0.137 | (0.218) | −0.055 | (0.295) |
| ROE*D | | | −0.759*** | (0.291) | −0.551** | (0.263) |
| ROE*E | | | −0.315 | (0.219) | −0.205 | (0.312) |
| ROE*F | | | −0.303*** | (0.089) | −0.253*** | (0.071) |
| ROE*G | | | −0.394 | (0.262) | −0.264 | (0.248) |
| ROE*H | | | 0.023 | (0.422) | 0.054 | (0.368) |
| ROE*I | | | −0.308* | (0.172) | −0.220 | (0.162) |
| ROE*J | | | −0.407** | (0.207) | −0.387** | (0.195) |
| ROE*L | | | −0.573 | (0.421) | −0.219 | (0.460) |
| ROE*N | | | 0.329 | (0.319) | 0.339 | (0.327) |
| ROE*P | | | −0.466*** | (0.097) | −0.389*** | (0.148) |
| ROE*Q | | | −0.281** | (0.143) | −0.291** | (0.118) |
| ROE*R | | | −0.166 | (0.127) | −0.061 | (0.122) |
| ROE*S | | | 0.027 | (0.128) | 0.038 | (0.149) |
| No. obs. | | 499 | | 499 | | 499 |
| $R^2$ | | 0.773 | | 0.794 | | 0.801 |
| Adj. $R^2$ | | 0.764 | | 0.779 | | 0.786 |
| Heteroscedasticity | 344.5 [0.000] | | 154.4 [0.000] | | 169.3 [0.000] | |
| Normality | 95.58 [0.000] | | 134.1 [0.000] | | 167.3 [0.000] | |
| AIC | −1422.9 | | −1444.3 | | −1458.7 | |

(continued)

**Table 3** (continued)

| Variable | Short-term debt (STD) | | |
|---|---|---|---|
| Interactions | Size | Industry | Size and industry |
| Joint significance for interactions | | | |
| size | 3.085 [0.002] | | 3.587 [0.000] |
| industry | | −2.022 [0.044] | −1.339 [0.181] |

Notes: (1) Robust standard errors in parentheses. (2) White test for heteroscedasticity. (3) Doornik-Hansen test for normality of residuals. (4) Interpretation of parameters in relation to section A and small firms

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

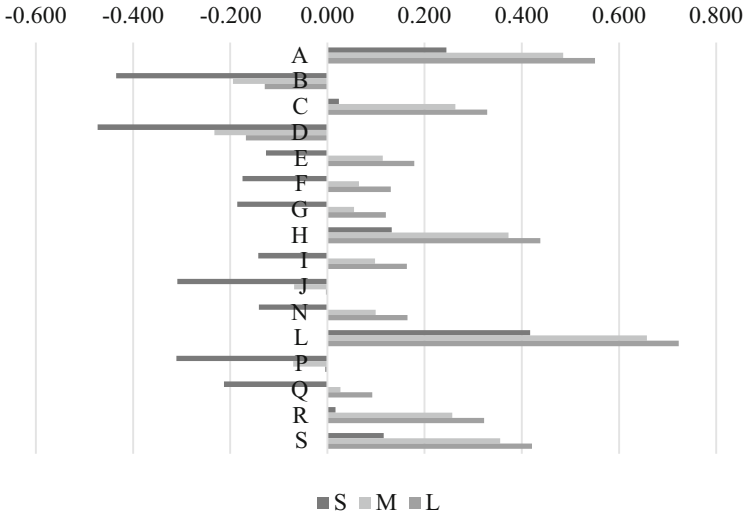


**Fig. 2** The impact of profitability on short-term debt across industries and size groups

firms, while small enterprises generally tend to follow the pecking order expectations on the profitability-leverage relation. These results are comparable to prior empirical studies, e.g. for Ghanaian companies (Abor 2005), where long-term debt was found to be negatively correlated with profitability. However, they are in opposition to the findings of Gill et al. (2011), who reported a positive relation between different debt measures and profitability regardless of firm industrial classification, i.e. for both service and manufacturing US public firms. These differences, however, may be attributed to country-related specifics of samples.

Generally, the findings highlight the relevance of the indirect industry and size effect in capital structure. The lack of straightforwardness in the profitability–leverage relation indicated by the study may provide some useful insights for example for lending institutions, which should not only consider firm profitability as a direct determinant of leverage-dependent risk level, but should also, perhaps to

greater extent, recognize industrial and size-related firm specifics. The study also contributes additional evidence suggesting that the relative importance of these effects may vary depending on debt maturity. This provides a framework for further exploration of the influence of the indirect factors on capital structure. For example, it would be also valuable to analyse the occurrence of these effects for other economies, which would allow for cross-country comparisons. This is left for future investigation.

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